

**May Economic Bubbles be Good Sometimes?:  
A Theoretical Investigation of How Bubbles Affect Privatization  
in Developing Countries**

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## Abstract

In this paper, we develop a model dealing with how economic bubbles arise and how they may affect privatization process in non- or little-privatized countries. After running the developed model and analyzing the results, we suggest two main propositions: First, the mechanisms inhering in the investment structures may form a structural barrier to the process of privatization in its very initial stages. Second and more interesting, while harmful to the economy from other aspects, the economic bubbles can help activate the process of privatization. The findings are supported mainly by theoretical justifications rather than empirical evidences. This work, we believe, is not necessarily a conclusive and ultimate one out of which ultimate privatization policies should be drawn. It is, rather, a directive setup based on which a modeling process can be founded so as to obtain the best policies.

## Introduction

In recent decades privatization of SOEs<sup>1</sup> has been considered as one of the most important strategies for enhancing economic structures in developed and under development countries. Many countries have decided to privatize their SOEs due to enormous costs of government agencies. As Nellis (1999) puts it “More than 100 countries, on every continent, have privatized some or most of their state-owned companies in every conceivable sector of infrastructure, manufacturing and services.”

In late 1980s, England and some other members of OECD<sup>2</sup> started pursuing privatization of SOEs, as state ownership was considered a fundamental weakness in performing fundamental and stable reformations in public companies. After their successful experience, privatization became an activity reformation tool for the SOEs and reduced the pressure they imposed against the government due to their performance inefficiencies. So it is obvious that the essence of privatization has become apparent to countries with state sovereignty structures during past decades.

Privatizations through share offerings played a significant role in this process. Share issue privatizations accounted for approximately 70% of the global privatization revenues in the last two decades (Aybar 2002). This article focuses on this kind of privatization.

Initial stages of privatization including issues regarding SOEs’ stock creation and transfer, is believed to be the bottleneck of this process. Since in this stage a big economic evolution is taking place all across the specified country and evolutions are generally interwoven with resistance. The resistance in our field of study is created due to the political nature and the

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<sup>1</sup> State-Owned Enterprise

<sup>2</sup> Organization of Economic Co-operation and Development

economic ramifications of privatization which raises the opposition of special interest groups affected by the changes (Forster 2006).

Challenges of privatization could be categorized in two major parts:

1. Challenges in SOEs' supply sector
2. Challenges for purchasing the stocks in demand sector

Challenges of SOEs' supply sector include issues like the necessity of changing the structure of public enterprises with the purpose of enabling them to continue operating when switched to the private mode too (Forster 2006), or the probable resistance of current organization high level managers against privatization and anticipated internal issues raised after privatization (like lay-offs). Organizations must therefore undergo a radical re-conceptualization of mission, leadership, strategy and culture. The changes required by the privatization include changes in strategy and structure as well as adjusting and encouraging individual employee behavior and motivation (Dean et al., 1999). Furthermore there are many political issues against privatization of SOEs which are also classified under supply sector challenges.

Challenges of demand sector are issues faced when purchasing the stocks of SOEs. The creation of investment demand in privatization and directing private sector investors toward SOEs' stock market are amidst the most vital issues of this sector. In this article we concentrate on the challenges of demand sector.

An issue faced in triggering privatization, is the private sector not being so welcoming and the recession of the market in early stages of the SOEs' transfer (Ramamurti 1999). One of the reasons causing the private sector wearing this attitude is the little knowledge of the investors about the assets and productivity capacity of the SOEs (Huyghebaert and Quanb 2009). On the other hand many governments which are obliged to privatize their SOEs due to economic crises, place an emphasis on the pace of this process (Ramamurti 1999). As a result these governments are forced to lower the SOEs' stock price in order to overcome the lack of acceptance of the private sector.

For example research in China's privatization process reveals that underpricing the stocks is a usual phenomenon especially when privatizing enterprises with lower qualities (Huyghebaert and Quanb 2009). This goes to the extent that (Kuczynski 1999) says that one of the largest motives of the private sector investors in Europe, Latin America and Australia to buy the SOEs' stocks has been their relatively lower suggested price compared to their real price. Underpricing can cause governments a great expenditure, not allowing them to gain the expected income from privatization of SOEs. Furthermore this great cost could have a negative effect on the extent of privatization the government is willing to do; meaning that if the government is not under crisis or forced to privatize, it will show little incentive in the transference of SOEs' stocks to people (Huyghebaert and Quanb 2009) . This unwillingness of the governments to privatize, assuming that privatization is proved to be advantageous, is an inconvenient event as it lowers the speed of privatization and makes the countries suffer the inefficiencies of the SOEs.

Privatization literature is rich and operational considering the challenges of the supply sector, but when it comes to attempting the investors to buy the stocks and creating demand, the literature does not have much to say. So creating deeper insight toward mechanisms triggering privatization in demand sector can be beneficial to governments. In this article we will review the mechanisms allowing the flow of Cash and investment (in spite of privatization's little initial attractiveness) in privatization market and explain the reasons why this market will stagnate in the absence of such mechanisms. We will begin by developing a model examining the cash flow among a country's primary markets and then continue by investigating the model's behavior in different conditions. In this behavior analysis at first we will explain the mechanism of cash flow between investment alternatives, and then will describe a situation in which this mechanism could not initiate the capital flow toward the privatization market. In this situation creation and burst of a bubble in the current attractive market causes the privatization market to come out of stagnation. In the end we will propose policies to trigger privatization using the insight created.

## Conceptualization:

The model created in this article generally shows the cash flow among different. It concentrates on three major markets in every country including real estate market, privatization market (the market where the SOEs' stocks are bought and sold) and the representative of the country's other markets. As illustrated in figure1, there are two main parts in this model, one part includes the internal components of the markets and their interconnections, and the other part shows the linkages of these markets and the liquidity flow between them.

The market internal structure part contains the assets of the market, the price of the assets, extent of demand and supply of the asset, associated risk and the return on asset and finally the attractiveness of that asset from investors' point of view. As all markets have similar structures and internal mechanisms, the structure is explained for only one of the markets, **the Real estate market**. The structure is conceptualized illustrating the internal dynamics of this market.

After explaining the internal structure of the real estate market in the format of its internal dynamics, the other part of the model, considering the connections among different markets is described.



## Model Assumptions:

Before explaining the model, we describe the model's assumptions.

- We focus on **Demand** of the SOEs' stocks and do not model their supply. Certainly there are points considering the relationship between these two concepts which we choose to overlook.
- The total cash (which is the summation of cash wanted to be invested in each option) is assumed to be constant. Although this assumption does not generate a change in model's observed behavior and assuming the total cash to increase over time will only cause the cash of each market to rise by a percentage annually.
- As illustrated in figure1 the attractiveness of the third market (which is the representative of the country's other markets) is assumed to be constant for simplicity. Therefore the investigation of the internal mechanisms of this market is ignored.
- In each market the relevant assets are considered to be homogenous and one price is assigned for each asset. For instance all houses are considered to be similar and hence equal in price. Similarly all stocks of the SOEs have the same price.

