

The Long Run Effects of Competitive Undervaluation of Dong Currency on Economic Growth of Vietnam

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Abstract: *Since joining the World Trade Organization in 2006, Vietnam has attracted increased foreign investment. Over the past few years, Vietnam has depreciated its currency compared to the U.S. Dollar, making Vietnam's exports to the U.S. lower-priced. This has helped Vietnam increase exports and boost national income in the short run. However, one consequence of this policy is to make imports more expensive, including imports to update its technology. This paper investigates what long term effects the undervalued Dong currency might have on the economy by using a system dynamics approach. The study finds that the devaluation causes productivity and percentage change of real GDP per capita to decline and reach a steady state.*

Keywords: devaluation, undervalued currency, total factor productivity, economic growth, per capita growth, real exchange rate, real GDP, system dynamics.

1. Introduction:

Since joining the World Trade Organization in 2006, Vietnam has attracted more foreign investment. Over the past few years, Vietnam has been depreciating its currency compared to the U.S. Dollar, making Vietnam's exports to the U.S. lower-priced. In the short run, this has helped Vietnam to increase its exports and boost national income. However, in the long run, this policy would be expected to negatively impact economic growth.

One consequence of this policy is to make imports more expensive, including imports to update its technology, which may limit per capita growth. The impacts on technological growth in Vietnam, measured as Total Factor Productivity, can affect the per capita growth of Vietnam. In the short term, an undervalued Vietnam Dong facilitates growth because undervaluation of currency enhances the relative profitability of tradable goods in a developing economy. However, in the long term, there is an effect on technology transfer since imports become more expensive and it will influence the productivity and per capita growth.

2. Hypothesis:

Hypothesis 1:

H_{01} : There are no long term effects of the undervaluation policies on the total factor productivity of Vietnam.

H_{a1}: There are long term effects of the undervaluation policies on the total factor productivity of Vietnam.

Hypothesis 2:

H₀₂: There is no time threshold where the effects of an undervalued currency become economically negative.

H_{a2}: There is a time threshold where the effects of an undervalued currency become economically negative.

3. Literature Review:

Most international trade involves monetary transactions. The exchange rate between two countries is the rate that specifies how much one currency is worth in term of the other. Because of their strong influence on the current account and other macroeconomic variables, exchange rates are the most important prices in an open economy (Krugman 1997).

Real exchange rate:

Professor Gustav Cassel of Sweden and John Maynard Keynes were both interested in computing the new correct exchange rate after World War I. Their method used the original exchange rate multiplied by the relative movement of price levels (Ohno 2005). This rate is also referred to as the real exchange rate (RER), where E is the actual exchange rate, P* is the foreign price, and P is the domestic price:

$$\mathbf{RER = (E \times P^*) / P} \quad \mathbf{(1)}$$

However, in this case, there is big gap between the Consumer Price Index of Vietnam and US. Thus, the researcher used the inflation rate instead of the Consumer Price Index of US and Vietnam. Since the inflation rate measures the change in prices of all new, domestically produced, final goods and services in an economy, it can give a more accurate result. Thus, the formula will become:

$$\mathbf{RER = E \times (Inflation\ in\ USA / Inflation\ in\ VN)}$$

When RER rises (domestic currency depreciates in real term, $E_{\text{VND}/\$} > E_{\text{(PPP) VND}/\$}$), Vietnam gains competitiveness because domestic prices become relatively lower. This is called undervaluation (Ohno 2005). So, when the nominal exchange rate is greater than real exchange rate, the Vietnam Dong is undervalued. Thus, the researcher has used this method to calculate the real exchange rate and compare it with the nominal exchange rate to determine whether the Vietnam Dong is undervalued or not.

Once a currency undervaluation is identified, it is necessary to understand the effects of the undervalued currency. This has been the subject of several researches and theories.

The effects of undervalued currency:

Over the years, economists and policymakers have focused primarily on fiscal and exchange rate policy (Bernanke 2008). Exchange rate policy comes in various styles: fixed, floating and “managed float” exchange rate. The first is the pegged or fixed exchange rate regime; exchange takes place at a fixed rate. Before 1973, many countries maintained fixed exchange rates. Under a fixed exchange system, a government buys and sells its currency at a certain exchange rate against all other currencies. To do this, government must keep large reserves of other nations’ currencies in order to maintain the value of its own currency (Wessels 2000). A country that is fixing its exchange rate sometimes decides to change the exchange rate suddenly. Devaluation occurs when the central bank raises the domestic currency price of foreign currency. Devaluation causes currency to be undervalued.

The second style is the floating exchange rate. In this system, the exchange rate is determined purely by the market forces of demand and supply. And, finally, the third system is the pegged or “managed float” regime, which is a mix of fixed and floating rate systems. Under this system, the central bank has to decide the range or band of the exchange rate in order to prevent the currency from deviating so much from the certain range by managing the demand and supply.

According to Bhalla (2008), the success or failure of a particular exchange rate policy does not depend on the nature of the regime, but rather on the direction of the misalignment of the currency. An overvalued currency can lead to factor misallocations, losses in efficiency, higher inflation, and lower GDP growth. Ratha, Kang and Edwards (2007) stated that currency devaluation boosts economic growth by increasing export, aggregate demand, and output. However, Bhalla (2008) argued that the Ratha, Kang and Edwards (2007) approach lacks empirical support.

In addition, Rodrik (2007) believed that competitive undervalued currency is important for economic growth. However, most of the empirical results to date do not support the conclusion that exchange rate undervaluation is helpful for growth. Easterley (2005) concludes, on the basis of an updated dollar measure of currency undervaluation that a policy of undervaluation does not matter as a determinant of economic development.

Since imports get more expensive, inflation is a natural by-product of devaluation. If the country’s export sector relies heavily on imported inputs, then cost-push inflation will appear in the export sector as well, and to that extent, diminish the competitiveness of a country’s exports (Nunnenkamp and Schweickert, 1990).

Production suffers because imported inputs get costlier following a real devaluation (Krugman and Taylor, 1978). Some countries, especially those with heavy foreign currency liabilities, tend to lose credibility upon currency devaluation. There are number of effects in other areas such as balance of payments, current account and output.

Cobb-Douglas production function provides a quantitative link between inputs and outputs (Baye 2008). The production transfers inputs, including Labor and Capital, into outputs. Outputs grow through the increases in inputs and through increases in productivity due to the improved technology and a more workable workforce. If L is for Labor, K is for Capital, and A is for level of technology, the Cobb-Douglas production function is:

$$Y = A K^{\alpha} L^{\beta}$$

“A” represents the level of technology because the higher A means that more output is produced for a given level of inputs. A is also called “total factor productivity”. Total factor productivity (TFP) is not necessarily a measure of technology alone, since TFP could change as a function of other factors such as military spending, monetary shocks, or political factors. Growth in total-factor productivity (TFP) represents output growth not accounted for by the growth in inputs (Hornstein and Krussel 1996). Instead, the level of TFP is determined by how efficiently and intensely the inputs are utilized in production.

Solow (1957) defined TFP-growth as the rate of growth of real output not accounted for by the growth of the factor inputs and associated it with a shift in technology. Lipsey and Carlaw (2000) states that total factor productivity of an economy only increases if people work smarter and learn to obtain more output from a given supply of inputs. Improvements in technology – the invention of the internal engine, the introduction of electricity, of semiconductors clearly increase productivity (Law 2000). In their article, Lipsey and Carlaw also show that the importance of technological change for economic growth is in the technological complementarities that it creates, not in the externalities.

Over the long run, TFP does in fact reveal the increased productivity associated with technological possibilities, either in the form of technical progress or through the better use of all available technologies. Technology progress or the growth of total factor productivity is estimated as a residual from the production function.

The Total Factor Productivity is measured as described below:

First, it is obtained from the growth equation:

$$Y = A \times F(K, L)$$

Marginal Product (MP) of an input is the change in total output attributable to the last unit of an input. The marginal product of capital (MPK) therefore is the change in the total output divided by the change in capital:

$$MPK = \Delta Y / \Delta K$$

The marginal product of labor (MPL) is the change in total output divided by the change in labor:

$$MPL = \Delta Y / \Delta L$$

The output changes ΔY can be expressed as below if labor changes by ΔL , capital changes by ΔK and technology changes as ΔA :

$$\Delta Y = MPK \times \Delta K + MPL \times \Delta L + F(K, L) \times \Delta A$$

Now, dividing both sides by Y ($Y = A F(K,L)$), the equation would be:

$$\Delta Y/Y = MPK/Y \times \Delta K + MPL/Y \times \Delta L + \Delta A/A$$

Multiplying and dividing the first term by K and the second term by L , the equation would become like this:

$$\Delta Y/Y = (MPK \times K)/Y \times \Delta K/K + (MPL \times L)/Y \times \Delta L/L + \Delta A/A$$

Assuming perfect competition, capital and labor are paid their marginal products. Thus $MPK = r$ and $MPL = w$, where w is the wage rate (the price of labor) and r is the rental rate (the price of capital). The total payment for labor is a fraction of all payments. So, it is called “labor share”. Similarly, the capital payment is called “capital share”.

