Inflation in Vietnam in the period from 2000 to 2015

Analyses of Main Causes and some Inflation-Hedging Forms of Investors

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INTRODUCTION

The rules of the economic development of each country experience crises with differences in feature, scope, level, and time due to subjective or objective reasons. Vietnam is a developing country with the economy affected by the crisis in the process of constructing and developing the market economy.

In Vietnam, the inflated economy has a direct impact on producers and consumers, since production costs are high, prices of goods increase, while policies of the government on wages, taxes, and other social benefits are not timely adjusted to adapt to inflation. Statistical tests show the negative relationship between inflation and economic growth - GDP growth. The empirical analysis using the linear regression model shows that a 1% increase in inflation rate lowers 0.0078% of GDP growth (the appendixes) over the whole period from the start of the economic reform, namely “doi moi” until 2015. Furthermore, the findings of Tung and Thanh (2015), using non-linear models, confirm that the negative effects on the economy are mainly attributed to the extremely high inflation rate instead of the low or moderate inflation rate for the similar period. In details, inflation only hinders the economics growth when its rate exceeds the threshold that is 7 percent. In reality, any ordinary citizen can observe the manifestations of this negative relationship. Many businesses in different economic sectors went bankruptcy or ceased production and sale. Unemployment led the lives of the workers to fall into difficult circumstances, especially the class of wage and salaried workers.

In Vietnam's economy, agriculture plays an important role, comprising a large proportion of the economy. Inflation made the farmers not have sufficient access to the capital in the manufacturing because of the skyrocketing of interest rates and prices of agricultural materials. Intensive agriculture was under outdated practices when cutting-edge scientific techniques were barely applied in farming, poultry, and fishing. Made agricultural products could not be exported, while domestic consumption decreased. Difficulties caused by inflation put a huge strain on the financial system of the country when the foreign debt of the government hiked. Furthermore, bad debts piled up due to unprofitability in operation of large state-owned conglomerates, and the banking system operated inefficiently, causing losses of national money, accompanied by local currency falling into the devaluation. To fend off inflation, credit
institutions must adjust interest rates to rise in line with inflation rates, an unintended decision that leads to destabilizing consequences for the economy and for society.

To the economy of Vietnam, a developing country, the control of inflation within one figure is a matter of the utmost importance, because it brings certain contributing factors to social and economic stability of the country. In order to offer effective solutions to control inflation, finding out the causes of inflation in Vietnam is necessary.

One of the thesis goals is to study inflation and its causes in Vietnam. I will examine whether classical theories - the quantity theory of money, demand-side factors, and supply-side factors – can explain inflation in Vietnam over the period from 2000 to 2015 by both figures of the relationship between inflation and variables drawn and empirical studies summarized. In addition, although Vietnam experiences low-to-medium inflation recently, a good protection against the probability of high inflation in the future is essential, as high inflation burdens creditors and benefits debtors. In the final chapter, by using the data over the last 15 years, I explore and compare the performance and inflation-hedging ability of different investing and saving forms with different strategies - the buy-and-hold strategy and the rebalancing strategy - in Vietnam. Three most popular investing and saving forms chosen in the thesis consist of gold, stocks, and banking deposits.

The results of the thesis will support to answer the following questions:

- How well the money supply, demand-side factors, and supply-side factors explain inflation in Vietnam over 15 years from 2000 to 2015?

- How do the investing and saving forms perform with different inflation rates during the period from 2001 to 2015 in terms of probability and inflation-hedging ability, and from there, which form is supposed to be the best inflation hedge?

- Does adding gold improve either risk-return performance or inflation-hedging ability of traditional non-real-asset portfolios of deposits and stocks, and what is the optimal weight of gold in those portfolios?

- Is rebalancing process worth implementing?
CHAPTER 1: INFLATION

1.1. The definition of inflation and the measurement of inflation

According to definitions of inflation of many national banks in the world, inflation is recognized as the continuous increase in the general price of goods and services of an economy in a certain period of time.\(^1\) Thus, the monetary value of that economy depreciates. For Vietnam, in particular, inflation can literally be interpreted as the decrease in the value of Vietnam dong, or in simple terms, 1 Vietnam dong at time \(t\) has less purchasing power than 1 Vietnam dong at time \(t-1\).

Worldwide, inflation is measured by many indicators, of which the most popular is the consumer price index, CPI - tracking the average increase in prices of consumer goods - and the producer price index, PPI - tracking the average increase in the costs of production inputs (E. McDill, 1999).\(^2\) In Vietnam, inflation is usually measured through the CPI. The index represents prices of a fixed basket of goods and services and measures the volatility of the prices at the current period in comparison with the base period. As defined by the Vietnam General Statistics Office, GSO, the consumer price is the price of goods and services directly serving for daily living demands, excluding assets, such as land, gold, dollar, or goods for manufacture and business. Details of the basket of goods are described in Table 1 with the weights being reviewed and assessed constantly and periodically every 5 years. Easily found, in the basket, the price of food always accounts for the highest proportion in the CPI calculation. In the period from 2009 to 2014, the figure is 39.93%, which is revised down slightly to 36.12% in the following period from 2015 to 2020. The high weight of food in the basket is explained by the fact that despite increasing over time, incomes of the majority of Vietnamese people are still low and largely spent on food.\(^3\)

Although the control of inflation is not the concentration only on one or two components, obviously, big changes in the cost of some components that have a high proportion in the basket, such as food, will result in a significant impact on inflation measurement. Usually, goods like food easily fluctuate due to seasons or global commodity prices. To capture and predict accurately long-term trends of inflation, a more narrowed index - Core Inflation - is formed (Rich and Steindel, 2005). For example, in the U.S., the core inflation index is measured by taking food and energy out of the basket of CPI. In Vietnam, the core inflation indicator was
discussed to calculate with various measures. For example, the SBV-GSO with the technical help of IMF proposed two measures – CPIxF, excluding 8 items of raw food and CPIxFEA, excluding 8 items of raw food, 3 items of energy, and 4 items of administered prices (Kalra and Dzung, 2016). However, at the end of 2015, GSO chose and announced the official calculation method for core inflation that is CPIxFEAHE, excluding food, energy and two government-managed categories – healthcare and education.

Table 1: Weights for the national CPI calculation of the period from 2009 to 2020

<table>
<thead>
<tr>
<th>Groups of goods and services</th>
<th>2009-2014</th>
<th>2015-2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and foodstuff</td>
<td>39.93</td>
<td>36.21</td>
</tr>
<tr>
<td>Beverage and cigarette</td>
<td>4.03</td>
<td>3.59</td>
</tr>
<tr>
<td>Garment, footwear, hat</td>
<td>7.28</td>
<td>6.37</td>
</tr>
<tr>
<td>Housing and construction materials</td>
<td>10.01</td>
<td>15.73</td>
</tr>
<tr>
<td>Household equipment and goods</td>
<td>8.65</td>
<td>7.31</td>
</tr>
<tr>
<td>Medicament, health</td>
<td>5.61</td>
<td>5.04</td>
</tr>
<tr>
<td>Transportation</td>
<td>8.87</td>
<td>9.37</td>
</tr>
<tr>
<td>Post and telecommunications</td>
<td>2.73</td>
<td>2.89</td>
</tr>
<tr>
<td>Education</td>
<td>5.72</td>
<td>5.99</td>
</tr>
<tr>
<td>Culture, sport, entertainments</td>
<td>3.83</td>
<td>4.29</td>
</tr>
<tr>
<td>Other goods and services</td>
<td>3.34</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Source: The website of the General Statistics Office of Vietnam

1.2. The optimal inflation rate

Before seeking an ideal inflation rate, it is important to answer the questions: what the harmful effects of inflation are, and whether with those damages if found, inflation should be maintained at a reasonable level, or the inflation should be eliminated.

Empirical studies indicate that the higher the inflation is, the more difficult the predictability of prices become. Okun (1971) is one of the pioneers suggesting evidence for the relationship between the high average annual rate of inflation and the increase in its volatility (Foster, 1978). In his paper, the data is selected from 17 industrialized countries in the OECD, over the period from 1951 to 1986. In each country, the average inflation rate is calculated by the mean of the changes in the GNP deflator, and the volatility of inflation rates is calculated by the standard deviation of the changes in the GNP deflator.
Later study of Logue and Willett (1976) based on the evaluation of Taylor (1981) is considered to be more complete at the international scale than the study of Okun (1971) by adding non-industrialized countries and Latin American countries, bringing the total number of countries in the sample to 41 in the period from 1949 to 1970. Logue and Willett jump to a conclusion that inflation at an extremely low or extremely high level will all lead to higher uncertainty in the future price than inflation at a moderate level. In addition, the relationship between inflation and uncertainty is weaker in highly industrialized countries, since they have a lower inflation level than others in the sample. From that, the study suggests a reasonable level of inflation that helps reduce costs of unanticipated inflation is at 2 to 4 percent.

Figure 1 illustrates the bond between high inflation and its volatility of 178 countries worldwide in the period from 2000 to 2015. A noticeable trend observed is that countries with the higher inflation experience greater volatility of inflation; in other words, inflation becomes less predictable in those countries. The correlation between inflation and its variability is 0.999, implying that $(0.999)^2$ “of the variance in variability of inflation among countries can be associated with the differences in their mean rates of inflation” (Foster, 1978).