## Real estate market Dynamics:

### Famous dynamics of demand/supply

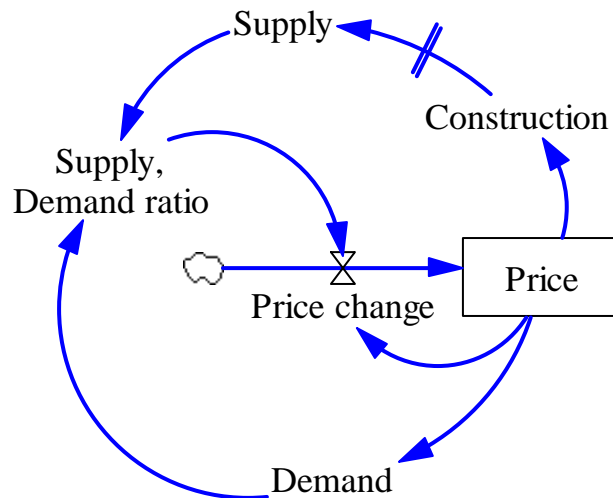


Figure 2: Demand/Supply dynamics



This dynamic is another market balancing loop which with some delay results in a change in asset revenue and consequently in the attractiveness. Before explaining the dynamics, it is necessary to explain two elements of the model:

1. **Attractiveness** of the investment is a variable demonstrating investors' will to invest in this market. It is determined by three factors: Ratio of revenue to price, price trend (the percentage of change in price in a specific period of time), and risk of the investment (on the asset).

Revenue in real estate market could be interpreted as rent and is the revenue gained from the ownership of an asset. It may be interpreted differently in other markets; like the dividend share of the stock of a special asset.

Percentage of price change which is called "capital gain" in finance is another element of attractiveness. These two elements (revenue and percentage of price change) together, create the return on a special asset which is the profit, the owner of an asset gains from the ownership of the asset in a specific period of time. For example for the stocks it will be interpreted as:

$$\text{Percentage return} = (\text{capital gain} + \text{dividend}) / \text{initial share price}$$

(Brealy, Myers and Marcus 2001)

Another element of attractiveness is the associated risk of the investment. The literature provides various definitions of risk. It is considered to be equivalent to variance and price fluctuation in finance and economic literature, where variance is also equivalent to uncertainty (Bekaert, Engstromb and Xing 2008). In this article when using risk, we mean the concept which results in uncertainty in the expected profit of a special asset. For instance in real estate market, large fluctuations in rent and house price are equivalent to large risk associated with investing in the market. All in all, referring to financial and economic articles and references, we see that whenever there is a discussion about the desirability of a specific investment option, risk and return are also somehow present.

Risk is considered to be constant in real estate market, so it is not included in the dynamics' figures. But considering privatization, it is not constant anymore and sometimes even plays an important role in creating specific behaviors which we will talk about more about it, later in behaviors analysis section.

2. **Cash** demonstrates total amount of money which investors wish to invest on a specific asset. It also includes the monetary value of an asset which the owner is about to sell and convert to another asset. For example an investor who is about to sell his/her stock and invest the released capital in real estate market, should consider his/her cash value of the investment (which is still in the stock form) as the real estate market portion of the investment. The capital of an investor who is about to sell a house and buy another one, is also classified under this variable.



In the attractiveness dynamics, an increase in the attractiveness of an option raises the demand value of the investment, which increases the demand of real estates. This results in the price to heighten which consequently decreases the revenue of this asset (the rent) twofold.

- High price of real estate encourages the constructors to build more houses. This causes the supply of real estate to increase with a delay, which results in a decrease in rent which subsequently decreases the revenue of the real estate asset.
- High price of the real estate, by itself causes the revenue/price ratio to decrease

Both sides of this mechanism, bring about a decrease in asset revenue percentage and consequently in the attractiveness of the market. It is worthwhile to mention that this dynamics could operate in reversed manner, meaning a decrease in the attractiveness by the process just described can cause the asset revenue percentage and consequently the attractiveness of the market to increase.

### Dynamics of the creation and burst of a bubble

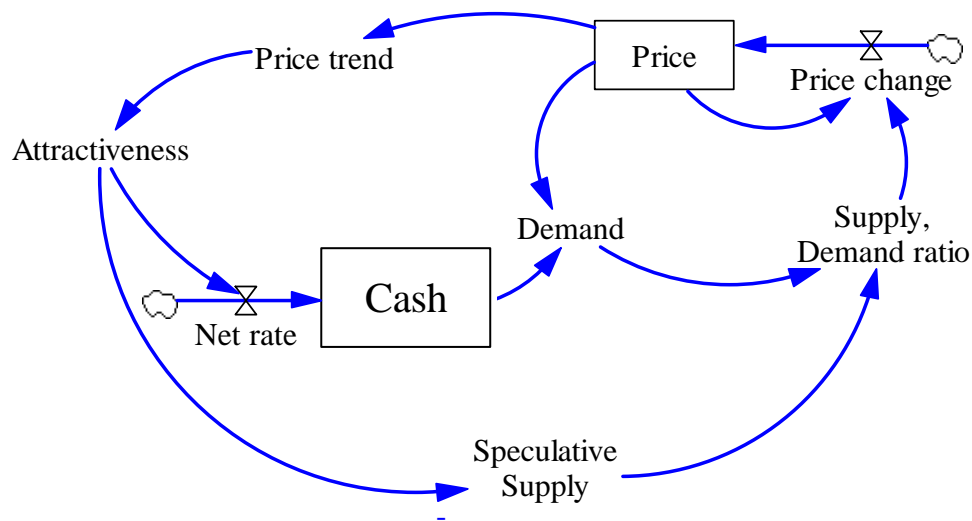


Figure 4: Dynamics of the creation and burst of a bubble

There are also growth intensifier mechanisms in the markets. As illustrated in figure4, an increase in the attractiveness of a market increases the investment interest in that market, which causes an increase in demand which consequently increases the price. Moreover, the increase in the market attractiveness makes the already present investors less willing to sell their owned real estate which reduces the speculative supply (selling an asset for investing in another asset). So the supply/demand ratio decreases from two sides which consequently increase the price. This increase in price is another market attractiveness factor, as it raises the investors' expectation about the future price raises, which by itself heightens their estimation of the market profitability

(Watson 1982). This mechanism which intensifies the market attractiveness is called “price intensifying loop”. It is important to mention that if these intensifying loops are reversed, they will result in a huge price decrease, market attractiveness reduction and an intense exit of capital from this market.