The growth rates of physical capital and labor are weighted by α and β . So, we can substitute the capital share “ α ” for $(MPK \times K)/Y$ and the labor share “ β ” for $(MPL \times L)/Y$. As is well known, these weights correspond to the respective shares of rental payments for capital and labor in total income. Under constant returns to scale, α and β sum to unity and we obtain the national income identity:

$$rK + wL = Y.$$

Then, the equation after the substitution of α and β would be:

$$\Delta Y/Y = \alpha \times \Delta K/K + \beta \times \Delta L/L + \Delta A/A$$

In this equation:

$\Delta Y/Y$ = Output Growth

α = Capital Share

$\Delta K/K$ = Capital Growth

β = Labor Share

$\Delta L/L$ = Labor Growth

$\Delta A/A$ = Total Factor Productivity Growth or Technical Progress

From the equation above, we can see that growth of output is contributed by the input growth and Total Factor Productivity Growth. The growth rate of “Total Factor Productivity” is the amount by which output would increase as the result of improvements in methods of production when all inputs are unchanged.

The total factor productivity index is computed as the ratio of an index of aggregate output to an index of aggregate inputs. Growth in TFP is therefore the growth rate in total output less the growth rate in total inputs. Technical progress can be measured by rewriting the equation as:

$$\Delta A/A = \Delta Y/Y - \alpha \times \Delta K/K - \beta \times \Delta L/L$$

With available data on α and the growth rates for output, physical capital and labor, TFP growth can be computed from the equation above as the residual. Accordingly, TFP growth is the so called Solow residual.

4. Methodology:

The researcher collected secondary data through the official Asian Development Bank and United States Government websites in eight categories:

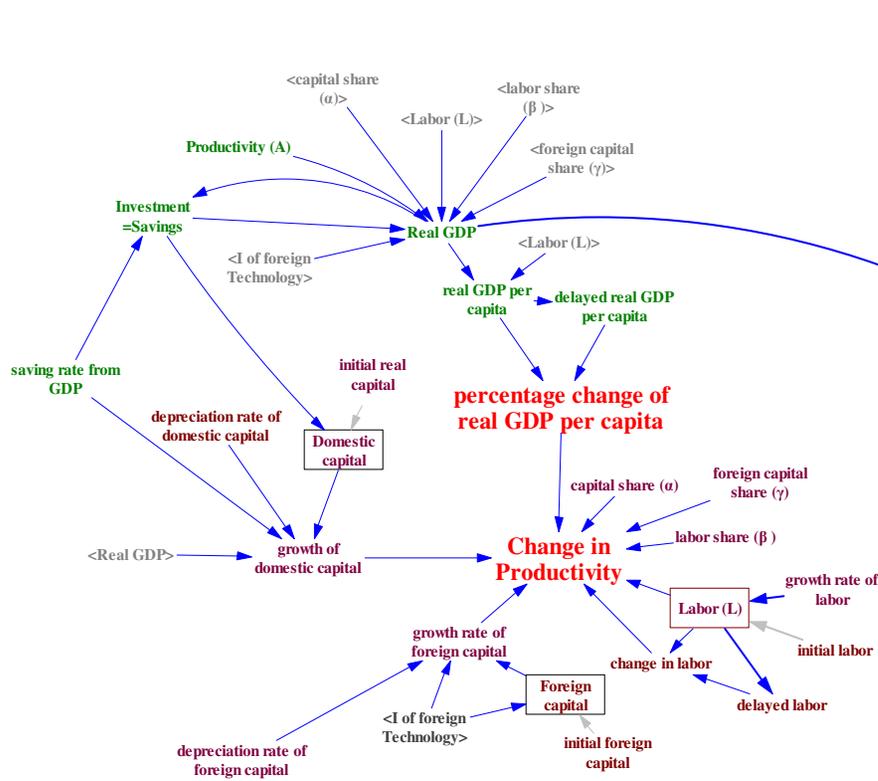
1. Annual Key Economic Indicators of Vietnam
2. Nominal exchange rate Dong/US\$
3. Annual Consumer Price Index of USA
4. Annual Consumer Price Index of Vietnam
5. Data of Population of Vietnam
6. Investment of Vietnam
7. Labor Force of Vietnam
8. GDP of Vietnam

Once the necessary data were collected, the researcher used The Statistical Package of the Social Sciences (SPSS) to perform regression analysis to describe the nature of the relationships between variables using a system dynamics model.

Once the relationships were estimated, Vensim PLE (Personal Learning edition) software was used to represent the system in dynamic form. Vensim is a visual modeling tool that allows the researcher to conceptualize, document, simulate, analyze and optimize models of dynamic systems.

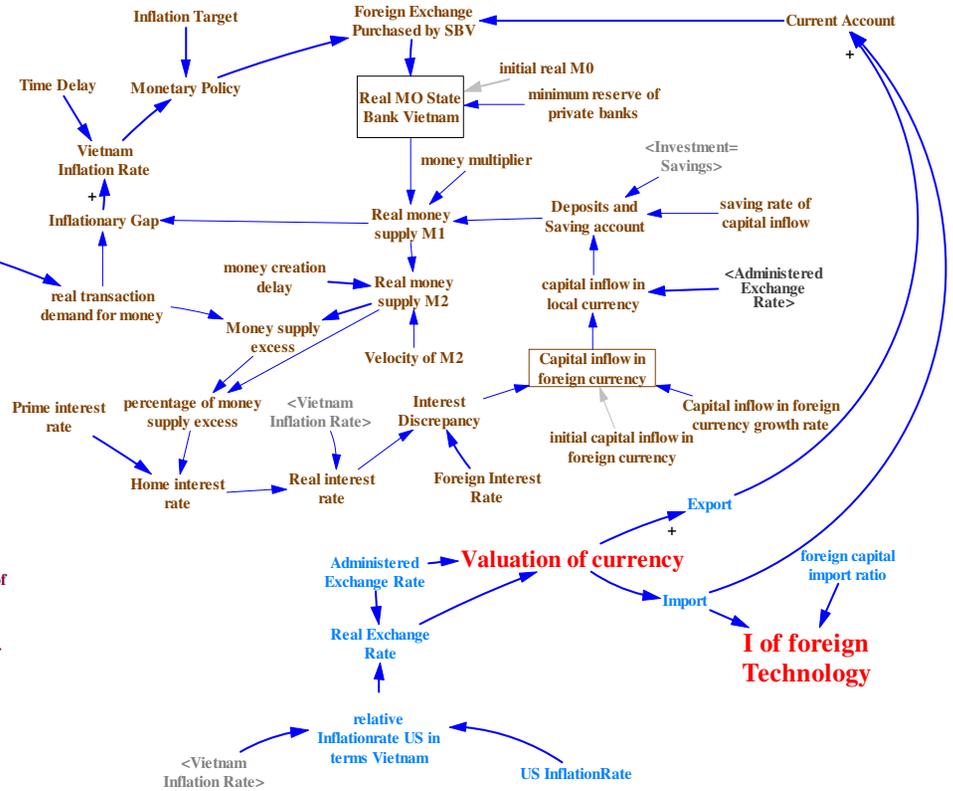
MODEL OF VALUATION OF CURRENCY

Gross Domestic Product (GDP)



Productivity

Monetary Market



Foreign Exchange Market

5. Explanation of model:

Real GDP is the Gross Domestic Product of Vietnam after adjusting for inflation. Real GDP was measured through the production function. The domestic investment is the domestic capital which was computed through a percentage of real GDP. This percentage was calculated as the average percentage of domestic capital from real GDP from the year 1990 to 2007. The change in real GDP affects the percentage change of real GDP per capita.

Transaction demand for money is the money used for the purchase of goods and services. In the model, transaction demand for money is influenced by real GDP (Transaction demand for money = Real GDP). As the real GDP rises, there will also be a higher demand for money to allow the transactions necessary to buy the extra GDP. If the percentage change of real GDP per capita falls, then people have less money for transactions.

The transactions demand for money is related to the inflationary gap. It is the difference between real money supply M1 and real transaction demand for money. When real money supply, M1, is greater than real transaction demand for money, people have more money than is required. Thus, they have more purchasing power. With a fixed amount of goods in the market, competition to buy would be expected to increase the prices of goods.