Figure 1: Mean and Variability of Percentage Changes of CPI, 178 countries, 2000-2015

Source: Database of World Bank

Unexpected inflation causes costs, including "the redistribution of wealth from debtors to creditors" and "the distribution of relative prices across the economy" (Horwitz, 2003). The
formal cost can be understood that when inflation is higher than expected, the loans that borrowers pay lenders are less valuable because the terms of contracts, signed before, are not adjusted for unexpected inflation. Hence, the real value of both the debt and interest is lower than the expected initial value (monetary authority of Singapore, 1999), benefiting borrowers but harming lenders. Meanwhile, the latter cost means “resources will be misallocated because some number of relative prices will no longer be at their equilibrium values” (Horwitz, 2003), reducing the growth rate of the economy. Explanations why the relative prices are affected by inflation derive from expenses incurred because of changes in prices - menu cost, different speeds in response to changes in prices of various economic sectors in the market, and especially the wrong translation of signals from the market.

Even if the unanticipated factors of inflation are set aside, Horwitz (2003) points out that a high level of inflation in expectation still causes negative consequences to the economy. Firstly, inflation is seen as a tax imposed on people who hold money when the actual value of money is reduced. Therefore, people are not willing to hold a large amount of money. Instead, they would convert their income and savings into non-monetary assets. This increases the number of times, people have to go to the bank to withdraw their money from the account. The term - shoe-leather cost - was born as the metaphor for these repeated travel expenses. This cost also broadly relates to the banking transaction cost. Secondly, inflation makes firms change the price of products many times. Costs incurred are named the menu cost, implying the cost of printing menus or catalogs repeatedly.

Inflation has many disadvantages, but M. Billi and A. Kahn (2008) give reasons why inflation should be maintained at a reasonable low level. Firstly, the measures of inflation may not be accurate, leading inflation to be announced to exist or exceed itself in reality. Secondly, inflation is considered better than deflation - the reverse of inflation: general prices fall. According to Oner (2010), consumers tend to delay their spending activities as prices fall, because they expect prices to drop continuously in the future. Take Japan as a good example of what deflation causes. For a long period during deflation, its economy experiences a slowdown. Thus, low inflation is an assurance that at least, the economy does not fall into deflation. Thirdly, little inflation helps businesses reduce the real wages paid for workers by keeping the nominal wage rise below the rate of inflation. Finally, inflation little above zero is better than that close to zero, because the
government will have more room to apply the conventional monetary policies in a little inflation environment, such as lowering the nominal interest fund rate in case of economic weaknesses, than in a zero inflation environment.

Most of the central banks over the world set a target of maintaining inflation at a low positive level. For developed countries, the ideal inflation is at 2 to 3 percent; while for developing countries, the target of inflation is often 1 more percent higher, reaching 3 or 4 percent (Schmitt-Grohe and Uribe, 2010).

Table 2: Inflation Targets around the World

<table>
<thead>
<tr>
<th>Country</th>
<th>Inflation target (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial countries</strong></td>
<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>1-3</td>
</tr>
<tr>
<td>Canada</td>
<td>1-3</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2</td>
</tr>
<tr>
<td>Australia</td>
<td>2-3</td>
</tr>
<tr>
<td>Sweden</td>
<td>2 ±1</td>
</tr>
<tr>
<td>Switzerland</td>
<td>&lt;2</td>
</tr>
<tr>
<td>Iceland</td>
<td>2.5</td>
</tr>
<tr>
<td>Norway</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Emerging Countries</strong></td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>1-3</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>3±1</td>
</tr>
<tr>
<td>Korea</td>
<td>2.5-3.5</td>
</tr>
<tr>
<td>Poland</td>
<td>2.5 ±1</td>
</tr>
<tr>
<td>Brazil</td>
<td>4.5 ± 2.5</td>
</tr>
<tr>
<td>Chile</td>
<td>2-4</td>
</tr>
<tr>
<td>Colombia</td>
<td>5 ± 1.5</td>
</tr>
<tr>
<td>South Africa</td>
<td>3-6</td>
</tr>
<tr>
<td>Thailand</td>
<td>0-3.5</td>
</tr>
<tr>
<td>Mexico</td>
<td>3± 1</td>
</tr>
<tr>
<td>Hungary</td>
<td>3.5 ± 1</td>
</tr>
<tr>
<td>Peru</td>
<td>2.5 ±1</td>
</tr>
<tr>
<td>Philippines</td>
<td>5-6</td>
</tr>
</tbody>
</table>

Source: Schmitt-Grohe and Uribe, 2010, p.2
1.3. Causes of inflation

Many theories have been put forward to explore the causes of inflation. Among them, three popular theories - the quantity theory of money, demand-side factors, and supply-side factors - are seen as the central school of thoughts to explain inflation in many countries around the world. It is because that the economies work under the rules of the market, and prices are related to the increase in money supply, as well as are decided by the supply and the demand in the market. While the quantity theory of money is viewed as the root of the variation of prices in the long term, demand-side factors and supply-side factors take responsibility for changes in prices in the short term.⁶

1.3.1. The quantity theory of money

The theory introduces the bond among “money supply (M), velocity of money (V), prices (P), and real GDP (Y)” (Quayyum, 2006). In details, the total value of all transactions in the market of an economy equals the amount of money circulating in the market to carry out all transactions in that period.

The equation describes the relationship as follows:

\[ MV = PY \]  \hspace{1cm} (1)

Source: Quayyum, 2006

or

\[ P = MV / Y \]  \hspace{1cm} (2)

Source: Quayyum, 2006

According to Quayyum (2006), by mathematical transformations, equation 2 is rewritten into the equation referring rates of growth of elements:

\[ g_p = g_m + g_v - g_y \]  \hspace{1cm} (3)

Source: Quayyum, 2006
With the assumption that velocity of money remains unchanged, the equation 3 shows that inflation stems from the increase in the money supply in excess of the growth of outputs in the market in an economy. If assuming that the increase in outputs is not affected by money, but by the factors of production, money growth creates inflation.

In fact, Ball (1993) argues that the price does not react immediately to the increase in nominal money supply, which is determined by the government through increasing or decreasing taxes, borrowing foreign loans, issuing bonds, or even printing money. This increases the real money supply, which is “the nominal money supply divided by the price level P” (Roubini and Backus, 1998). As a result, the equilibrium of the money market changes. Equilibrium is the point in which real money supply curve to meet demand curve written by the equation:

\[ \frac{MD}{P} = \frac{MS}{P} = L(i, Y) \]  

Where: Y is transactions, i is the nominal interest rate, MD is the number of dollars demanded, MS is the amount of money/currency supplied by the Central Bank (through open market operations), and P is the price of goods (Roubini and Backus, 1998).\(^7\)

As a result, the interest rate is lower because of the shift of the real money supply curve to the right-hand side. This leads to the stimulation of economic growth through the enhancement of corporate lending and consumer spending, creating an increase in the price of goods in the next period (Roubini and Backus, 1998).\(^8\)

### 1.3.2. Demand-side factors

The faster increase in the aggregate demand of the economy than in the aggregate supply is the cause of inflation (Monetary Authority of Singapore, 1999).\(^9\) According to Bronfenbrenner and D. Holzman (1963), pure aggregate-demand theorists believe that the aggregate supply curve is inelastic at a level of income \(Y_0\), and it is impossible that the employment can reach the full level when income is lower than \(Y_0\). Meanwhile, the increase in the aggregate demand will only move prices from the old equilibrium position to the new one, which is higher than before, while income and employment remain unchanged (Figure 3a). As a result, inflation coming from the push of demand is said to be easily controlled by fiscal and monetary policies, as it does not drag income or employment down.
Figure 3a and Figure 3b: The models for the pure demand-pull theory on the left side and the pure supply-push theory on the right side\textsuperscript{10}

All factors that increase the aggregate demand leads to inflation. Before Keynes, theorists, relying primarily on the quantity of money, argue that the imbalance in the money market is considered the main cause of the variation in the aggregate demand, since an excessive stock of money generates a demand for non-monetary assets.\textsuperscript{11} Therefore, inflation is believed to be a result of “too much money chasing too few goods”. However, then, Keynes and his followers state that national expenditure including consumption, investment, and government expenditure are determinants of prices in a closed market, since those variants make up the aggregate demand.\textsuperscript{12} The basic mathematical model describing the aggregate demand is written as the equation:

$$Y = C + I + G$$ \hspace{1cm} (5)

Where: $Y$ is real output, and $C$, $I$, and $G$ are real consumption, investment, and government expenditure, respectively (Dutt and Skott, 2005).
The model expands for an open market with the added component of net export (total export minus total import). In some small open markets, such as Singapore, a typical example, the increase in export demand also gives rise to inflation (Monetary Authority of Singapore, 1999). According to Jalil (2011), government spending and the money circulation are factors inducing demand-pull inflation controlled by the government. Policies related to two factors, such as cutting (raising) taxes or increasing (decreasing) the supply of money can help adjust the rate of inflation.