This is a mechanism which creates and bursts price bubbles in markets with investment capitals. The logic used to describe the bubble creation in this article is similar to the bubble modeling equations proposed by Watson (1982).

Till now, we described the structure of one investment option in its dynamics format. Afterwards we will explain the interconnections of different investment options.

### Options’ Interrelations

The cash present in each market and the market’s attractiveness together influence the relationship of different investment options. The investors compare the attractiveness of the markets and decide to invest in one of these options regarding the perceived difference. The decision making process is arranged in a way so that if one market is more attractive, it attracts all the available capital, as it is considered illogical for an investor to invest in other markets when one market is more attractive. This capital attraction continues as long as one market is still the most attractive.

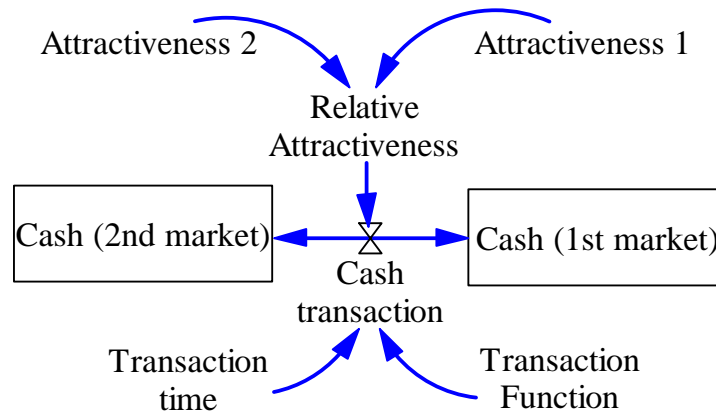


Figure 5: Options interrelations

In order to see the relationships between different parts of the model in more details refer to figure1 and to see the equations used in it, refer to the appendix of the article.

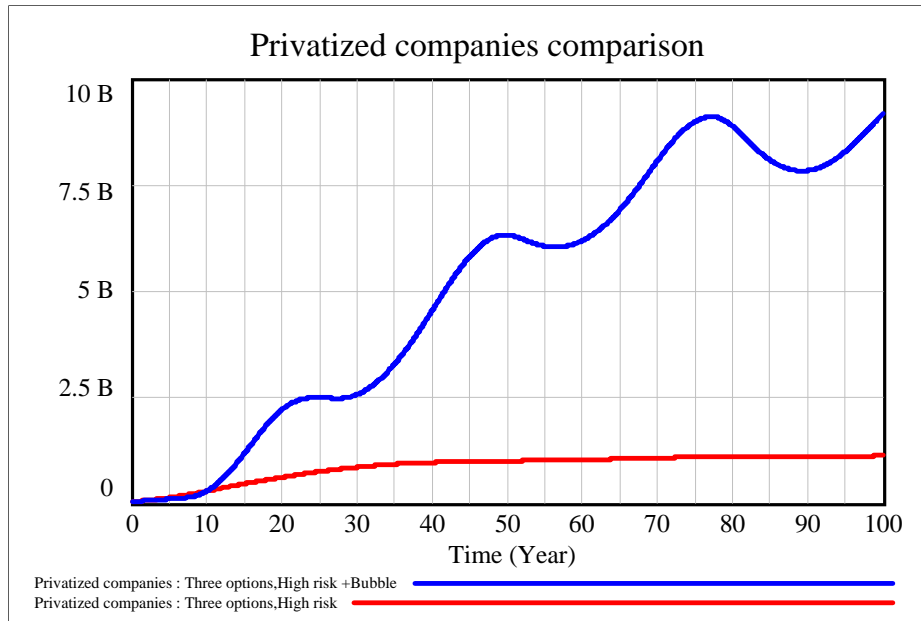
## Behavior Analyses

### The theory outline

Before demonstrating the model's behavior in different situations, it seems important to represent an outline of the theory and our purpose of expressing these behaviors.

Using the dynamics explained up to this point, we show that cash (investment demand) could not stay in a market forever. We call this concept "cash movement law". According to this law, if there are only two markets present, the cash will flow between them; but if there are more than two options available for investment and one of them is less attractive than the others, then the "cash movement law" can only make the cash (investment demand) move between the markets with higher attractiveness. So there is a need for another stimulus to make the third market come out of recession. We claim that one of these effective stimuli in activating the (at first) unattractive market is the creation and burst of a bubble in one of the other markets.

If we want to specialize the proposed theory for the privatization issue, we should say that when privatization is in its initial stages and the investors' lack of knowledge risk of the investment return on SOEs' stocks makes this option less attractive, the "cash movement law" could not activate privatization on its own, as there are more than two options available for investment and the "cash movement law" could only make the investment demand flow between the two initially attractive options. In this situation, **creation and burst of a bubble in one of these attractive investment options (like real estate market) can motivate the investors to buy SOEs' stocks and cause cash to flow into this option.** This is the main assertion of this article.



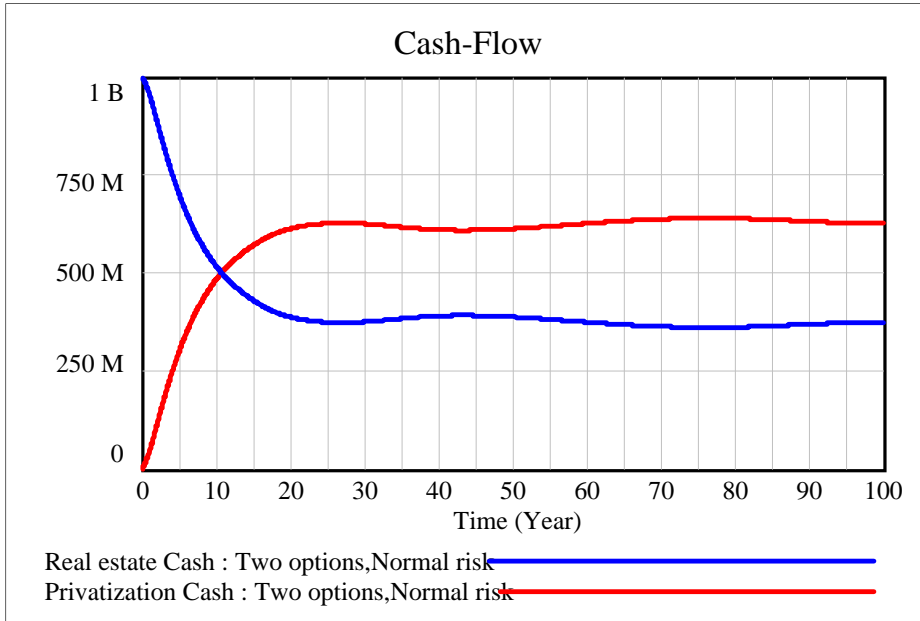
**Figure 2: Total value of SOEs which are privatized. Blue: When Bubble is present in another market. Red: When there is no Bubble in other markets**