As the inflation gap increases, the inflation rate may increase. When it increases, it will influence the monetary policy. If the inflation rate is greater than inflation target, monetary policy is 0.5 which means the State Bank of Vietnam (SBV) will buy fifty percents of foreign currency and the other fifty percent is sterilized. If the inflation rate is less than inflation target, SBV will supply one hundred percent money.

This monetary policy will have an impact on the real M0 of State Bank of Vietnam. Real M0 is composed of any liquid or cash assets held within a central bank and the amount of physical currency circulating in the economy after adjusting for inflation. It includes the foreign exchange purchased by State Bank of Vietnam and minimum reserves of private banks. Real money supply M1 is a measure of total money supply, includes the transaction deposits at banks and cash in circulation. Thus, real money supply M1 includes M0 and deposit and saving accounts. The demand deposits are from the capital inflow in local currency. When there is an increase in capital inflow in foreign currency, there is an increase in demand for capital inflow in local currency.

Real money supply M2 is enlarged by M1 with the velocity of M2. It is influenced by money creation delay time of 24 months. If the real money supply M2 is greater than the real transaction demand for money, there will be a money supply excess. An increase in the real money supply lowers the home interest rate while a fall in the real money supply raises the home interest rate. Real interest rate is the interest rate after adjusting inflation rate. The difference between real interest rate and foreign interest rate is the interest rate discrepancy. This interest rate discrepancy will affect the foreign direct investment or capital inflow in foreign currency. The higher the interest discrepancy is, the more attractive for foreign investors.

The valuation of currency is influenced by the administered exchange rate and real exchange rate. If the administered exchange rate is greater than real exchange rate or the division between administered exchange rate and real exchange rate is greater than 1, the currency is undervalued. On the other hand, if the administered exchange rate is less than the real exchange rate, the currency is overvalued.

When the value of currency increases, exports will decrease because domestic prices of goods are more expensive compared with the foreign goods and import increase because the prices of goods in foreign countries are cheaper than producing at home country. If the value of currency instead decreases (undervalued currency), exports will increase because prices of home manufacturing goods are cheaper than those of other countries and imports will decrease because the prices of imported goods are more expensive. Further, the decrease of imports will cause a decline in the imports of foreign capital such as machines, equipments, and related items. This is assumed to affect the productivity of the country and cause the real GDP per capita decline as well.

6. Simulation explanation:

The researcher ran 19 simulations with all the policy parameters to identify which policy parameters significantly influence the target variables. The simulations results are listed in the below table.

TABLE 1: MODEL SIMULATIONS OF VIETNAMESE AND US GOVERNMENT POLICY PARAMETERS

		Vietnamese Government Policy							US Policy		Target variables				
		Saving rate from GDP	Depreciation rate of domestic capital	Saving rate of capital inflow	Money multiplier	Minimum reserves of private banks	Prime interest rate	Depreciation rate of foreign capital	Foreign capital import ratio	Foreign interest rate	US Inflation rate	Valuation of currency	Change of productivity	Percentage change of real GDP per capita	Import of foreign capital
1	Current	0.35	0.05	0.085	20	0.05	0.085	0.2	0.28	0.01	0.03				
2	Change saving rate from GDP = 0.4	0.4	0.05	0.085	20	0.05	0.085	0.2	0.28	0.01	0.03	Lower	Higher	Higher	Lower
3	Change depreciation rate = 0.1	0.35	0.1	0.085	20	0.05	0.085	0.2	0.28	0.01	0.03	Same	Higher	Same	Same
4	Change saving rate of capital inflow = 0.1	0.35	0.05	0.1	20	0.05	0.085	0.2	0.28	0.01	0.03	Lower	Same	Same	Same
5	Change money multiplier=50 & reserve rate=0.02	0.35	0.05	0.085	50	0.02	0.085	0.2	0.28	0.01	0.03	Lower	Lower	Lower	Lower
6	Change prime interest rate = 0.12	0.35	0.05	0.085	20	0.05	0.12	0.2	0.28	0.01	0.03	Lower	Same	Same	Lower
7	Change depreciation rate of foreign capital = 0.3	0.35	0.05	0.085	20	0.05	0.085	0.3	0.28	0.01	0.03	Same	Higher	Same	Same
8	Change foreign capital import ratio = 0.1	0.35	0.05	0.085	20	0.05	0.085	0.2	0.1	0.01	0.03	Lower	Lower	Lower	Lower
9	Change foreign interest rate = 0.05	0.35	0.05	0.085	20	0.05	0.085	0.2	0.28	0.05	0.03	Higher	Same	Same	Higher
10	Change US Inflation rate = 0.12	0.35	0.05	0.085	20	0.05	0.085	0.2	0.28	0.01	0.12	Higher	Higher	Higher	Higher

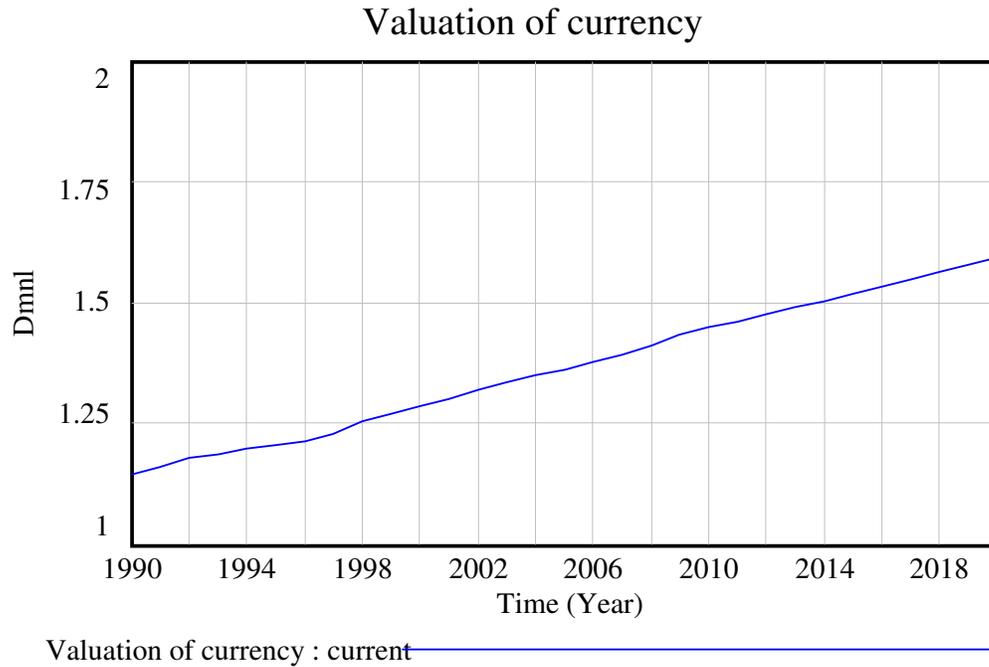
TABLE 2: MODEL SIMULATIONS OF US AND OTHER POLICY PARAMETERS

		Other policy parameters									Target variables			
		Time Delay (inflation)	Money creation delay	Velocity of M2	Capital inflow in foreign currency growth rate	Productivity (A)	Capital share (alpha)	Labor share (beta)	Foreign capital share (gamma)	Growth rate of labor	Valuation of currency	Change of productivity	Percentage change of real GDP per capita	Import of foreign capital
	Current	2	2	2.38	0.105	0.0075	0.643	0.931	0.049	0.026				
11	Change time delay = 1	1	2	2.38	0.105	0.0075	0.643	0.931	0.049	0.026	Lower	Lower	Lower	Lower
12	Change money creation delay = 3	2	3	2.38	0.105	0.0075	0.643	0.931	0.049	0.026	Same	Same	Same	Same
13	Change velocity of M2 = 1	2	2	1	0.105	0.0075	0.643	0.931	0.049	0.026	Same	Same	Same	Same
14	Change productivity = 0.03	2	2	2.38	0.105	0.0300	0.643	0.931	0.049	0.026	Higher	Higher	Higher	Higher
15	Change capital inflow in foreign currency growth rate = 0.15	2	2	2.38	0.15	0.0075	0.643	0.931	0.049	0.026	Lower	Lower	Lower	Lower
16	Change capital share = 0.8	2	2	2.38	0.105	0.0075	0.8	0.931	0.049	0.026	Higher	Higher	Higher	Higher
17	Change labor share = 0.5	2	2	2.38	0.105	0.0075	0.643	0.5	0.049	0.026	Lower	Lower	Lower	Lower
18	Change foreign capital share = 0.1	2	2	2.38	0.105	0.0075	0.643	0.931	0.1	0.026	Higher	Higher	Higher	Higher
19	Change growth rate of labor = 0.04	2	2	2.38	0.105	0.0075	0.643	0.931	0.049	0.04	Same	Higher	Same	Same