1.3.3. Supply-side factors

According to Zahoor et al. (2010), supply-push factors relate to sudden increases in the cost of production factors, such as wages, input cost, and exchange rate, without obligation to demand factors. From the perspective of those who follow the pure theory of supply push, differing from demand-side factors and more complex, inflation caused by supply shocks is associated with a decrease in income and an increase in unemployment as the aggregate supply curve changes (Figure 3b). Therefore, maintaining the old price requires the sacrifice of income and employment. As a result, the followers of the schools of supply-push inflation suggest that minimizing and limiting inflation is better than eliminating inflation.

The factors contributing to the spontaneous increase in the production costs of a country can be divided into 3 main groups including: Wage-push, profit-push, and supply-shocks (Zahoor et al., 2010).

Firstly, inflation is generated when the wage increases faster than labor productivity as a result of the pressure from labor unions to business owners. A vicious cycle is created when the wage’s increases give rise to the increased price of products, and this price increase put pressure to create the next wage increase (Jalil, 2011).

Secondly, in terms of the increase in profits, prices are dominated by monopolies with powers in imperfectly competitive markets. Typically, oligopolistic enterprises raise prices to cover the increased costs of production, thereby maintaining profit margins, since demands for their goods are stable (Bronfenbrenner and D. Holzman, 1963). There are also cases in which companies raise prices of products to increase profitability by their monopoly power regardless of wages
and production costs. However, Batten (1981) points out that although the prices are higher in a monopoly market than those in a competitive market, “a monopolist has no incentive to raise its price continually” because this action reduces the numbers of goods sold, resulting in a decrease in profits.

Thirdly, “a supply shock is an event that suddenly changes the price of a commodity or service” (Zahoor et al., 2010). Primarily, sudden changes of the price of a product can derive from an external shock. For example, changes in the price of imported goods coming from changes in global commodity prices and adjustments of the exchange rate policy. The decrease (increase) in exchange rate increases (decreases) the price of imported goods but decreases (increases) the price of exported goods. In addition, a supply shock can occur when there is a sudden increase or decrease in supply affected by the production conditions and natural conditions. For example, in developing countries, with the shortage of the application of science and technology, agricultural products are directly affected by weather conditions, such as floods and droughts. Even for developed countries, such as Japan, natural disasters, such as tsunamis and earthquakes, can also have immediate negative impact on production activities.

In short, the pressure from social unions, monopoly groups, and other groups primarily pushes inflation. According to Batten (1981), with the explanation in this way, the responsibilities of the governments for inflation are removed, while the list of groups continue to be expanded, because whoever can cause inflation, for instance, farmers, financial institutions, or foreigners. Therefore, methods to tackle inflation are to find the key components causing inflation from time to time.

CHAPTER 2: CAUSES OF INFLATION IN VIETNAM FROM 2000 TO 2015

According to the data from World Bank over past 15 years, the average inflation rate in Vietnam reached 7.17% per annum, the 55th highest, and the volatility of inflation reached 6.19, the 37th highest in 179 countries in the world, including Zimbabwe. Compared to 30 countries with similar annual average inflation rates - 15 countries with lower inflation and 15 countries with higher inflation - inflation in Vietnam fluctuates strongly. Specifically, the volatility of inflation
in Vietnam is only lower than that in 4 countries among 30 countries with similar annual average inflation rates (Figure 4).

Figure 4: Mean and variability of percentage changes of CPI of Vietnam and 30 countries with similar average CPI, 2000-2015

Source: Database of World Bank

According to Sathirathai (2011), the number of components that mainly make up the variability of inflation in Vietnam is not one or two but four components, including food, housing, transportation, and education. While international factors could drive prices of food, housing, and transportation, they have no role to play in changes in prices of education.

Obviously, inflation in Vietnam is complex, which comes from neither mere external factors nor mere internal factors. In this chapter, the thesis will examine how well three theories - the quantity theory of money, demand-pull, and supply-push - explain causes of inflation over the past 15 years in Vietnam.

2.1. The quantity theory of money

In Vietnam, in the period from 2000 to 2015, while the mean rate of the money supply is very large of 28.56% per annum, the GDP growth was much smaller. Thus, the money supply could be seen as the primary factor leading to inflation, while the GDP growth could be seen as the secondary factor.
In Vietnam, most empirical studies agree on the use of M2 to represent the money supply; however, there is not a consensus on the answer for the question: whether the money supply affects inflation among empirical studies in Vietnam (Bhattacharya, 2013). According to Hang and Thanh (2010), the controversy occurs because of different data, methods, and time collecting data. However, most researches rejecting the effect of the money supply on inflation study the period before 2004 (Hung and Pfau, 2008; Phuoc and Long, 2005; Camen, 2006; and IMF staff, 2003). Meanwhile, the impact of the money supply on inflation is recorded more with the data after 2004 from the studies of Pham The Anh (2008), Hoang Khieu Van (2014), and Sathirathai (2011). Clearly, the money supply is not the only factor affecting inflation in Vietnam in the entire period from 2000 to 2015. At many moments such as before 2004, many other factors could affect inflation more strongly than the money supply does.

Figure 5: Inflation rate and growth rate of money supply M2, 2000-2015

Source: Database of World Bank

Figure 5 clearly shows the relationship between the money supply and inflation from 2004 to the end of 2011, the period that inflation start to thrive. Inflation peaked two times in 2008 and 2011 with the corresponding rates of 23.12% and 18.68%. In 2007 and 2010, the amount of money added to the market by the government reached all-time highs at 49.11% and 29.71%, respectively. This suggests that the increased supply of money increases inflation in one year later. This relationship is shown in almost entire period since 2004. In some points of time,
inflation fell significantly when the government reduced the money supply to the market in an effort to reduce inflation intentionally. The question then arises as to why the government let the money supply continue to increase the money supply excessively and repeatedly. According to Ball (1993), the government creates money to cover expenditures exceeding revenues by borrowing through bonds and foreign debts. This could be a reasonable explanation for Vietnam's economy, as in many consecutive years, spending exceeded the permitted level. Many state-owned enterprises expanded inefficiently their businesses in many industries, leading to the burden the government budget. Many of the government debts compensated for those inefficient investment activities.

However, data from 2000 to 2003 and from 2013 to 2015 show that inflation in Vietnam was likely to be affected by not only the money supply, but other factor as well, since inflation and the money supply are disconnected. During these periods, Vietnam experienced deflation or low inflation. The government had taken several measures to encourage economic growth. The money supply rose but did not raise inflation in the same year or in the next year. It proved that the positive relationship between the money supply and inflation was broken at these stages. Inflation was strongly affected by other factors. Ball (1993) argues that in the short term, inflation is driven by the movement of supply and demand based on the model of aggregate demand and aggregate supply (AD / AS). Even by using the VAR model, Vu (2011) suggests that the demand and supply shocks rather than monetary shocks are the main determinants of inflation in Vietnam.

2.2. Demand-side factors

Figure 6 depicts the relationship between government spending and consumer spending. The demand of household consumers increased, along with the peaks of government spending, especially during the period from 2008 to 2015. Government spending plays a major role in stimulating and supporting enterprises, making the operation of the economy more vibrant. Consequently, the unemployment rate decreases, accompanied by the increase in the incomes of the people and consuming needs also, resulting in an increase in the aggregate demand of the economy.
Figure 6: Annual increases in government consumption and household consumption, 2000-2014

The empirical findings of Vu in the period from 2000 to 2010 show that demand shocks, such as government spending, is the main cause of inflation in the period 2004Q1-08Q3. Dang Nguyen (2014) also points out a positive relationship between inflation and government spending in the long term. However, in the short term, a negative relationship exists from inflation to government spending; in other words, inflation reduces government spending.
2.3. Supply-side factors

2.3.1. Profit-push inflation

According to Batten (1981), the increase in monopoly power leads to the decrease in the existing output, thereby rising prices. In other words, the less competition the economy has, the higher the price of goods is. This can be verified through the relationship between real output growth represented by the GDP growth and inflation represented by the consumer price index, CPI. The increase in monopoly is considered to cause inflation when it is accompanied by the decrease in GDP. For the economy of Vietnam, through 15 years, figure 6 shows that there is not a continuous reduction in real output during inflation; therefore, the increasing-monopoly factor is rejected. In fact, during the 15 years of economic reform, although a number of state-owned enterprises, SOEs, still play a key part in the economy, the policy of the government is to increase the competition between SOEs and private enterprises. Furthermore, despite playing important roles in many industries in the economy, it cannot be said monopolies for profit maximization leads to inflation in Vietnam. To prove, take energy, the most important input for the production of an economy, as an example. According to the report of Asian Development Bank (ADB), the energy sector in Vietnam is operated and controlled by three state-owned enterprises – “the Viet Nam Electricity (EVN), the Vietnam Oil and Gas Group (PetroVietnam),
and the Vietnam National Coal and Mineral Industries Group (Vinacomin)”. However, the price of energy is not high in comparison with other countries in the region, sold under the cost of production in the past,\textsuperscript{16} and in the future will be gradually adjusted following market principles. The aim of this adjusting roadmap, according to that report, is to avoid losses in the energy industry to create profit for other industries as well as to cause inflation. Therefore, it is hard to tell that the impact of the monopoly for the purpose of profit maximization triggers inflation in Vietnam.

Figure 8: Annual growths of real GDP and annual rates of Inflation, 2000-2015

Source: CPI is obtained from the database of World Bank, while real GDP is obtained from CIA World Factbook.