### A step by step explanation

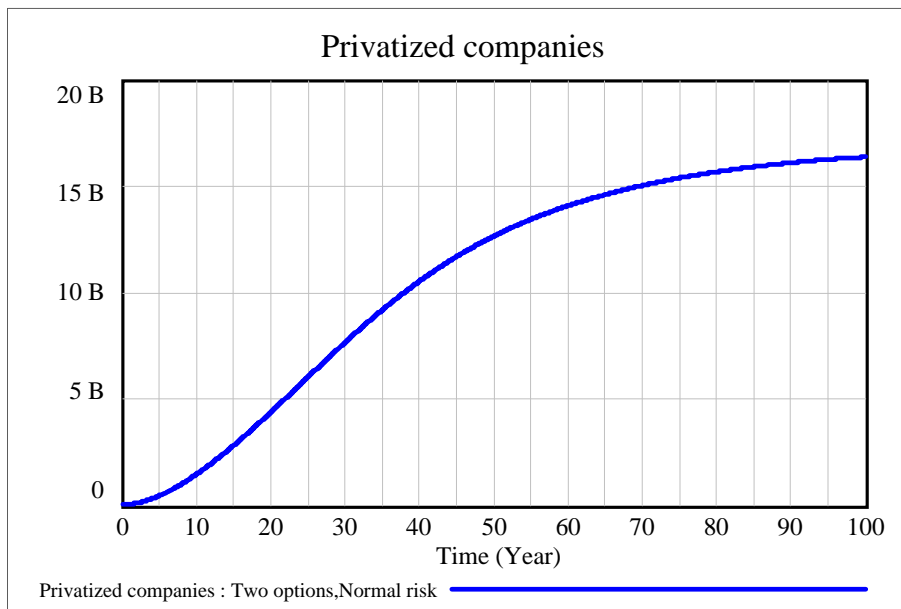
#### 1. Cash does not stay in a market

Our purpose of expressing this stage is to illustrate what the “cash movement law” actually is and how it can make the cash flow to the less attractive market (even without a bubble) when there are only two markets available.

In this stage we assume the presence of two markets for investment, the real estate market and the SOEs’ stocks market, our next assumption is that the needed dynamics of bubble creation and burst is not present in the markets. Referring the bubble dynamics in previous part, it is known that in order to eliminate the price bubble one can eliminate the price trend from market’s attractiveness elements. Also it is assumed that the initial risk is equal in the markets. When the privatization is started, the investment demand in this market is equal to zero and all the cash is in the real estate market. After running the model for a period of a hundred years, the following behaviors are observed (figure7 and figure8).



**Figure 7: Cash-flows (Blue: Real estate Red: Privatization), two options, no abnormal initial risk**



**Figure 8: Total value of SOEs which are privatized, two options, and no abnormal initial risk**

As it is demonstrated in the figures above, cash penetrates to the SOEs’ stocks market and the investors welcome the privatization market. The reason of this flow could be explained using the two equivalence dynamics (“supply and demand” and “attractiveness reduction”) proposed in the previous section and “the markets relationships”.

Initially the real estate market attractiveness is high, which results in cash not flowing to the privatization market. Because of high demand in the real estate market, “supply

and demand” dynamics causes the real estate price to increase. This price increase reduces the real estate revenue which by itself reduces the market attractiveness (the dynamics of change in attractiveness). On the other hand as initially there is no demand for SOEs’ stocks, its price is severely low (the “supply and demand” dynamics working reversed). This low price causes the revenue on stock (dividend/price) of these enterprises and consequently the market attractiveness to increase (the “change in attractiveness” dynamics working reversed). The fall in real estate market attractiveness on one hand and the attractiveness of the privatization market on the other hand, causes cash to flow to the privatization market. This process continues until two markets reach an equal level of attractiveness. With the increase of investment demand in privatization market and hence the amount of cash flowing in this market, the quantity of SOEs bought by the private sector increases and privatization takes place successfully. In this condition, it is the market’s dynamics which activates the privatization; this mechanism is called “cash movement law” which finally results in cash flow.

2. “Cash movement law” works even when one option is in an initially worse condition.

In order to make our model more realistic, we actualize the risk in privatization market. It is known that in the beginning of the operation of the SOEs’ stock market, it contains a great amount of risk from the investors’ point of view. The lack of knowledge about the SOEs’ stock market in developing countries with an infant stock market, the lack of trust toward the efficiency of SOEs and uncertainty about these enterprises’ future because of their own inefficiency on one hand and the government not supporting them anymore on the other hand, altogether lead to an increase in the risk of investment in this market. Even though as investors gradually get to know the SOEs and the way they operate, some of these risks (like the risk of not knowing the stocks’ market) could be lowered with the activation of privatization.

So here we assume the initial risk of SOEs’ stock market to be high and model a mechanism (which works with the cash penetrating into the market and the privatization of the SOEs) to decrease this risk gradually until it reaches the level of a normal risk. The figure and its associated equations could be found in the appendix of the article; once again we run the model without the mechanism that creates bubble for a period of 100 years.

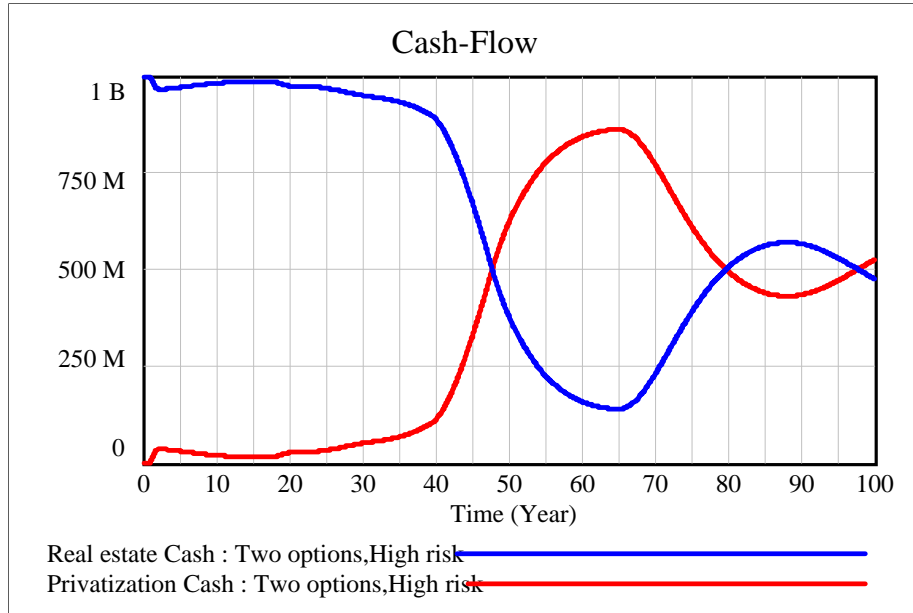


Figure 9: Cash-flows (Blue: Real estate Red: Privatization), two options, Abnormal initial risk