7. Results from the simulations:

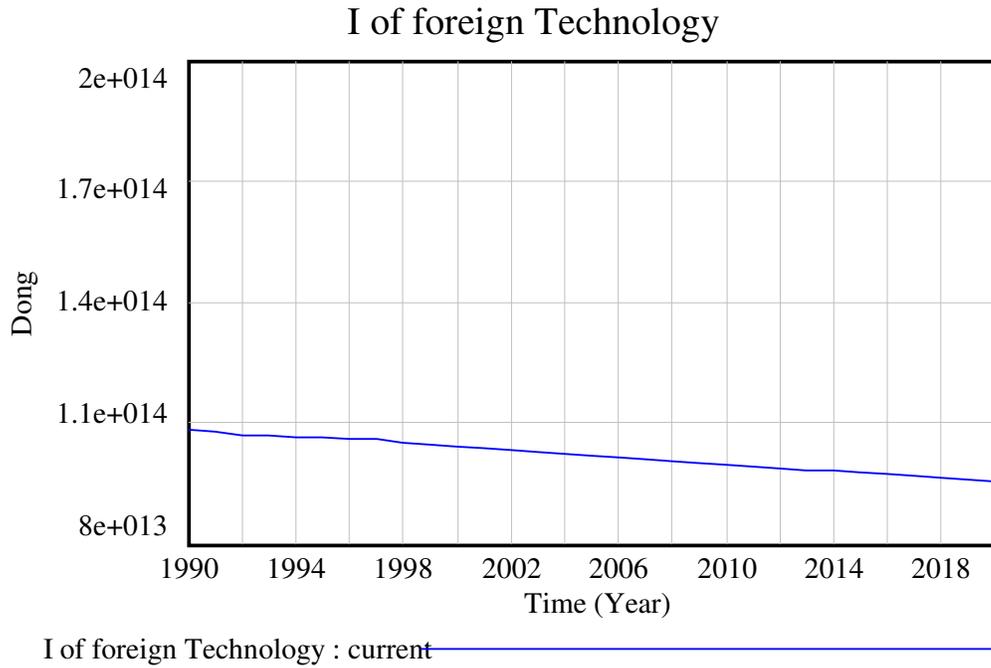
Simulation of current scenario:

Figure 1: Valuation of currency in the current scenario



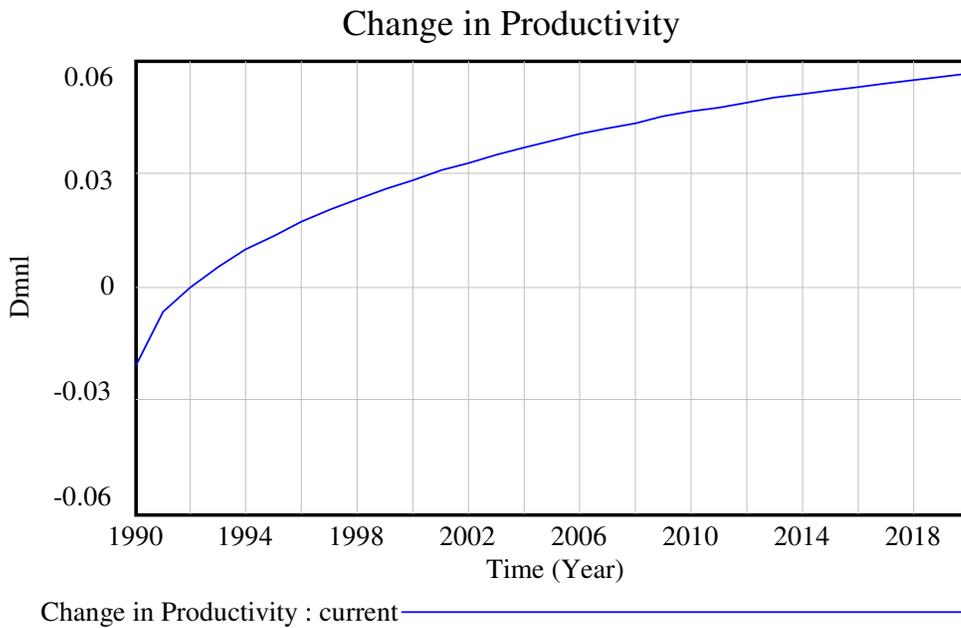
The currency is undervalued from 1990 to 2020. From the curve, the currency was undervalued from about 15 to 60 percent. High devaluation occurs in 1998 and 2008, and the simulation suggests it will continue to increase until 2020.

Figure 2: Import of foreign technology in the current scenario



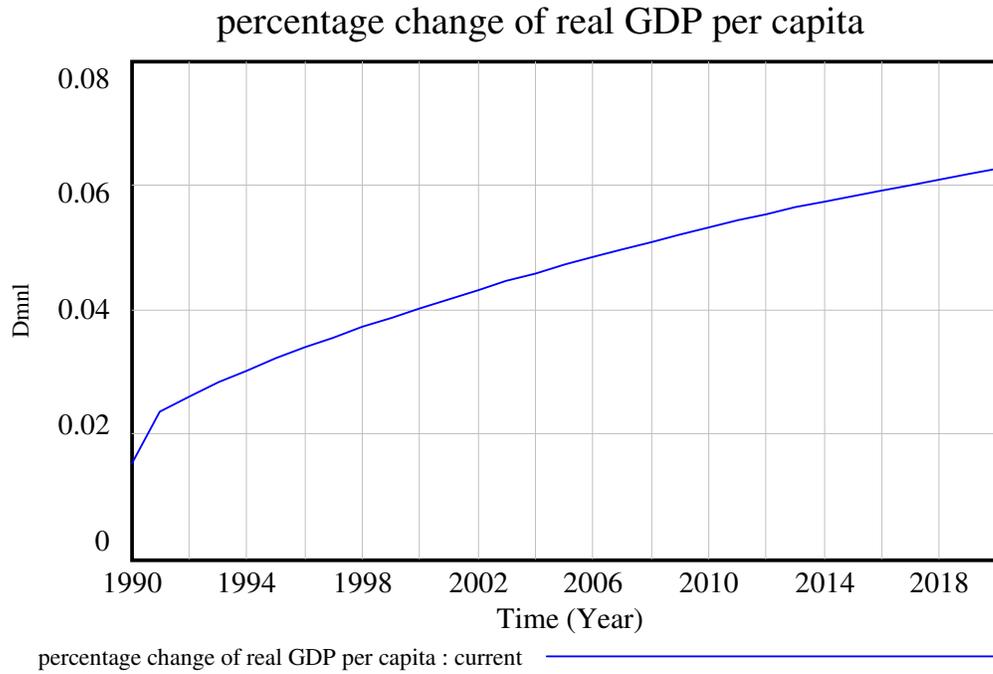
Because of the undervalued currency, the import of foreign technology decreases from 1994 to 2008 and is expected to continue to decrease through 2020.

Figure 3: Percentage change of real GDP per capita



Using the current scenario, productivity increases from 1990 to 2020. However, the curve gets flatter as the currency becomes more and more undervalued.

Figure 4: Percentage change of real GDP per capita in current scenario

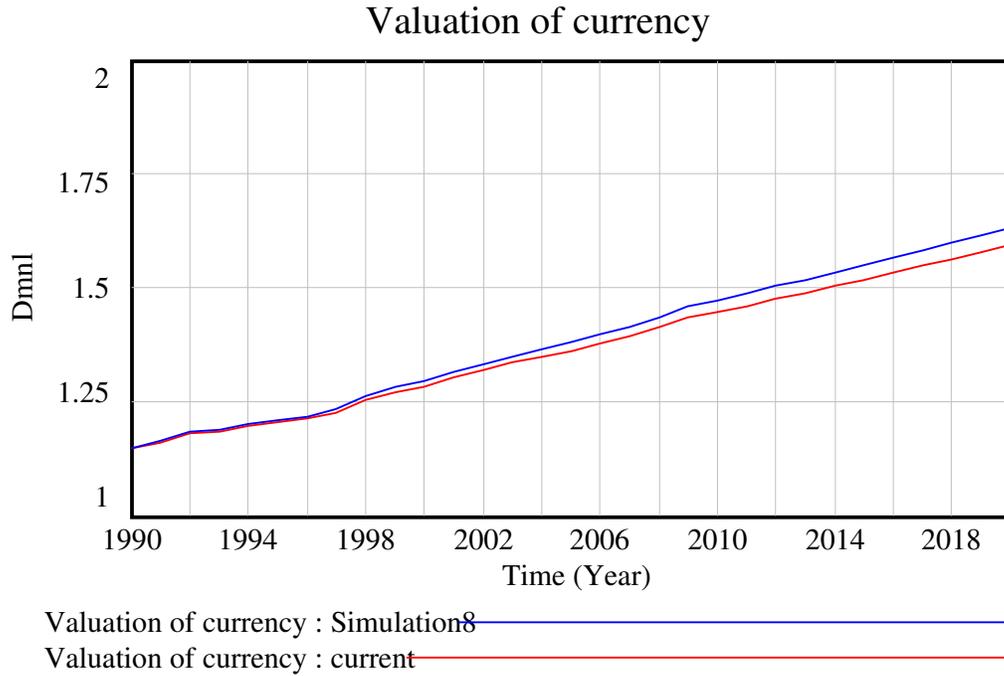


In simulation one, the percentage change of real GDP per capita is increasing in the current scenario from 1990 to 2020.