2.3.2. Wage-push inflation

In terms of wage-push inflation, in Vietnam, wages are paid differently between private enterprises and state enterprises as well as between domestic enterprises and foreign enterprises. In Vietnam, simply, empirical studies primarily use the minimum wage, stipulated by the parliament, as the representative of the general wage to study the relationship between inflation and wages, as data are in shortage, and contracts between employers and workers are often determined through the reference from the minimum wage. Especially, for all employees who work in state owned companies, the wage frame is established from the minimum wage. According to Cuong Nguyen (2014), before 2008, in Vietnam, there was only one common minimum wage for the entire domestic sector. From 2008 onwards, minimum wages for the different regions are formed. The minimum wage is adjusted based on changes in inflation and in
living conditions of people. Furthermore, from 2000 until the end of 2015, there are only eleven times the parliament approves to raise the minimum wage from 210,000 Vietnam dong to 1,150,000 Vietnam dong. Therefore, we can see the minimum wage increases as a consequence of inflation rather than a root for inflation. By empirical evidence, Cuong Nguyen (2012) concludes similarly that inflation causes wages to increase in Vietnam; however, there is not a two-way relationship that the rise in wages also causes the increase in prices. Even in both the short run and the long run, increases in the minimum wages reduce the overall price. Cuong Nguyen (2012) proposes two reasons to explain. Firstly, the number of workers affected by the minimum wage is small compared to the majority of workers who are freelancers. Secondly, under the competitive condition, the number of firms affected by the minimum wage increases, a result that does not allow these enterprises to increase costs and prices. Cuong Nguyen (2014) also finds out that the increase in the minimum wage may reduce the number of employees in the enterprise, but the labor costs of enterprises do not increase.

Clearly, in both the planning process of the policy makers and the consequences of adjustments of the minimum wage, a specific impact of the minimum wage on inflation has not been revealed. However, in practice, as stated by D. Schmillen and G. Packard in 2016, there exists a huge gap in the minimum wages among regions in Vietnam, and the minimum wage increases beyond the increase in labor productivity. In other words, the current general minimum wage in the economy is high. The raising rate of minimum wage is much higher than that of general prices. Since the beginning of 2000 until the end of 2015, while general prices rose about three times, the minimum wage increased nearly five times. D. Schmillen and G. Packard (2016) argue that the adjustments of the minimum wage based on the mere increase in current inflation instead of productivity can cause negative effects on the competitive advantages in cheap labor of Vietnam compared to other countries in the region. Those raised obstacles affect the ambitious target of the government: the minimum wage is raised until households reach “minimum monthly living standards” in 2018.

2.3.3. Imported inflation

Vietnam's economy opened since 1986. In parallel with bilateral and multilateral trade agreements signed with countries all over the world, the import value increases continuously. Therefore, it is likely that inflation is imported from abroad. To assess the impact of world prices
to domestic prices, the relationship between general domestic prices and prices of imported goods will be analyzed.

Figure 9: Annual changes of import prices and CPI, 2000-2015

Source: Import price from www.tradingeconomics.com, while CPI from World Bank

In most of the time, the price of imported goods rose more slowly than that of domestic goods. It could be easily explained by two reasons. Firstly, many imported goods are inputs of domestic production; therefore, the price could be added up later on, during the domestic production. Secondly, non-tradable goods even drove the domestic inflation more than tradable goods.

Inflation responds quickly to globe prices when facing shocks in prices of commodities. Typically, in 2004, 2008 and 2011, domestic prices soared together with prices of imported goods. In contrast, inflation responds slowly to deep declines in world prices. From 2009 until now, except in 2011, prices of imported goods dropped very deeply but did not drag domestic prices down the same probably because of other causes governed inside countries. This raises the fears that low inflation, recently, is a result from the deep decline in world prices rather than efforts to control inflation in policies of the government. Table 3 illustrates the inflation of 8 largest import partners of Vietnam over 15 years. The results show that the general price of Vietnam is extraordinarily higher than that of those countries with the average annual inflation rate of 7.17% and with the longest fluctuation range from -1.71 to 23.12. Thus, the worst-case scenario could happen, if the world prices rise strongly again in the future, and they will have great impact on domestic prices.
Table 3: Inflation rates of Vietnam and biggest import partners, 2000-2015

<table>
<thead>
<tr>
<th></th>
<th>Inflation</th>
<th>Variability</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>2.24</td>
<td>1.94</td>
<td>-0.77</td>
<td>5.86</td>
</tr>
<tr>
<td>Korea</td>
<td>2.72</td>
<td>1.05</td>
<td>0.71</td>
<td>4.67</td>
</tr>
<tr>
<td>Japan</td>
<td>0.02</td>
<td>0.99</td>
<td>-1.35</td>
<td>2.75</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.36</td>
<td>1.74</td>
<td>-0.90</td>
<td>5.47</td>
</tr>
<tr>
<td>Singapore</td>
<td>1.89</td>
<td>1.94</td>
<td>-0.54</td>
<td>6.52</td>
</tr>
<tr>
<td>United States</td>
<td>2.24</td>
<td>1.14</td>
<td>-0.36</td>
<td>3.84</td>
</tr>
<tr>
<td>Malaysia</td>
<td>2.24</td>
<td>1.15</td>
<td>0.58</td>
<td>5.44</td>
</tr>
<tr>
<td>India</td>
<td>6.81</td>
<td>2.77</td>
<td>3.68</td>
<td>11.99</td>
</tr>
<tr>
<td>Vietnam</td>
<td>7.17</td>
<td>6.19</td>
<td>-1.71</td>
<td>23.12</td>
</tr>
</tbody>
</table>

Source: Database of Asian Development Bank

According to economists, the price of oil and food is two factors, which govern the fluctuations of prices most strongly in the world in the short term. The relationships among world oil prices, world food prices, and the price of imported goods are also reflected in the Figure 10. It can be seen that the price of imported goods into Vietnam is affected by shocks of oil prices and food prices in 2008 and 2011. The correlation coefficient between the world price of oil and the price of imported goods is 0.78, while this figure between the world food price and the price of goods imported is 0.85. This shows the strong association of prices of two commodities with the price of imported goods of Vietnam; however, the impact of the global food price on imported goods is stronger than that of the global oil price. Therefore, it is reasonable to confirm that inflation in Vietnam is influenced by world prices, especially the oil price and the food price.

While the impact of oil prices may be easy to explain as reported by IMF (2005) that oil is the input imported mainly for transportation and housing and construction materials, which are 2 of 4 main drivers of variability of inflation in Vietnam (Sathirathai, 2011). It is a surprise result that world food prices affect food prices in Vietnam, a big food exporter mainly produces and consumes agriculture food locally, in food crises in 2007, 2008 and 2011. Different views are proposed to explain this relationship. According to Sathirathai (2011), Vietnam imports other food products also, causing imported food inflation. Meanwhile, Nguyen (2010) suggests that domestic food exporters raise the domestic price based on the increase in foreign prices. However, the report of the World Bank says that this paradox is explained by the government's currency devaluation, leading to inflation and the rising demand of importers, a result that raises the price of agricultural products in general and the price of rice in particular (via ADB, 2011).
Empirical studies to test whether foreign prices affect inflation in Vietnam are often conducted through two favorable indexes – the world food price and the world oil price - due to the available of these data and the lack of other data. Huu Minh Nguyen et al. (2012) points out that the global prices of food and oil are two of three biggest factors affecting inflation. Kim and Hirata (2008) also agree that the price of oil and food are two factors, which cannot be denied, influences inflation. However, Sathirathai (2011) finds that the global food price affects inflation, but the global oil price does not. In short, both figure and empirical studies agree on the impact of the global food price. However, the impact of the world oil price on inflation is still a question of debate. This seems not unfounded when domestic oil prices are stabilized by the government before 2008 and are only loosened under a market-oriented manner after 2008, but still receive support from the government by the price- stabilizing fund in case global price shocks happen. Therefore, Vietnam’s petrol prices remain less responsive to world petroleum prices.

Figure 10: Annual rates of import price, the global oil price, and the global food price

Source: Import prices from the website: www.tradingeconomics.com, OPEC oil price from the website: www.opec.org, and food price index from the website: www.foa.org

2.3.4. Exchange rate

In many countries, the exchange rate is an effective tool to reduce inflation (Edwards, 2006), since the exchange rate has an impact on domestic inflation, named the exchange rate pass-through. According to Takhtamanova (2003), the exchange rate pass-through effect is primarily
studied by the relationship between exchange rate and either imported prices or aggregate price indices. In Vietnam, research by Vinh and Fujita (2007) in the period from 1992 to 2005 shows that the exchange rate does not have significant influence on inflation after 1999, when the exchange rate changed to the crawling peg regime. Hieu's research (2011) for the period from 2000 to 2011 shows a clearer finding about the degree of the pass-through effect. The exchange rate affects imported price faster and stronger than it does to inflation. However, the impact on inflation lasts much longer than that on the imported price.