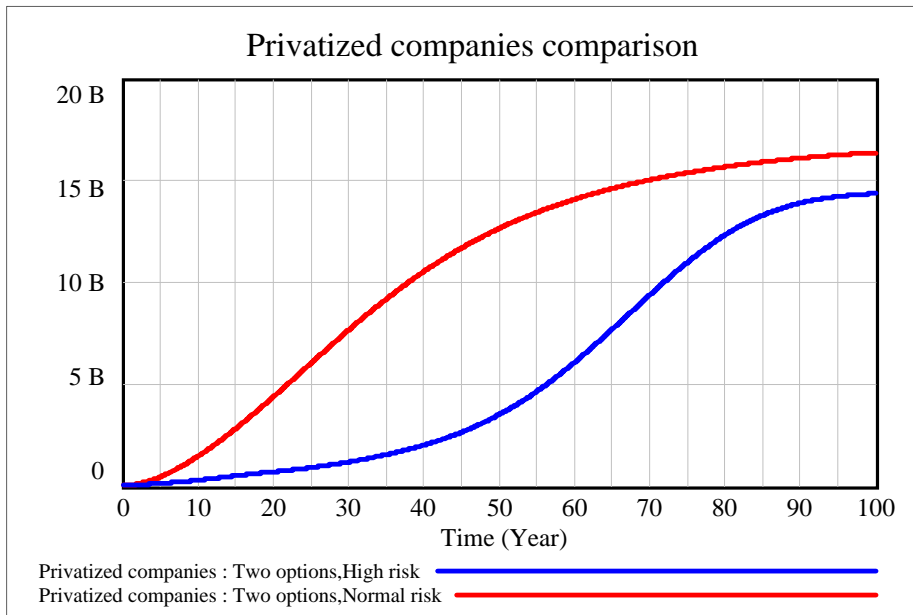


Figure 10: Total value of SOEs which are privatized, two options, (Red: Normal initial risk Blue: Abnormal initial risk)

It is observed that even with a worse initial condition (meaning a higher risk) the “cash movement law” succeeded transferring the capital and investment demand to the privatization market.

3. When there are more than two investment options available (**without** a high risk in privatization market)

Now we want to relax the assumption of the presence of only two investment options. In real world it is obvious that most of the time other than the real estate and privatization market, there are also other investment options available. So we add another option called “other markets” to the model which is the representative of other available markets for investment. In order to prevent the problem from more complication, we assume the attractiveness of this option to be constant. In the initial stage, just like the first stage explained, we assume all risks to have an equal amount of risk and run the model for a period of a hundred years (note that the bubble creation structure is still absent in the model).

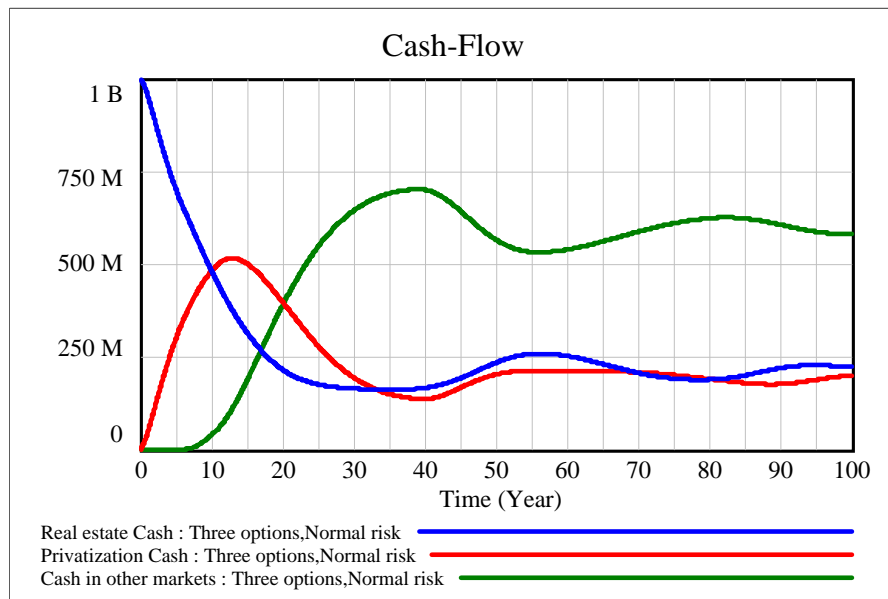


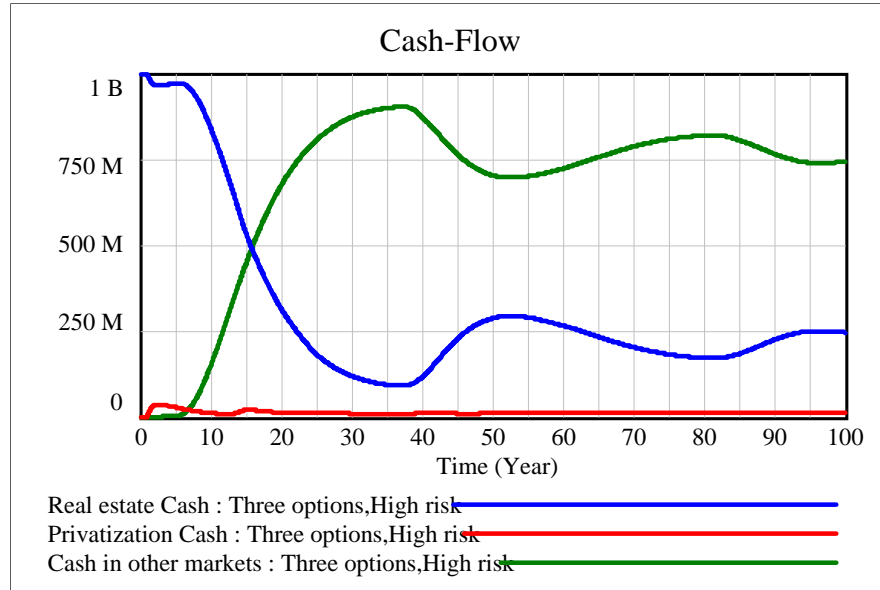
Figure 4: Cash-flows (Blue: Real estate, Red: Privatization, Green: Other Markets), Three options, Normal initial risk

It is observed that the cash flow could still move the investment to the new option and hence activate privatization. According to the attractiveness of different options, the cash flows between them, until it reaches equivalence.