Analyze significant simulations

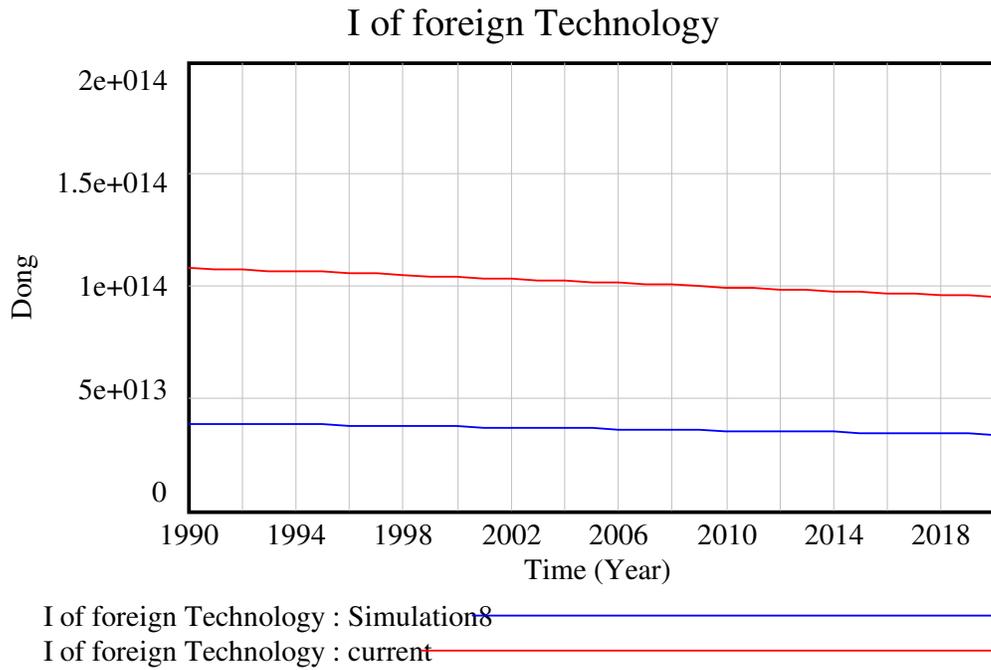
Simulation 8: Decrease foreign capital import ratio from 0.28 to 0.1

Figure 5: Valuation of currency in simulation 8



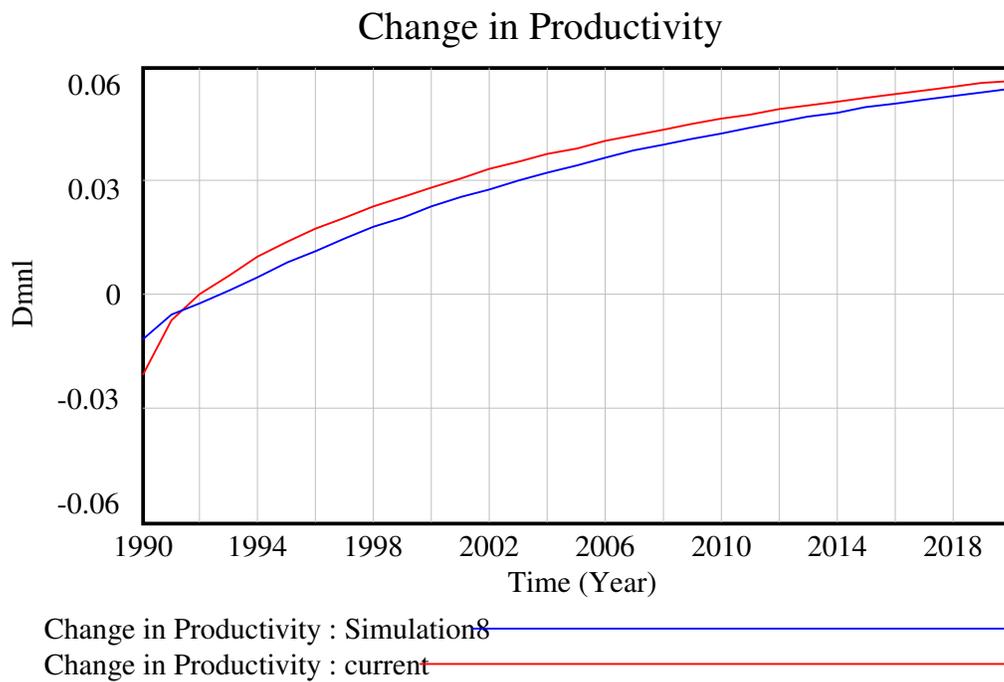
The currency is undervalued from 1990 to 2020. When decreasing the foreign capital import ratio from 0.28 to 0.1, the currency is depreciated. It is more undervalued than the current scenario. Since import becomes more expensive, the undervalued currency has an effect on the import of foreign capital.

Figure 6: Import of foreign capital in simulation 8



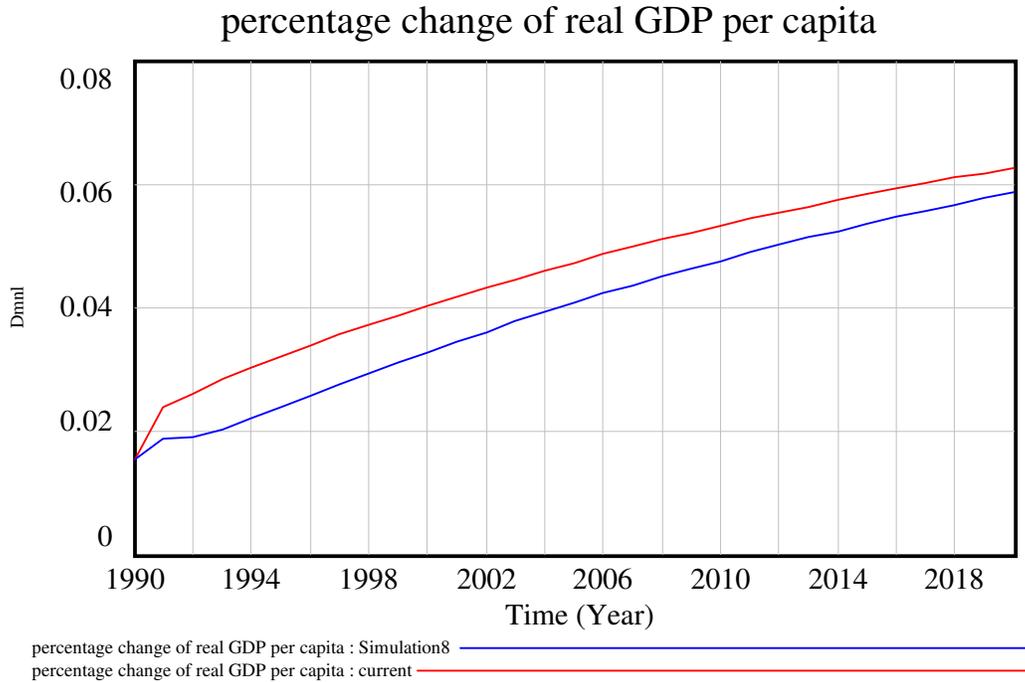
When decreasing the foreign capital import ratio, import of foreign capital decreases substantially from 1990 to 2020.

Figure 7: Change in productivity in simulation 8



With the decline in foreign capital import, the change in productivity also decreases from 1991 to 2020. This shows that foreign capital import has an impact on the productivity.