Figure 11 shows that the exchange rate was stable, from 2000 to 2007 and did not have a clear relationship with inflation. The period from 2008 to 2011 experienced the complicated exchange rate with the average increase of over 5% per annum. This is also the period associated with a sharp rise in inflation. Since 2012, the exchange rate was kept stable, and so was the exchange rate. Until 2015, the exchange rate was raised again due to the fluctuations of the world market as the Fed raised the interest rate, and the Yuan was devalued. It is worth noting that over 15 years, the sum of the arithmetic mean of increases in the exchange rate and the arithmetic mean of inflation of 8 main import partners of Vietnam is 6.03, a figure which approximately equals the average inflation rate in Vietnam.

Figure 11: Nominal annual increase in the exchange rate and annual CPI, 2000-2015

Source: Exchange rate and CPI are obtained from the database of World Bank

To understand the relationship between the exchange rate and inflation, we come back to the adjusting policies of the government in each stage. According to Tran Phuc Nguyen and Duc-
Tho Nguyen (2010), since 1999, Vietnam began converting the inflexible regime into the more flexible one, which is more market-oriented. The exchange rate is adjusted and announced each day by the State Bank of Vietnam, SBV, and fluctuates around the trading band. In the period from 2008 to 2011, the government intervened in the exchange rate. Trading band was allowed to widen in the years from 2008 to 2009 due to external shocks caused by the global financial crisis. In 2011, to improve the trade balance as well as to reduce the difference between the exchange rate regulated and the exchange rate traded on the black market, SBV took measures to intervene in the market by devaluing the interbank exchange rate strongly. This action greatly affected Vietnam’s inflation although the trading band was narrowed, and the ceiling deposit rate for dollar fell to 2% in order to avoid the holding of dollars and the dollarization of the economy.

CHAPTER 3: INFLATION-HEDGING FORMS

One of the biggest influences of inflation is the redistribution of wealth in society, or a reduction in the money of holders. With high inflation in recent years, finding a safe place to preserve cash and gain profit is essential for investors. In this chapter, the thesis analyzes some forms that minimize harms of inflation to the investors. Specifically, the thesis will compare the profitability and inflation protection of popular forms of investments and savings in Vietnam in the context of inflation over 15 years from 2001 to 2015.

In the world, to meet the demand for asset protection from inflation risks, some inflation-hedging assets have existed, such as Treasury Inflation-Protected Securities Index (Tips), Real Estate Investment Trust Index (Reits), or trading commodities. However, in Vietnam, these asset classes are not available yet. In general, Vietnam dong deposits at banks, investments in gold, investments in the stock market, and investments in real state are 4 main saving and investing forms that are invested by the majority of Vietnamese, including both individual and institutional investors.

Unlike other countries, the banking deposits are more favorable and popular than bonds in Vietnam. Reasons could be given for that. Firstly, bonds are traded in the form of auctions among large credit institutions in the primary market and only began trading publicly on the
secondary market in 2007 (Asian Development Bank Team, 2012). Secondly, banks are the most important institution to provide and distribute capital for the entire market; therefore, depositing money in banks also provides a competitive return compared to other investment channels.

Among 4 investing forms in the market, real state and gold are considered traditional assets hedging inflation. People, in Vietnam, are in favor of gold because of its liquidity. In contrast, despite a traditional hedging-inflation asset, real estate is pretty much less liquid than gold in Vietnam, since the capital requested is huge, and other factors, for instance, location and legal procedures, play an important role in real-state-buying decision.

In the end, 3 investing forms - banking deposits, gold, and stocks - will be focused to discover in the thesis, since real estate is skipped due to the lack of data in the past 15 years. In addition, the thesis employs T-bill as the risk-free asset for the Vietnamese market.

3.1. Literature overview

Fisher (1930) argues that the nominal interest rate equals the sum of the expected real interest rate and expected inflation. With the hypothesis that the expected real rate of interest is constant, the change in the nominal interest rate equals the change in the expected inflation. However, Wood (1981) suggests that the reaction of interest rates is slower and disproportionate in response to the volatility of inflation.

In history, in the world as well as in Vietnam, many times, central banks use the interest rate as a tool to bring down inflation. The rise in interest rates leads to the rise in deposit rates and lending rates. Tight monetary policy through interest rates, leads to a reduction in borrowing activities due to expensive capital, thereby reducing the circulation of money in the market. Taylor (1993) argues that “changes in short-term interest rate, set by the central bank,” are associated with changes in the general price and the real GDP.

The relationship between stocks and inflation are recorded negatively in many researches worldwide. In the U.S. market, Fama (1981) argues that stock returns are negatively correlated to expected inflation, because stock returns are positively correlated to future real activates, while expected inflation is negatively correlated to expected real activates. Next, Kaul (1985) detects the negative relationship between inflation and real activity, which explains the negative
relationship between stock returns and inflation in the post war period in Canada, the U.K., the U.S., and Germany. However, the relationship between stocks and inflation could change over time under impacts of demand and supply. Later, H. DeFina (1991) argues that unexpected inflation could also have a negative impact on stock returns due to nominal contracts.

In Vietnam, statistical findings of Amonhaemanon et al. (2014) also show a negative relationship between inflation and stocks. However, this relationship is ambiguous, since there is no statistical significance. A further in-depth analysis by this author indicates that stock return is positively associated with the anticipated inflation rate but insignificantly negatively associated with unanticipated inflation rate. Therefore, stocks could be a good hedge when inflation is moderate.

According to Ghosh et al. (2000), despite the controversy about the inflation-hedging function in short term and medium term, gold is a long-run Inflation hedge. The statistical studies of Bekaert & Wang (2010); Worthington & Pahlavani (2007); and Attie & Roache (2009) indicate that gold has the ability to hedge both anticipated inflation and unanticipated inflation in the long run (Arnason and Persson, 2012). In Vietnam, research of Le Long Hau et al. (2013) shows that gold overreacts to inflation over the period from 2001 to 2011. In details, a one percent increase in the inflation rate gives rise to a more-than-one-percent increase in gold returns.

The gold price has a close positive relationship with the world oil price (Shafieeand and Topal, 2010). Clearly, Vietnam’s inflation decreases slowly in relation to the decrease in world oil price due to internal factors. Without external shocks, the expected inflation in Vietnam is usually around 5 to 7%. Therefore, gold may not be a good hedge, in case Vietnam experiences low expected inflation.

Is investing in gold a good protection against inflation in the next years? Shafieeand and Topal (2010) suggest that in the long term, gold is likely to increase due to three reasons, including the increase in the cost of production, expectations of investors into the safety of gold, and finally the increasingly easier investment in gold. Furthermore, compared to the general level of world inflation, the gold price calculated until 2008 remained much lower. However, some technical analysts believe that gold is in a bear market, and it just started since the bearish market last from 15 to 20 years.
3.2. Data

3.2.1. Data Sources

The set of data is obtained from various sources. In details, the thesis employs the VN index as the proxy of the stock market; therefore, the data for the market index used in this analysis is collected from the website of Bao viet securities. Domestic gold prices are represented by the gold price index, which are collected from the database of the General Statistics Office of Vietnam. Inflation is represented by the consumer price index. All the consumer price index, the saving interest rate in Vietnam dong, and the interest rate of T-bills are collected from the database of international financial statistics of IMF. Since the stock market began operating from the end of 2000, the thesis employs the studying period from the beginning of 2001 to the end of 2015. Consequently, all data are adequate and collected from reliable resources in the studying period.

3.2.2. Data overview

Table 4: Descriptive annual data from 2001 to 2015

<table>
<thead>
<tr>
<th></th>
<th>T-bill</th>
<th>Deposit</th>
<th>Stock</th>
<th>Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometric Mean</td>
<td>7.06</td>
<td>8.02</td>
<td>7.41</td>
<td>12.78</td>
</tr>
<tr>
<td>Maximum</td>
<td>12.35</td>
<td>13.99</td>
<td>144.48</td>
<td>39.00</td>
</tr>
<tr>
<td>Minimum</td>
<td>4.15</td>
<td>4.75</td>
<td>-65.95</td>
<td>-11.49</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.78</td>
<td>2.77</td>
<td>46.52</td>
<td>16.09</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.01</td>
<td>1.06</td>
<td>1.22</td>
<td>-0.11</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.30</td>
<td>0.15</td>
<td>3.88</td>
<td>-0.84</td>
</tr>
</tbody>
</table>

The average value of interest rates of T- Bills is 7.06, and its volatility is 2.78. The rates of T-Bills are right skewed and platykurtic with the skewness value and kurtosis value of 1.01 and -0.30, respectively. Thus, those interest rates are normally distributed based on the Jarque-Barre test. The minimum T-Bill rate is 4.15, while the maximum T-Bill rate is 12.35.

The average rate of deposit is 8.02 with its deviation of 2.77. Skewness value is 1.06, meaning that the right tail of stock returns is longer than the left tail. Kurtosis value is 0.15. Therefore, the deposit rates are normally distributed. The saving rates vary from 4.75 to 13.99.
The average return of stocks is 7.41 with the deviation of 46.52. Skewness value and kurtosis value are 1.22 and 3.88, respectively. Therefore, the stock returns are not normally distributed at 1% level of significance. The range of stock returns is from -65.95 to 144.48.

The mean return of gold is 12.78, and its volatility is 16.09. Gold returns are left skewed with the negative value for skewness of -0.11, indicating that the extreme values locate more on the left side of mean than on the right side of mean. The kurtosis is -0.84, and the distribution of gold returns is a normal distribution. The gold returns are between -11.49 and 39.00.