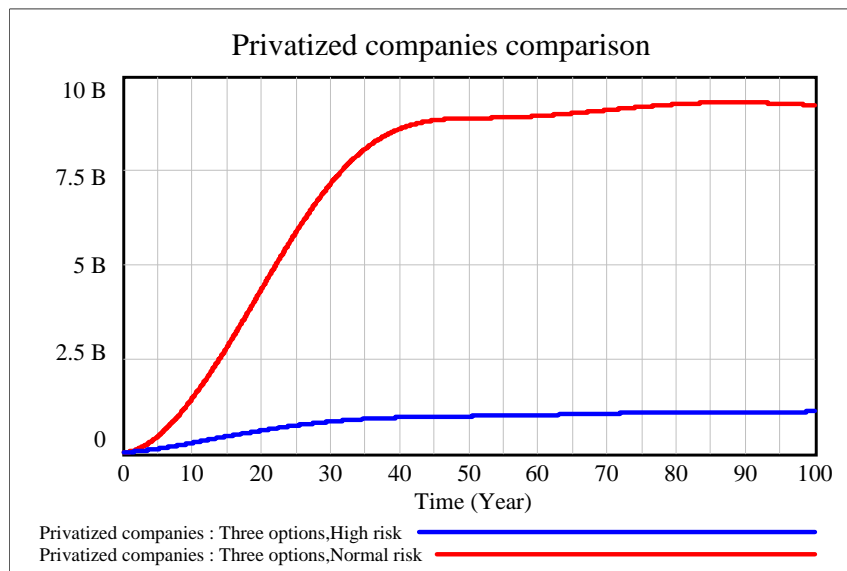
4. When there are more than two investment options available (**with** a high risk in privatization market)

Now we add the structure proposed in the second stage for the risk of the privatization market to the model with three investment options and view the results:





**Figure 5: Cash-flows (Blue: Real estate Red: Privatization Green: Other Markets), Three options, Abnormal initial risk**



**Figure 6: Total value of SOEs which are privatized, Three options, (Red: Normal initial risk Blue: Abnormal initial risk)**

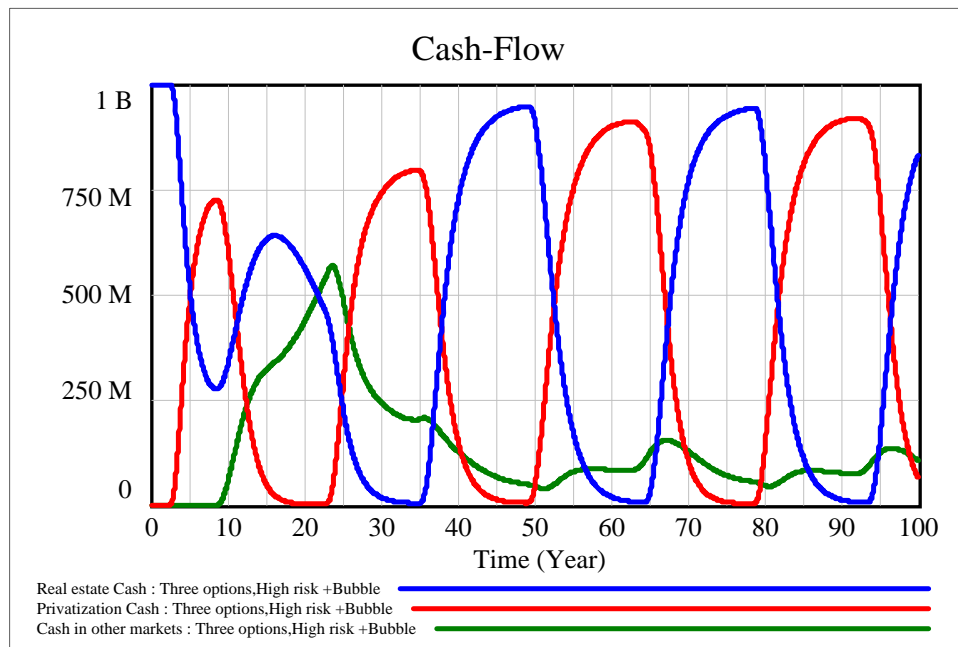
It is observed that in this condition (with the initial risk of the privatization market to be high), the “cash movement law” is not able to activate privatization, which leads to the recession of the privatization market. The reason of this phenomenon is that in this condition, the privatization option (because of having higher initial risk) has an initial lower attractiveness compared to the other two investment options. So the “cash movement law” can only make the cash flow between the two more attractive options. Subsequently in the presence of more than two investment options and an initial high risk of one of the options, that specific option stagnates and as no

investment is done in it, the risk which could be overcome by investment and the knowledge creation about that market stays.

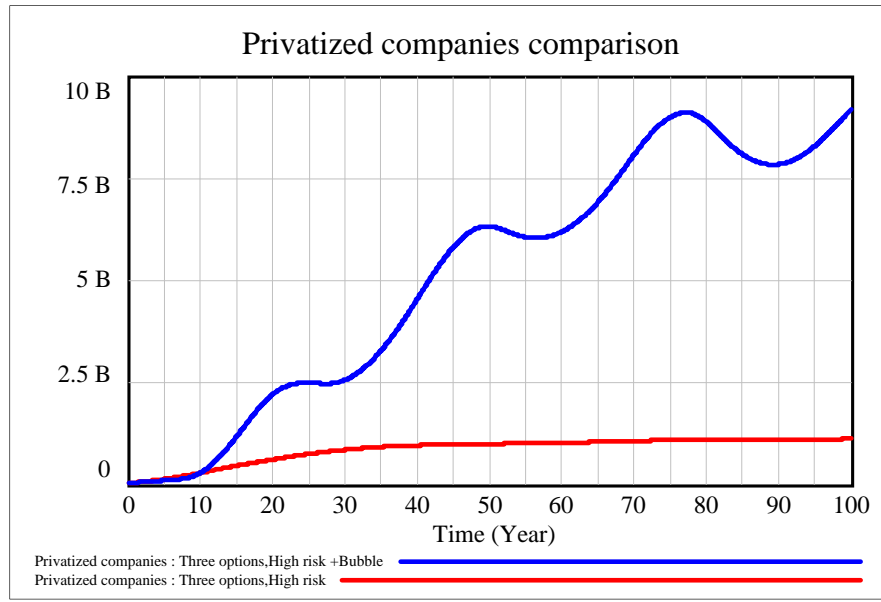
5. Bubble creation and burst in at least one of the markets with an initial higher level of attractiveness

In this stage we want to relax the assumption of the absence of bubble in the markets. In this stage high initial risk and hence less attractiveness is also assumed for the privatization market. The investment options are still more than two (for simplicity assumed to be three). Altogether this stage is very similar to the previous stages and the only difference is the relaxation of the bubble absence assumption. This means that a market's attractiveness is not only a function of the return on asset and the asset's risk, but also is affected by the price trend which further activates the "bubble creation and burst" dynamics.