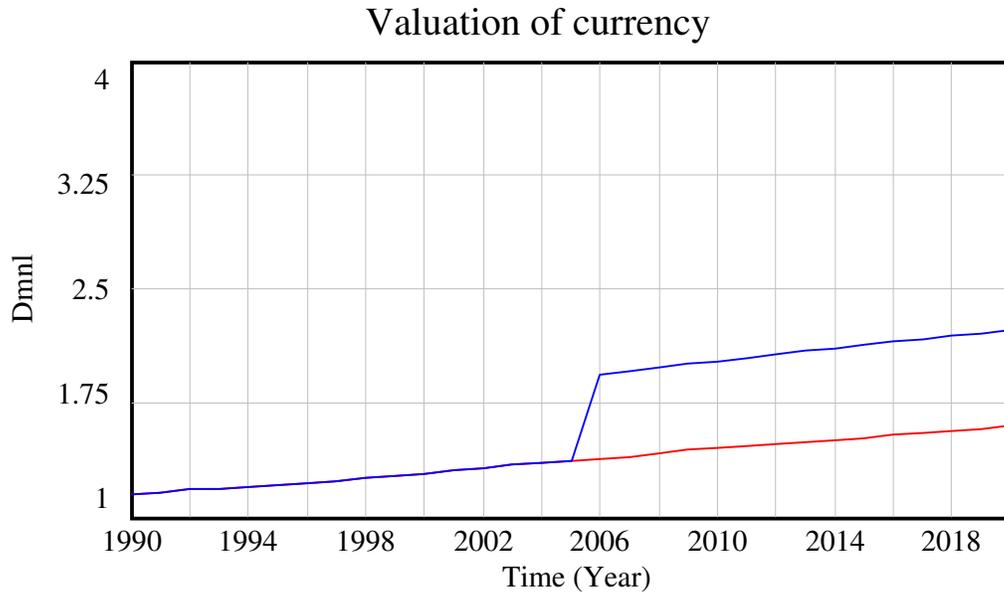
Figure 8: Percentage change of real GDP per capita in simulation 8



When the change in productivity decrease compared to the current scenario, the percentage change of real GDP per capita also goes down. The curve is getting flatter because of the undervalued currency. As the currency is more and more undervalued, the per capita growth will cease.

Simulation 20: Devalue the currency in 2006 by increasing the administered exchange rate to 84,000 Dong/Dollar (4 times compared to the current situation).

Figure 9: Valuation of currency in simulation 21

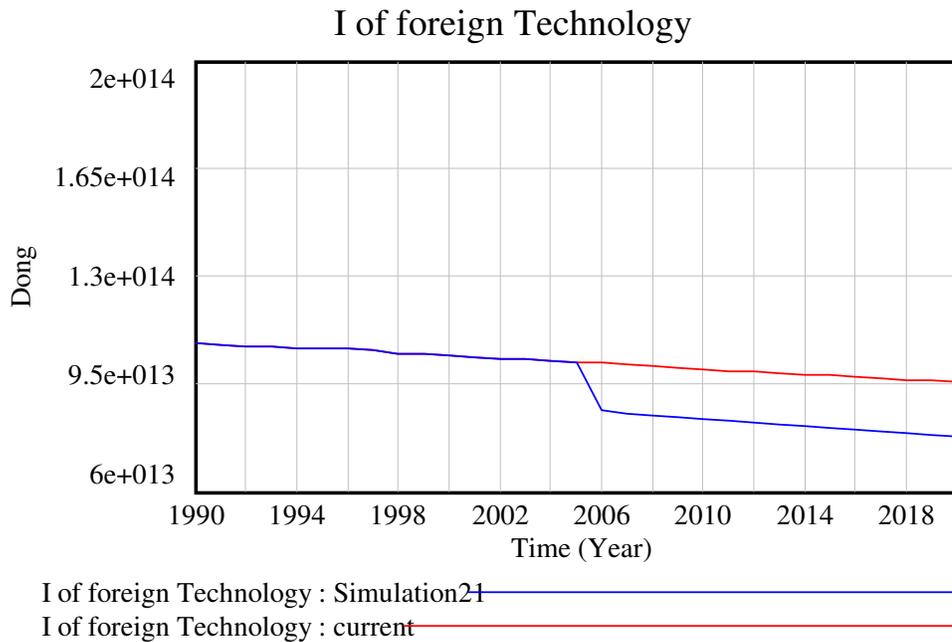


Valuation of currency : Simulation21

Valuation of currency : current

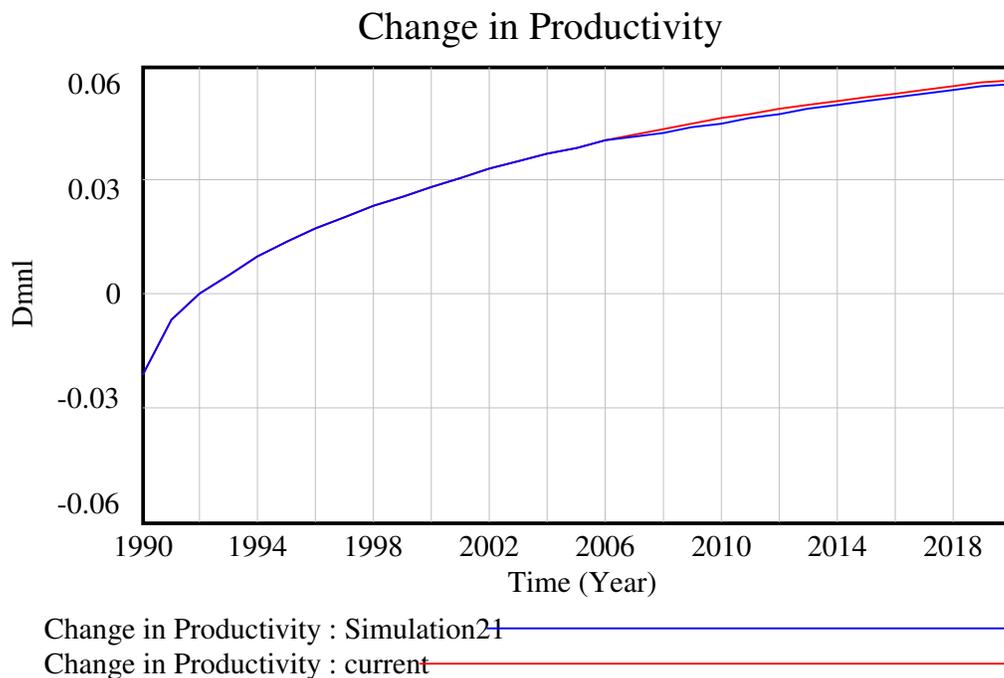
When devaluating the currency, valuation of currency is decreased. It is more undervalued than the current scenario.

Figure 10: Import of foreign capital in simulation 21



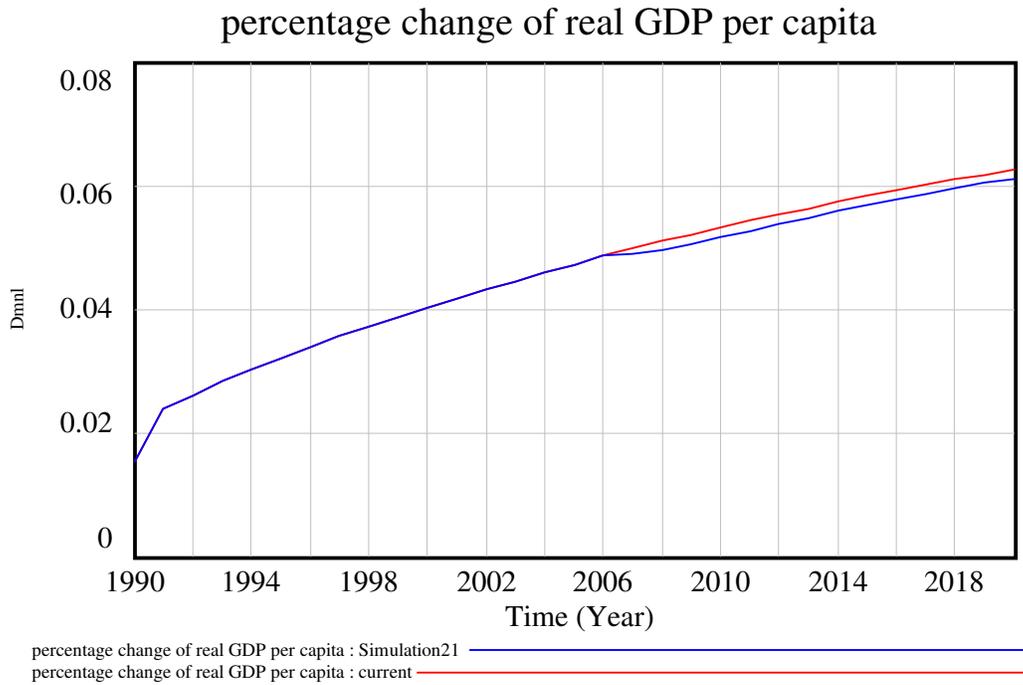
Because of undervalued currency, import of foreign capital has been decreased since 2006. This has an effect on the change of productivity and percentage change of real GDP per capita.