3.3. Methodology

To put it simple, let assume that 1 unit of equal value is invested at the beginning of 2001 in each of channels: the stock market, savings in Vietnam dong, savings in dollar, and gold is held until the end of 2015. All positions are close by selling gold and stocks or withdraw all dollar and Vietnam dong out of saving accounts by the end of 2015. The value and the returns of each investment are recorded at the end of each year. The annual return of gold is measured through changes in the gold spot price index in Vietnam over the years. The annual return of deposits in Vietnam dong equals the annual deposit rate. The annual return of the investment in the stock market will be measured by the annual return of the VN-Index. The value of the investment channels at the end of 2015 will be compared with the general increase of prices in Vietnam for 15 years. To compare the performance of assets, the thesis employs three ratios: Sharpe, Sortitno and Omega. The reason of using three ratios is that Sharpe ratio has a drawback that assumedly, returns of assets are normally distributed, and the use of two other ratios - Sortino and Omega – can address this problem (Waser and Dunham, 2012). In details, Sortino ratio can be applied to the returns of assets with skewness, while Omega ratio can be applied to the returns of assets with both skewness and kurtosis (B. Grelck et al., 2010).

The formula for Sharpe ratio:

\[ S_p = \frac{r_p - r_f}{\sigma_p} \]  

Where: \( S_p \) is Sharpe ratio of portfolio P, \( r_p \) is the average return of portfolio P, \( \sigma_p \) is the standard deviation of portfolio P, and \( r_f \) is riskless rate of return (B. Grelck et al., 2010).
The Sortino ratio’s formula:

$$SO_p = \frac{r_p - \text{MAR}}{\text{DD}_p}$$ \hspace{1cm} (7)

Where: $r_p$ is the average return of portfolio P, MAR is the minimum acceptable return, and $\text{DD}_p$ is the downside deviation (B. Grelck et al., 2010). In the calculation, the minimum acceptable return is defined as the risk-free rate.

The formula for the downside deviation:

$$\text{DD} = \sqrt{\frac{\sum_{i=1}^{n} (r_i - \text{MAR})^2}{\sum_{i=1}^{n} r_i < \text{MAR}} / n}$$ \hspace{1cm} (8)

Where: $r_i$ is the rate of return at time i, and n is the number of observations (B. Grelck et al., 2010).

The Omega ratio’s formula:

$$\Omega_p = \frac{\sum_{i=1}^{n} \max(0, r_i - T)}{\sum_{i=1}^{n} \max(0, T - r_i)}$$ \hspace{1cm} (9)

Where: n is the number of observations, $r_p$ is the rate of return in the time i, and T is the threshold return, which varies from 0% to the risk-free rate (B. Grelck et al., 2010). The thesis uses the risk-free rate as the threshold return.

To assess the inflation-hedging ability, the thesis uses the linear regression suggested by Amonhaemanon et al. (2014), Adam and Frimpong (2010), and Ghazali et al. (2015) together with the correlation coefficient.

The linear model for the ex post relationship between actual asset returns and inflation:

$$R_t = \alpha + \beta \cdot I_t + e_t$$ \hspace{1cm} (10)

Where: $R_t$ is the nominal return of asset, $\alpha$ is the intercept, $\beta$ is the slope of the inflation rate, $I_t$ is the annual CPI, $e_t$ is the error, and $t$ is the time.
If the slope is equal to 1, the asset is a perfect hedge. If the slope is smaller (greater) than 1, the asset is a partial (over) hedge.\textsuperscript{21} However, the result of linear model could be spurious due to the small set of data and statistical problems, such as stationary time series.

3.4. Results

3.4.1. The risk-adjusted performance and inflation protection of forms

Table 5: Annualized performance of assets

<table>
<thead>
<tr>
<th></th>
<th>T-bill</th>
<th>Deposit</th>
<th>Stock</th>
<th>Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real returns</td>
<td>-0.78</td>
<td>0.20</td>
<td>-6.37</td>
<td>5.31</td>
</tr>
<tr>
<td>Sharpe</td>
<td>---</td>
<td>0.35</td>
<td>0.01</td>
<td>0.36</td>
</tr>
<tr>
<td>Sortino</td>
<td>---</td>
<td>0.31</td>
<td>0.01</td>
<td>0.61</td>
</tr>
<tr>
<td>Omega</td>
<td>---</td>
<td>3.05</td>
<td>1.83</td>
<td>2.82</td>
</tr>
</tbody>
</table>

Bank deposits

The regression result (Table 6) shows a positive relationship between inflation and Vietnam dong deposit rates. The R squared is high at 0.79, meaning that 79\% of variance of deposit rates is explained by the inflation rate. The correlation between inflation rate and deposit interest rate in the last 15 years is 0.89, which is also high.

The domestic currency savings at the end of the investment period is worth 3.18, which is more than 3 times higher the original investment. The figure is higher than the increase in the price of 3.01. This is an unexpected result because although the figure shows that inflation and interest rates are correlated to each other positively and closely, for many years, the interest rate was raised in respond to the increase in inflation rate but still lower than inflation rate, leading to negative real interest rates. In other words, interest rate hikes could not keep pace with high inflation some times. This result coincides with the study by Wood (1981), albeit in different markets. The threshold of inflation leading to positive real interest rates in Vietnam is about 8\%. The little positive average real return of 0.20\% was due to accumulated gains in periods of low inflation from 2001 to 2004 and from 2012 to 2015. The positive real interest rates at those times varied slightly at the level of 5\%, which are enough to offset the losses in years of high inflation. Therefore, it can be seen that in the long-term period, if inflation is stable and low, the Vietnam
dong deposit can be a safe haven but bring very low inflation-adjusted profits for money holders. In addition, this channel is less likely to hedge inflation when inflation is high.

**Gold**

The investment in gold is highly profitable, 6.07 times the original value and more than two times the rise of general prices in Vietnam in a 15-year span. Although gold does not bring incomes and costs to keep, the increase in value is exceptional. This can be explained that in addition to the increase of gold itself, there is also the contribution of the exchange rate as the price of gold are converted into Vietnam dong from foreign currency (A. Kriz, 1952). The bull of gold in Vietnam was continuous in line with the bull of the global gold price for over 10-years from 2001 to 2011. After 2011, gold went into a bear market, but profits accumulated during the previous term still make the investment value very high in the end. Gold brings great gains from the instability of the market, including economic, social, and political factors. Gold prices in Vietnam are governed by international gold prices in the long term and by the domestic supply and the domestic demand in the short term.

In Vietnam, gold is definitely an effective hedge against inflation over the past 15-year span. The correlation coefficient of nominal gold returns and inflation rates is 0.65 (Table 6). The regression model suggests that gold is overly hedge the inflation when 1% increase in annual the inflation rate would trigger 1.7% increase in the nominal annual gold returns. However, inflation explains only 0.42% changes of nominal gold returns.

Gold prices react quickly to sharp rises in inflation. In the years of high inflation, such as 2008 and 2011, the price of gold in Vietnam peaks respectively, with the rising rate several times higher than the rate of inflation. However, in recent years from 2012 to 2015, with a less volatile trend of the global and domestic economy, gold prices plummet much faster than inflation rates.

**Stocks**

As of the end of 2015, the investment value reaches 2.92, which nearly equals the increase in general prices. This suggests that the stock market is likely to beat inflation in the long term. However, stocks are risky, and a positive relationship between inflation and stocks does not exist, as the correlation coefficient between these two variables is -0.37. Furthermore, the result from regression shows that 1% increase in inflation rate would lower 2.8% of stock returns;
however, inflation only accounts for 0.14% the changes in stock returns. Apparently, this asset is risky and tends to suffer in the short term when inflation is high. When inflation rises, stock could decline, and vice versa.

To justify for this relationship, Waser and Dunham (2012) state that businesses have the ability to offset inflation from rising product prices, pass inflation risks to customers in the long term. However, in the short term, slow responses to unexpected inflation may be the cause of the negative relationship between inflation and stocks.

Table 6: Measurement of inflation-hedging ability

<table>
<thead>
<tr>
<th></th>
<th>T-bill</th>
<th>Deposit</th>
<th>Stock</th>
<th>Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.26***</td>
<td>4.92***</td>
<td>37.96*</td>
<td>0.60</td>
</tr>
<tr>
<td>Slope</td>
<td>0.36***</td>
<td>0.40***</td>
<td>-2.80</td>
<td>1.70***</td>
</tr>
<tr>
<td>R</td>
<td>0.64</td>
<td>0.79</td>
<td>0.14</td>
<td>0.42</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.89</td>
<td>-0.37</td>
<td>0.65</td>
<td></td>
</tr>
</tbody>
</table>

Note: (*), (**), and (***)) mean that the value is statistically significant at the level of 10%, 5% and 1%, respectively.

Next, the thesis compares the performance of assets based on three risk-return measures proposed before. All three ratios lead to the common outcome that deposits and gold outperform stocks, because albeit profitable, stocks are risky. However, there is a slight difference between the result of Omega ratio and that of two other ratios. For Omega ratio, deposits perform better than gold, while for Sharpe ratio and Sortino ratio, gold performs better than deposits. Obviously, deposits and gold would be good investments in the long run.