Once again we run the model for a period of a hundred years.



**Figure 7: Cash-flows (Blue: Real estate Red: Privatization Green: Other Markets), Three options, Abnormal initial risk , And Bubble is present**



**Figure 8: Total value of SOEs which are privatized, Three options, (Red: Normal initial risk Blue: Abnormal initial risk), And Bubble is present**

It is observed that the privatization market started attracting capital in spite of initial high risk and the presence of more than two investment options. The difference of this model compared to the previous ones, was the addition of bubble dynamics. The bubble burst in one of the initial more attractive options, makes that option to become unattractive for some time. If this attractiveness reduction is in a level which makes the option to be even less attractive compared to the initially worse option (here privatization), then the “cash movement flow” will make the cash flow between the other two options (rather than the option which has recently experienced a bubble burst); which means an adequate amount of cash penetrating into the privatization market. The initial high risk of the privatization market starts to reduce when the cash flows inside it and investors start buying the SOEs’ stocks (this is due to the investors getting to know the SOEs’ stock market and its way of operation). In consequence of the reduction of the initially high risk of the privatization market, even when the option with a bubble burst experience comes back to a normal condition, the privatization market does not go back to its initial long term recession situation.

**So the bubble creation and burst in one of the primary investment options rather than the privatization market, can lead to the destruction of the initial lack of knowledge risk of the SOEs’ stock market and later to the attractiveness of it.**

This is a non obvious result derived from this model. In the economic and finance literature a lot has been said about the bubble creation and its negative influences on economics (due to the fluctuation caused in the market’s different variables), but till now there are no positive influences mentioned for these bubbles. **These are the dynamic complexity of the real world which causes a previously assumed negative factor to be beneficial in some situations.**

## Policies

In the introduction we mentioned that some countries including China when confronted the private sector's not so kind welcome in the privatization process, were forced to lower the SOEs' stock price in order to put an end to the privatization market's recession. We also indicated that this low price supply of the SOEs' stocks both prevents the government from having large revenues and lessens their desire toward privatization. The policies suggested here could result in the private sector's more welcoming attitude toward the privatization market. These policies are the subsequent of the non obvious result acquired in the model's behavior analysis section (the role of the bubble creation and burst in the attractive investment option):

1. In the previous section we saw that bubble creation and burst in the real estate market will cause the privatization market to come out of recession. So a policy proposed could be the government starting privatization when there has been a bubble created and burst in one of the country's primary markets. In this situation the privatization market competes against markets with temporarily less attractive markets as the investment attractiveness in a market which has recently experienced a bubble burst is very low (refer to the explanation of the bubble dynamics). In this case the possibility of the privatization market activation will be higher.

2. In some markets there are certain bubble constraining rules. For example in some stock markets (like the metals or private enterprises stock markets) there are rules specifying a maximum and minimum price for the stocks. These rules avert sudden increase/decrease in the prices, slow price trends and reduce the probability of bubble creation. Considering the insight created in this article about one of the advantages of bubbles, one suggestion for activating privatization could be the temporary suspension of these rules from a country's primary economic markets. In this way the likelihood of bubble creation and burst increases in these markets and the SOEs' stocks could be supplied immediately after the burst of these bubbles.

## Future Research

The insight proposed in this article is extracted from a model with many assumptions (refer to the model's assumptions part). Relaxing these assumptions will end in more detailed models which may subsequently develop newer and more reliable insights.

Considering the main insight of this article which is the positive consequences of activating privatization market, several questions rise. About the policies proposed for developing bubbles, one can ask that if the bubble creation and burst in itself is a costly process or not? The resulting fluctuations or the great loss many of the investors experience as a consequence of this bubble, are not small issues one can ignore easily. So the study of these costs and the efficiency of undergoing them in order to activate privatization could be a good subject for further research in this area.

Another question, which may lie out of the boundary of our model, is about the other alternatives. Is bubble the only way through which a privatization process may better function? Or may there exist a less costly alternative which is as beneficial to privatization as bubble?

Another point is about the structure of the price bubble in this model. In order to eliminate the bubble in our model, we excluded the price trend influence from the market attractiveness; which in reality never happens. Future research can model a market which bubble doesn't exist in it. As a result, the bubble elimination in this future model is valid. This future model can be a validation mechanism for the fourth section of the behavior analysis part (which was proving that without a bubble, in presence of more than two investment options, the privatization market stagnates).

One can note two points about this issue: First, this unreal structure is about bubble elimination, not about bubble creation and burst. The bubble creation and burst structure itself, is extracted from its real world process (refer to bubble creation and burst dynamics in the conceptualization section). So the model's claim considering the privatization activation as a result of price bubble is even now validated by the model. Second, models are not about revealing all unknown parts of the under study field correctly and thoroughly, but that even imperfect models can act as an infrastructure for more complete future models and in this way, they can create contribution (Forrester 1985).

## **Conclusion:**

Here we developed a system dynamics model concerning two main issues. The first one was how economics bubbles arise and the second was how bubbles may affect privatization in non- or little- privatized developing countries. By simulating the model, we showed that without economic bubbles privatization does not take place. We argued that there are two reasons for this: first, there is a high risk associated with privatization market because of investors not being much familiar with the SOE market. Second, the number of investment options in a country is greater than two. Considering these reasons together, we showed how privatization may not take place despite the fact that cash could not remain in one option market forever and should move from one investment option to another. We argued that if, on one hand, one option is initially of less attractiveness, and on the other hand, there are at least two other options for investment, then cash can move among the other options and never enter the initially less attractive market which in here is the stock market. This is why privatization is difficult in developing countries. In fact one can say privatization faces a "structural barrier" here.

We had another finding in this paper. That was, economic bubbles help activating the privatization process. We discussed how bubbles cause highly intensive oscillations in the behavior of investors leading to periods of very high price, demand, and attractiveness for each

of the markets amongst which cash is flowing. These periods are, then, followed by periods of very sharp drops in the above mentioned variables. We argued, based on the model simulations, the drops in the attractiveness of the real estate market and the other options may be so intensive that make them even less attractive than the stock market attempting the investors to invest their capital in this third option. Having entered the stock market, the investors gradually get more familiar with this market and, hence, the initial risk and unattractiveness eliminates. This way, the stock market becomes capable of attracting even more investors and privatization runs. In other words, bubbles can help privatization defeat the structural barrier faced in developing countries.