Figure 11: Change in productivity in simulation 21



The productivity has been decreased from 2006 to 2020 because of the devaluation.

Figure 12: Percentage change of real GDP per capita in simulation 21



The percentage change of real GDP per capita also decreases from 2006 to 2020 due to the devaluation. So, undervalued currency does have an effect on the change of productivity and percentage change of real GDP per capita.

Therefore, hypothesis H1 is accepted. It has shown that there are long term effects of undervalued currency on the total factor productivity of Vietnam.

Simulation 21: Forecast for the next 80 years.

Figure 13: Valuation of currency in simulation 19

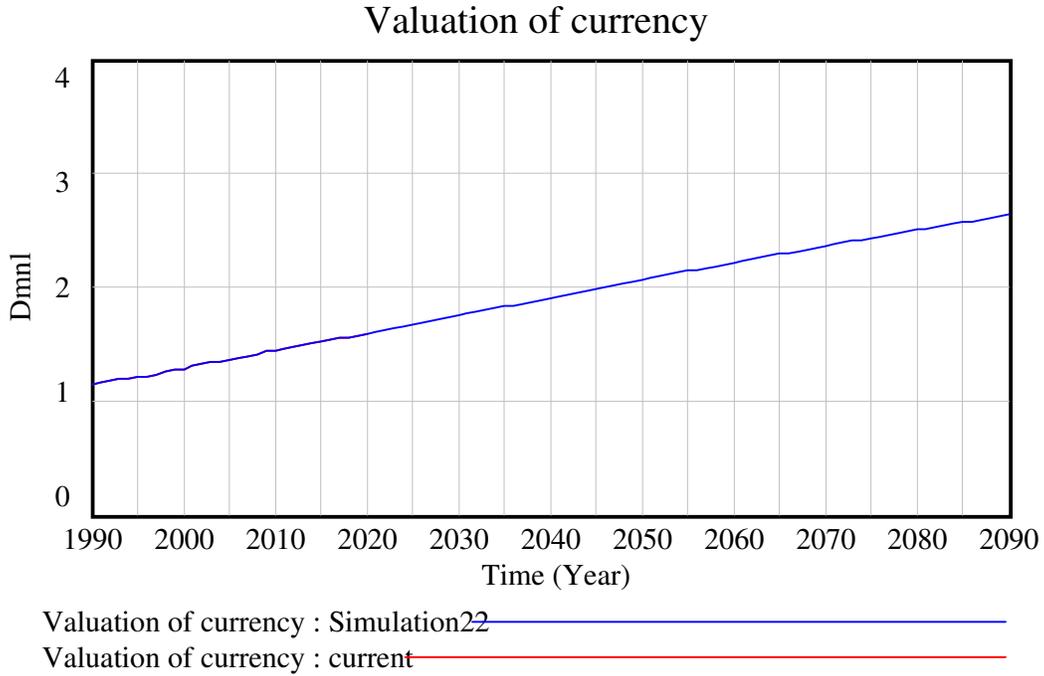


Figure 14: Import of foreign capital in simulation 19

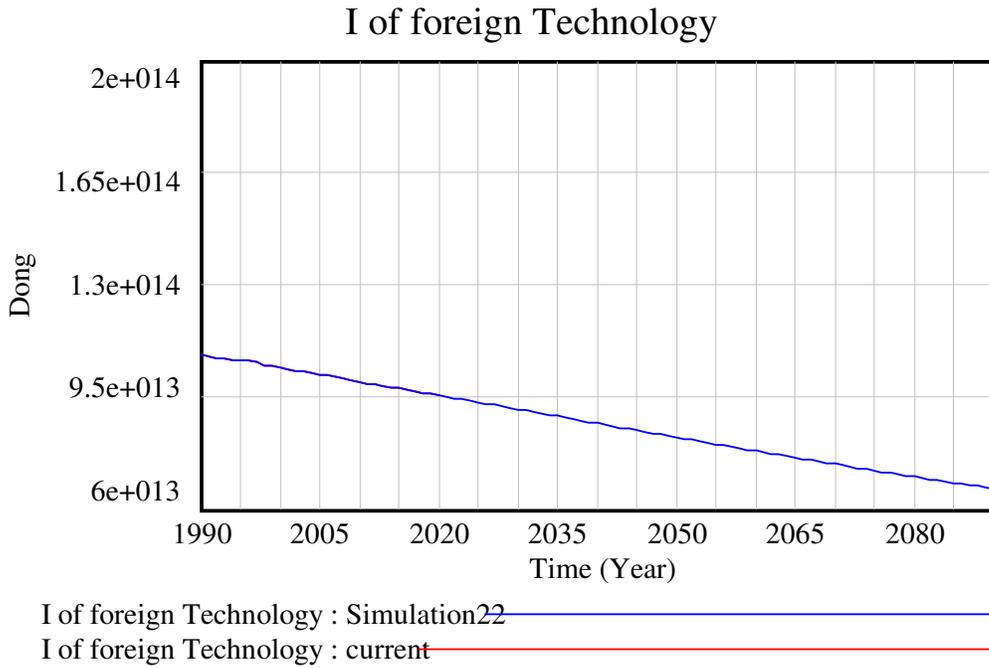


Figure 15: Change in productivity in simulation 19

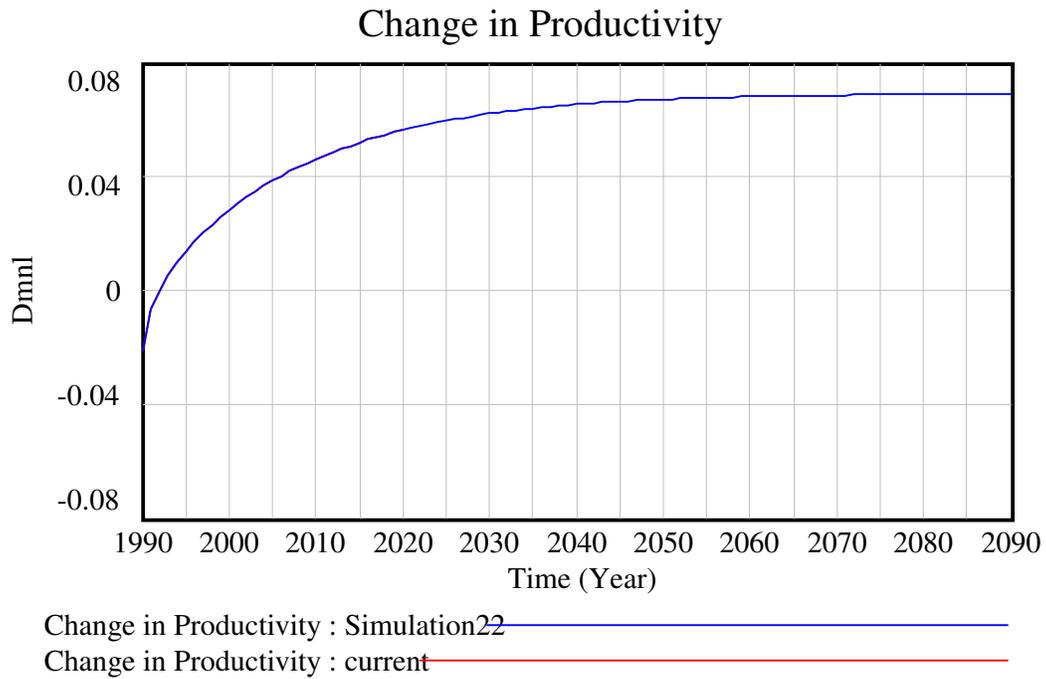
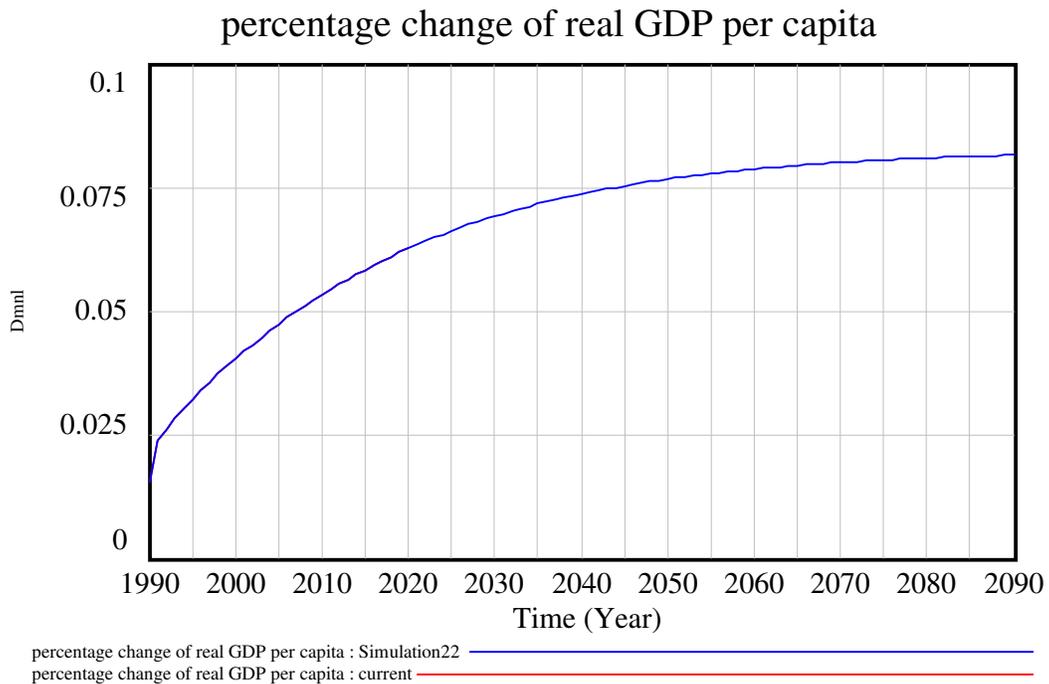