3.4.2. Different inflation environments and analyses of mixing portfolios

Table 7: Real annual returns of assets with different levels of inflation

<table>
<thead>
<tr>
<th></th>
<th>T-bill</th>
<th>Deposit</th>
<th>Stock</th>
<th>Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deflation</td>
<td>5.96</td>
<td>5.78</td>
<td>14.29</td>
<td>0.04</td>
</tr>
<tr>
<td>Low inflation</td>
<td>2.71</td>
<td>3.32</td>
<td>-11.33</td>
<td>7.79</td>
</tr>
<tr>
<td>Medium inflation</td>
<td>-0.48</td>
<td>0.41</td>
<td>49.63</td>
<td>1.51</td>
</tr>
<tr>
<td>High Inflation</td>
<td>-3.68</td>
<td>-2.29</td>
<td>-17.12</td>
<td>10.04</td>
</tr>
</tbody>
</table>

Based on the study of Waser and Dunham (2012), the thesis divides inflation environments into different categories and studies the performance of the assets in these different environments.
Inflation is classified into 4 levels, matching the characteristics of inflation in Vietnam for 15 years.

In the environment of deflation – the inflation rate is less than or equal to 0% - stocks perform the best with the average real return of 4.29%, followed by T-bills and deposits with similar real earnings of 5.96% and 5.78%, respectively. Gold performs the worst in this environment with little real return of 0.04%.

In the low inflation category, in which the inflation rate is higher than 0 but not higher than 4%, gold is the best performer with the real return of 7.79%, while, stocks are the worst performer with the negative real return of -11.33%. T-bills and deposits perform well in the context of low inflation with real earning of 2.71% and 3.32%.

When the inflation rate is at a medium level that is from 4% to 8%, stocks are the winner with the very high real return of 49.63%. In contrast, deposits and gold earn very little to no real return. T–bills are the loser with the real earning of -0.48.

All asset classes suffer when inflation is higher than 8%, except for gold. Stocks record an inflation-adjusted loss of 17.12% per annum, while the figures for T-bills and deposits are -3.68% and -2.29%, respectively. Gold provides a good protection against high inflation with the high real earning of 10.04%.

In summary, from the table, of four asset classes, only gold is generally a good inflation hedge in all inflation environments and especially the best performer in the high inflation environment. The performance of T-bills and deposits deteriorates with the increase in inflation. In addition, stocks and gold perform very differently in response to changes in inflation environments, suggesting a combination of gold and stocks in the portfolio.

The analyses show the inflation protection of gold in case of high inflation as well as the ability to maintain high profitability of the banking deposits and the stock market. The previous studies of Dempster and Artigas (2010) and Waser and Dunham (2012) are supportive of adding gold to the portfolio. Evidence is found in the U.S. market when adding gold to traditional portfolios of bonds and stocks even brought more impressive outcomes than adding Tips, Reits, or other inflation-infhedging assets did. Therefore, the question raised is whether the combination of gold
and traditional portfolios of deposits and stocks could help bring higher profits as well as better ability to cope with risks of high inflation than traditional portfolios themselves in Vietnam. To address this question, gold will be added to 3 traditional portfolios of deposits and stocks: 33% deposits and 67% stocks, 50% deposits and 50% stocks, and 67% deposits and 33% stocks. The traditional portfolios of deposits and stocks are named base portfolios, and the weights of gold added to each base portfolio are 25%, 50%, and 75%. Therefore, totally, there are 12 portfolios are formed.

Unlike prior studies that consider only buy-and-hold approach - no assets trading throughout the entire holding period, the rebalancing approach is implemented in the thesis. The process is simply selling and buying assets in the portfolio regularly with the purpose of maintaining the initial weights of these assets in the portfolio. The frequency of rebalancing is annual. In other words, the rebalancing point chosen in the thesis is at the beginning of each year. Therefore, in the end, 12 portfolios and 2 approaches create 24 investing strategies. Gold-added portfolios are compared to their base portfolio, while the use of rebalancing approach is assessed in terms of both risk-return performance and inflation-hedging ability.

Table 8: Risk-return performance of gold-added portfolios and base portfolios

<table>
<thead>
<tr>
<th>Deposit</th>
<th>Stock</th>
<th>Gold</th>
<th>Sharpe R</th>
<th>Sortino R</th>
<th>Omega R</th>
<th>Sharpe R</th>
<th>Sortino R</th>
<th>Omega R</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% deposits and 50% stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>0.50</td>
<td>0.00</td>
<td>0.03</td>
<td>0.03</td>
<td>1.56</td>
<td>0.14</td>
<td>0.17</td>
<td>2.01</td>
</tr>
<tr>
<td>0.38</td>
<td>0.38</td>
<td>0.25</td>
<td>0.12</td>
<td>0.14</td>
<td>1.85</td>
<td>0.26</td>
<td>0.34</td>
<td>3.04</td>
</tr>
<tr>
<td>0.25</td>
<td>0.25</td>
<td>0.50</td>
<td>0.23</td>
<td>0.28</td>
<td>2.19</td>
<td>0.39</td>
<td>0.60</td>
<td>4.00</td>
</tr>
<tr>
<td>0.13</td>
<td>0.13</td>
<td>0.75</td>
<td>0.33</td>
<td>0.56</td>
<td>2.75</td>
<td>0.44</td>
<td>0.80</td>
<td>3.42</td>
</tr>
<tr>
<td>33% deposits and 67% stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.33</td>
<td>0.67</td>
<td>0.00</td>
<td>0.02</td>
<td>0.02</td>
<td>1.65</td>
<td>0.09</td>
<td>0.13</td>
<td>1.92</td>
</tr>
<tr>
<td>0.25</td>
<td>0.50</td>
<td>0.25</td>
<td>0.09</td>
<td>0.12</td>
<td>1.86</td>
<td>0.20</td>
<td>0.29</td>
<td>2.63</td>
</tr>
<tr>
<td>0.17</td>
<td>0.33</td>
<td>0.50</td>
<td>0.19</td>
<td>0.24</td>
<td>2.10</td>
<td>0.34</td>
<td>0.55</td>
<td>3.75</td>
</tr>
<tr>
<td>0.08</td>
<td>0.17</td>
<td>0.75</td>
<td>0.31</td>
<td>0.44</td>
<td>2.70</td>
<td>0.44</td>
<td>0.86</td>
<td>3.64</td>
</tr>
<tr>
<td>67% deposits and 33% stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.67</td>
<td>0.33</td>
<td>0.00</td>
<td>0.04</td>
<td>0.04</td>
<td>1.50</td>
<td>0.19</td>
<td>0.20</td>
<td>2.21</td>
</tr>
<tr>
<td>0.50</td>
<td>0.25</td>
<td>0.25</td>
<td>0.16</td>
<td>0.17</td>
<td>1.89</td>
<td>0.34</td>
<td>0.43</td>
<td>3.63</td>
</tr>
<tr>
<td>0.33</td>
<td>0.17</td>
<td>0.50</td>
<td>0.27</td>
<td>0.33</td>
<td>2.38</td>
<td>0.44</td>
<td>0.91</td>
<td>4.08</td>
</tr>
<tr>
<td>0.17</td>
<td>0.08</td>
<td>0.75</td>
<td>0.34</td>
<td>0.56</td>
<td>2.72</td>
<td>0.43</td>
<td>0.74</td>
<td>3.22</td>
</tr>
</tbody>
</table>

Note: Each R column contains the rank of 12 portfolios based on the risk-return measure in the column next to the left.
3.4.2.1. Added gold portfolios and non-added gold portfolios

In terms of profitability, the table shows that adding gold improves the performances of all 3 base portfolios based on all 3 risk-return measures. For the buy and hold strategy, the more gold an investor adds to any base portfolio, the better that portfolio performs. For the rebalancing strategy, also, the increase of gold in the portfolios: 50% deposits and 50% stocks and 33% deposits and 67% stocks improves their risk-adjusted reward; however, the performance of the portfolio with 67% deposits and 33% stocks does not go hand in hand with the increase in the weight of gold in the portfolio. More interestingly, the ranks of portfolios are totally the same with 2 risk-reward measures - Sharpe and Sortino - regardless of base portfolios. Compared to the ranking of Sharpe and Sortino, the ranking of Omega is similar for all buy-and-hold portfolios and just slightly different for rebalancing portfolios with the high weight of gold. This result suggests that Sharpe ratio is able to replace Sortino and Omega, even though there is a drawback in the assumption of this ratio.

Based on the maximization of the Sharpe ratio, an investor who holds the portfolio of 33% deposits and 67% stocks would optimize the risk-adjusted wealth by adding 95.93% gold if using the buy-and-hold approach or 76.54% gold if using the rebalancing approach. For the portfolio of 50% deposits and 50% stocks, the optimal weight of gold found is 95.98% and 69.95% with the buy-and-hold and rebalancing strategy, respectively. The corresponding figures are 98.61% and 58.68% for the portfolio of 67% deposits and 33% stocks.