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## Appendix: model formulations

(01)attractiveness1=  $\text{EXP}(\text{return1}+\text{trend1}*0-0.5*\text{risk1})$  (in runs with the existence of bubbles: =  $\text{EXP}(\text{return1}+\text{trend1}-0.5*\text{risk1})$ )

(02)attractiveness2= $\text{EXP}(\text{return2}+\text{trend2}*0-0.5*\text{risk2})$  (in runs with the existence of bubbles: =  $\text{EXP}(\text{return2}+\text{trend2}-0.5*\text{risk2})$ )

(03)attractiveness3=1.1

(04)Cash in other markets=  $\text{INTEG}(\text{"csh trns 2-3"}+\text{"csh trns 1-3"},0)$

(05)cmpeletion1=Under Transition/cnstrctn time1

(06)cmpltn2=Under Cnstruction/cnstrctn time2

(07)cnstrctn time1=5

(08)cnstrctn time2=2

(09)creation time= $f2(\text{Privatized companies}/\text{"normal Privatized co.s"})*\text{normal crtn time}$

(10)"csh trns 1-2"= $(\text{Privatization Cash} * f1(\text{relative attractiveness}) - \text{Real estate Cash} * f1(1/\text{relative attractiveness})) / \text{trns time}$

(11)"csh trns 1-3"= $(\text{Privatization Cash} * f1(\text{relative attractiveness 13}) - \text{Cash in other markets} * f1(1/\text{relative attractiveness 13})) / \text{trns time}$  (in runs with two options for investment: =  $(\text{Privatization Cash} * f1(\text{relative attractiveness 13}) - \text{Cash in other markets} * f1(1/\text{relative attractiveness 13})) * 0 / \text{trns time}$ )

(12)"csh trns 2-3"= $(\text{Real estate Cash} * f1(\text{relative attraciteveness 23}) - \text{Cash in other markets} * f1(1/\text{relative attraciteveness 23})) / \text{trns time}$  (in runs with two options for investment: =  $(\text{Real estate Cash} * f1(\text{relative attraciteveness 23}) - \text{Cash in other markets} * f1(1/\text{relative attraciteveness 23})) * 0 / \text{trns time}$ )

(13)demand1=Privatization Cash/Stock Price

(14)demand2=Real estate Cash/Real estate Price

(15)Depreciation=Real estate/life2

(16)direct supply1= $\text{nrml cnstrctn1} * f3(\text{Stock Price}/\text{nrml prc1})$

(17)direct supply2= $\text{nrml cnstrctn 2} * f3(\text{Real estate Price}/\text{nrml prc 2})$

(18)earning1= $f4(\text{Privatized companies}/\text{"normal Privatized co.s"})^0 * \text{normal earning1}$

(19)earning2= $f4(\text{Real estate}/\text{normal Real estate}) * \text{normal earning2}$

(20)f1([(0,0)-(1,1)]  
,(0,1),(0.0795107,1),(0.259939,1),(0.293578,0.842105),(0.357798,0.592105),(0.480122,0.267544),(0.648318,0.0614035),(0.755352,0.0219298),(1,0),(30,0))

(21)f2([(0,0)-(2,10)]  
,(0.00152905,9.95614),(0.0565749,9.51754),(0.125382,7.2807),(0.17737,4.25439),(0.269113,2.32456),(0.368502,1.40351),(0.5,1),(2,1))

(22)f3([(0,0)-(100000,100000)],(0,0),(0.25,0),(0.672783,0.192982),(1,1),(3.97554,3.98246),(100000,100000))

(23)f4([(0,0)(4,4)]  
,(0.0122324,3.98246),(0.342508,2.33333),(0.587156,1.70175),(1,1),(1.92049,0.22807),(2.93578,0.0526316),(3.98777,0))

(24)f5([(0,0)-(1,6)]  
,(0.5.97368),(0.296636,5.34211),(0.422018,4.71053),(0.504587,3.42105),(0.58104,2.15789),(0.737003,1.5),(1,1))

(25)FINAL TIME = 100 Units: Year ~The final time for the simulation.

(26)icr=(ideal institutions-Institutions1)/creation time

(27)ideal institutions=1

(28)INITIAL TIME = 0 Units: Year ~The initial time for the simulation.

(29)Institutions1= INTEG (icr-obsln rate,0)

(30)life1=20

(31)life2=20

(32)normal crtn time=5

(33)normal earning1=0.2

(34)normal earning2=20

(35)"normal Privatized co.s"=1e+010

(36)normal Real estate=1e+008

(37)normal risk=0.1

(38)nrml cnstrctn 2=1e+006

(39)nrml cnstrctn1=1e+008

(40)nrml prc 2=100

(41)nrml prc1=1

(42)obsln rate=Institutions1/obsln time

(43)obsln time=30

(44)prc chng1=0.05\* Stock Price \* ln( (1+demand1)/(1+supply1))

(45)prc chng2=0.05\* Real estate Price \* ln( (1+demand2)/(1+supply2))



(46)Privatization Cash= INTEG (-"csh trns 1-3"- "csh trns 1-2",0)

(47)Privatized companies= INTEG (cmpeletion1-Shut down,1.5e+007)

(48)Real estate= INTEG (cmpltn2-Depreciation,1e+008)

(49)Real estate Cash= INTEG ("csh trns 1-2"- "csh trns 2-3",1e+009)

(50)Real estate Price= INTEG (prc chng2,100)

(51)relative attraciteveness 23=attractiveness2/attractiveness3

(52)relative attractiveness=attractiveness1/attractiveness2

(53)relative attractiveness 13=attractiveness1/attractiveness3

(54)return1=earning1/(Stock Price)

(55)return2=earning2/Real estate Price

(56)risk1=f5(Institutions1/ideal institutions)\*normal risk  
(in runs without High risk of privatization: =f5(Institutions1/ideal institutions)\*normal risk\*0+0.1)

(57)risk2=0.1

(58)sales rate1=direct supply1/transaction time1

(59)sales rate2=direct supply2/transaction time2

(60)SAVEPER = TIME STEP, Units: Year [0,?], The frequency with which output is stored.

(61)Shut down=Privatized companies/life1

(62)speculative spply1= Privatized companies\*f1(attractiveness1/(max(attractiveness2, attractiveness3 )))^3

(63)speculative spply2=Real estate\*f1(attractiveness2/(max(attractiveness1, attractiveness3 )))^

(64)Stock Price= INTEG (prc chng1,1)

(65)supply1=direct supply1+speculative spply1

(66)supply2=direct supply2+speculative spply2

(67)TIME STEP = 0.03125, Units: Year [0,?] The time step for the simulation.

(68)transaction time1=0.3

(69)transaction time2=0.3

(70)trend1=(Stock Price-DELAYII(Stock Price, 1 , 1 ))/DELAYII(Stock Price, 1 , 1 )

(71)trend2=(Real estate Price-DELAYII(Real estate Price, 1 , 40 ))/DELAYII(Real estate Price, 1 , 40 )

(72)trns time=0.05

(73)Under Cnstruction= INTEG (sales rate2-cmpltn2,0)

(74)Under Transition= INTEG (sales rate1-cmpeletion1,0)