Figure 16: Percentage change of real GDP per capita in simulation 19



The currency keeps depreciating more and more from 1990 to 2090. Import of foreign capital is decreasing through the years as the currency is more and more undervalued. It is shown that from 2057 upward, productivity does not change much. So, with the continuing devaluation, the productivity will not grow as it has reached the steady state. It shows that from 2062, there is not much change in percentage change of real GDP per capita (about 1 percent every 8 years). So, hypothesis 2 is accepted. As the currency continues to be undervalued, percentage change of real GDP per capita ceases to grow.

Conclusion from 20 simulations:

- From these simulations with 18 policy parameters, there are several parameters that have a great impact on the target variables:
 - Foreign capital import ratio
 - When there is a decrease in foreign capital import ratio (simulation 8), there is a great decrease in importing of foreign technology. This affects the productivity and percentage change of real GDP per capita, cause them decline.
 - Depreciation rate of domestic capital:
 - Increase depreciation rate of domestic capital (simulation 3): there is no change in valuation of currency, import of foreign technology, and percentage change of real GDP per capita. However, the change of productivity increases much.
 - Money multiplier and reserve ratio
 - Increase money multiplier to 50 and decrease reserve ratio to 0.02 (simulation 5): valuation of currency is decreased (more undervalued), import of foreign technology decreases while change of productivity and percentage change of real GDP per capita also go down.
 - US inflation rate:
 - Increase US inflation rate (simulation 10): valuation of currency is increased (overvalued), import of foreign technology increases while change of productivity also rises a bit. The percentage change of real GDP per capita goes up from 1990 to 2020.
 - Time delay (inflation):
 - Decrease time delay (inflation) (simulation 11): valuation of currency is decreased (more undervalued), import of foreign

technology decreases while change of productivity and percentage change of real GDP per capita also go down.

- Domestic capital share (alpha):
 - Increase domestic capital share (alpha) (simulation 16): there is an increase in valuation of currency (more overvalued) and import of foreign capital also rises. This causes change of productivity and percentage change of real GDP per capita increase substantially. However, the curve tends to decline over the period.
- Labor share (beta):
 - Increase labor share (beta) (simulation 17): there is a decrease in valuation of currency and thus, import of foreign capital also declines. Consequently, the change of productivity and percentage change of real GDP per capita goes down.
- Foreign capital share (gamma):
 - Increase foreign capital share (gamma) (simulation 18): there is an increase in valuation of currency and import of foreign capital. The change of productivity and percentage change of real GDP per capita also rise. However, the curve of change in productivity and percentage change of real GDP per capita tend to claim down over the period.
- To change the value of currency:
 - To increase the value of currency:
 - By decreasing saving rate from real GDP
 - By decreasing saving rate of capital inflow
 - By decreasing prime interest rate
 - By decreasing money multiplier and increasing reserve ratio
 - By increasing foreign capital import ratio
 - By increasing foreign interest rate
 - By increasing US inflation rate
 - By increasing time delay (inflation)
 - By increasing productivity (A)
 - By increasing capital share (alpha)
 - By increasing labor share (beta)
 - By increasing foreign capital share (gamma)
 - By decreasing capital inflow in foreign currency growth rate
 - Decrease the value of currency:
 - By increasing saving rate from real GDP
 - By increasing saving rate of capital inflow

- By increasing prime interest rate
 - By increasing money multiplier and increasing reserve ratio
 - By decreasing foreign capital import ratio
 - By decreasing foreign interest rate
 - By decreasing US inflation rate
 - By decreasing time delay (inflation)
 - By decreasing productivity (A)
 - By decreasing capital share (alpha)
 - By decreasing labor share (beta)
 - By decreasing foreign capital share (gamma)
 - By increasing capital inflow in foreign currency growth rate
- To increase the productivity:
 - By increasing saving rate from real GDP
 - By increasing depreciation rate of domestic capital
 - By increasing US inflation rate
 - By increasing domestic capital share (alpha)
 - By increasing labor share (beta)
 - By increasing foreign capital share (gamma)
 - By increasing growth rate of labor
 - By increasing productivity (A)
 - By decreasing money multiplier and increasing reserve ratio
 - By increasing depreciation rate of foreign capital
 - By increasing foreign capital import ratio
 - By increasing time delay (inflation)
 - By decreasing capital inflow in foreign currency growth rate
- To increase the percentage of change of real GDP per capita:
 - By increasing saving rate from GDP
 - By decreasing money multiplier and increasing reserve ratio
 - By increasing foreign capital import ratio
 - By increasing US inflation rate
 - By increasing the time delay (inflation)
 - By decreasing capital inflow in foreign currency growth rate
 - By increasing domestic capital share (alpha)
 - By increasing labor share (beta)
 - By increasing foreign capital share (gamma)

In short, the undervalued currency has negative effect on the total factor productivity. As the currency continues to be undervalued, productivity and percentage change of real GDP per capita cease to grow about 2060. With lack of technology, the real output per capita growth has been declined.

8. Conclusion and recommendations:

8.1 Conclusion:

The Dong currency of Vietnam has been undervalued from 1990 to 2007. The undervalued Dong currency has an impact on the total factor productivity of Vietnam. From a system dynamic model, the important determinants of growth in real GDP per capita are technical progress and foreign capital import. Without foreign capital import, the productivity and real GDP per capita growth decrease significantly. In addition, devaluation also causes productivity and percentage change of real GDP per capita decline. In the long run, both of them will reach the steady state and will not be able to grow further. This will have great impact on the whole economy.

As a consequence of undervalued currency, the real GDP per capita ceases to grow in the absence of continuing improvements in technology. Just accumulation of more capital per worker in the absence of technological progress is impossible to maintain per capita growth of a country because of diminishing returns. Thus, the capital or labor augmenting technological progress becomes essential, consistent with neoclassical economic theory.

The simulations indicate that there is a time threshold when the initial positive effects of undervalued currency valuation turn first neutral and later negative. The time threshold is within 15-25 years after administratively undervaluing currency.

US inflation also has strong influence on the developing countries such as Vietnam. By changing the US inflation rates, it really changes the economy in term of valuation of currency, import of foreign technology, productivity and percentage change of real GDP per capita.

8.2 Recommendations:

Arnold C. Harberger, an economist, has once said that “Policy can influence growth, either for good or ill, in many ways. The task is therefore to try to exploit as many as possible of these avenues for good”. A policy might have a good and bad side, thus it is important to focus on the good and avoid the bad thing to happen. Undervalued currency also has the advantages and disadvantages. Vietnam government can exploit the advantages and try to avoid the disadvantages. Currency should be undervalued for initial period of 15 to 20 years to enhance exports, after that currency should be valued to the market.

Since foreign capital is very important in increasing productivity and real GDP per capita growth. Vietnamese government should encourage investment in new technology from foreign countries. This can be done through lowering the taxes imposed on importing technology such as machines, equipments...

As technology improvements is a very critical factor in the production. Vietnamese government can also focus on domestic and foreign technology

improvements. There should be policies to encourage new ideas or innovation in the production process. This will help to lower the costs and increase the productivity.

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