In terms of inflation-hedging ability, for all 3 base portfolios with 3 ratios for deposits and stocks of 1:2, 1:1, and 2:1, adding gold increases the correlation coefficient with inflation. In other words, the more gold is added, the better the inflation protection is. In the portfolio with 50% deposits and 50% stocks and the portfolio with 67% deposits and 33% stocks, when the weight of gold is above 50% the portfolio starts providing a hedge protection. Meanwhile, the figure for 33% deposits and 67% stocks is 75%. Among 12 portfolios, the portfolio with 0.17% deposits, 0.08% stocks and 0.75% gold is the best inflation hedge with or without rebalancing, while the portfolio with 67% deposits and 33% stocks and the portfolio with 33% deposits and 67% stocks are the worst inflation hedge with balancing and without rebalancing, respectively.
Table 9: Correlation coefficient of gold-added portfolios and base portfolios

<table>
<thead>
<tr>
<th>Deposit</th>
<th>Stock</th>
<th>Gold</th>
<th>Buy and Hold Correlation Coefficient</th>
<th>Rebalancing Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% deposits and 50% stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>0.50</td>
<td>0.00</td>
<td>-0.42</td>
<td>-0.32</td>
</tr>
<tr>
<td>0.38</td>
<td>0.38</td>
<td>0.25</td>
<td>-0.22</td>
<td>-0.17</td>
</tr>
<tr>
<td>0.25</td>
<td>0.25</td>
<td>0.50</td>
<td>0.06</td>
<td>0.11</td>
</tr>
<tr>
<td>0.13</td>
<td>0.13</td>
<td>0.75</td>
<td>0.40</td>
<td>0.46</td>
</tr>
<tr>
<td>33% deposits and 67% stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.33</td>
<td>0.67</td>
<td>0.00</td>
<td>-0.40</td>
<td>-0.35</td>
</tr>
<tr>
<td>0.25</td>
<td>0.50</td>
<td>0.25</td>
<td>-0.26</td>
<td>-0.23</td>
</tr>
<tr>
<td>0.17</td>
<td>0.33</td>
<td>0.50</td>
<td>-0.04</td>
<td>-0.01</td>
</tr>
<tr>
<td>0.08</td>
<td>0.17</td>
<td>0.75</td>
<td>0.31</td>
<td>0.38</td>
</tr>
<tr>
<td>67% deposits and 33% stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.67</td>
<td>0.33</td>
<td>0.00</td>
<td>-0.42</td>
<td>-0.27</td>
</tr>
<tr>
<td>0.50</td>
<td>0.25</td>
<td>0.25</td>
<td>-0.12</td>
<td>-0.04</td>
</tr>
<tr>
<td>0.33</td>
<td>0.17</td>
<td>0.50</td>
<td>0.22</td>
<td>0.29</td>
</tr>
<tr>
<td>0.17</td>
<td>0.08</td>
<td>0.75</td>
<td>0.49</td>
<td>0.54</td>
</tr>
</tbody>
</table>

3.3.2.2. Rebalancing and non-rebalancing

In terms of hedging inflation, rebalancing portfolios experience the higher correlation with inflation than non-rebalancing portfolios regardless of weights of deposits, stocks and gold. Therefore, the rebalancing process is effective to increase the inflation-hedging ability for all 12 portfolios.

In terms of profitability, clearly, annual rebalancing also improves the performance of the portfolio significantly. All rebalancing portfolios perform better than corresponding non-rebalancing portfolios.

Thus, the rebalancing is superior to the buy-and-hold strategy in terms of both risk-return measure and inflation protection.

To check the robustness of the performance of rebalancing portfolios, transaction costs and taxes are taken into consideration as these fees associated with buying and selling assets arise in line with the frequency of rebalancing and affect the performance of the portfolio over time.
In Vietnam, no taxes are imposed on banking deposits and gold investments. However, income tax is levied on stocks. Specifically, 0.1 percent of the total value of the transaction is charged as the income tax whenever investors sell stocks.\(^2\) Therefore, the negative influence of taxes on rebalanced portfolios is small; however, transaction costs are the main concern, investors face when rebalancing their portfolio. The transaction costs contain “commissions, differences between purchase and sale prices, and costs related to the price impact of trades” (Reiss and M. Werner, 1996).

For stocks, in the U.S., the transaction cost is highly variable because this cost varies between small investors and large investors as well as the size of the market capitalization. Meanwhile, in Japan, the transaction cost is more fixed than that in the U.S., and this cost is “a piecewise disjunctive linear function of an amount of stock to be traded” (Yoshimoto, 1995). In Vietnam, the transaction cost is charged higher on small investors than on large investors, ranging from 0.15% to 0.3% of total value of stocks traded each time, and there is no fixed cost attached (Alphonse, 2012).

For savings accounts, because Vietnam’s banking system largely focuses on profit sourced from interest, which is the spread between the deposit rate and the lending rate, while pays less attention to profit from the charges of transactions. The maximum transaction fee of most banks is 0.03% of total value of the transaction but does not exceed 1 million Vietnam dong each transaction.\(^2\)

For gold, the only transaction cost is the spread between the buying price and the selling price of the intermediary organizations, as the government does not impose any particular cost. This cost is usually 1% to 2% of the price; however, in many times, higher gap between domestic demand and domestic supply makes it huge. The thesis assumes that the transaction cost of gold in Vietnam is 1%. This rate is also the average rate applied for the transaction of commodities in the world (Yan and Garcia, 2014).

Based on the real conditions listed above, the thesis uses the simple model for costs associated with transaction costs and taxes, written as follows:
\[ \varphi_i(x_i) = \begin{cases} 
\alpha_i^+ x_i , & x_i \geq 0 \\
-\alpha_i^- x_i , & x_i \leq 0 
\end{cases} \] (11)

Where: \( x_i \) is the amount of asset i traded, and \( \alpha^+ \) and \( \alpha^- \) are the rates of costs related to buying and selling the asset i (Lobo et al., 2006).

By assuming that the fixed cost is insignificant, the model describes that the cost is the variable cost, which is proportional to the value of assets traded. For stocks, \( \alpha^+ \) is set 30 basic points, and \( \alpha^- \) is set 40 basic points, as buying stocks is associated with only transaction costs of 0.3%, but selling stocks is associated with both taxes of 0.1% and transaction costs of 0.3%. For deposits, \( \alpha^+ \) and \( \alpha^- \) are set equally of 3 basic points. For gold, \( \alpha^+ \) and \( \alpha^- \) are the same of 100 basic points.

In addition, the portfolio is self-financed, or the purchase of any asset 3 assets - gold, stocks or deposits - requires the selling of 1 for 2 remaining assets. The transaction cost is financed from outside. The thesis assumes that the debt for transaction costs is paid at the end of 2015, and the annual interest rate is the actual floating annual lending rate.

The results in the Table 12 (the appendixes) are robust with transaction costs and taxes. Gold still improves risk-return measures and inflation protection of base portfolios, while rebalancing portfolios is still superior to non-rebalancing portfolios in terms of inflation hedging and profitability.
CONCLUSION

Inflation in Vietnam is high and difficult to anticipate from 2000 to 2015. Based on three theories - the quantity theory of money, demand-side factors, and supply-side factors - the results of the analyses show that for the whole period, the relationship between money supply and inflation is still a question of debate, but the positive relationship of demand-side factors and supply-side factors with inflation is obvious. The increase in money supply is unlikely to go with the increase in general prices in the period before 2004 or after 2011. Demand-side factors, such as government spending, are positively correlated to inflation. For supply-side factors, monopolies with profit maximization and wage increases do not lead to inflation in Vietnam; however, price shocks from external factors with the contribution of exchange rate explain inflation in Vietnam. Domestic prices react quickly to the increases in imported goods and global commodity prices, such as oil and food. However, domestic prices are not sensitive to the decreases in imported goods and global commodity prices due to the influence of internal factors on domestic prices, such as money supply or government spending.

By using the data from 2001 to 2015, the thesis finds that gold is a good performer in the long run and a good inflation hedge in all inflation environments. Especially, gold is the best hedge in the high inflation environment. Like gold, banking deposits beat inflation in long term. However, they cannot keep pace with high inflation in the short term. The performance of deposits deteriorates with the increase in inflation. Stocks are likely to hedge inflation in the long term, but in the short term, this asset is risky and suffers the most when inflation is high. When comparing 3 forms to each other in terms of risk-return performance, deposits and gold outperform stocks.

Adding gold to traditional portfolios of deposits and stocks could help bring higher risk-adjusted profits as well as better inflation protection than traditional portfolios themselves in Vietnam. The more gold an investor adds to the portfolio the better result is. The results are highly similar for all 3 risk-return measures: Sharpe, Sortino and Omega. Based on maximizing the Sharpe ratio, for the buy-and-hold approach, the optimal weights of gold to add to 3 base portfolios - 33% deposits and 67% stocks, 50% deposits and 50% stocks, and 67% deposits and 33% stocks -
are 95.93%, 95.98% and 98.61%. Those figures for the rebalancing approach are 76.54%, 69.95%, and 58.68%.

Another result worth noting is that the annual rebalancing process helps improve both the risk-reward performance and the inflation-hedging ability of portfolios. The result is robust with transaction costs and taxes taken into account.

APPENDIXES

The relationship between inflation and GDP growth

In order to avoid the spurious results of the regression, the augmented Dickey-Fuller (ADF) is employed to examine the stationary of data - the annual GDP series and the annual inflation series. Table 1 displays the results of the stationary test by using the Eviews 8.1. Based on the critical value, the null hypothesis – the time-series has a unit root - is rejected in both time series of annual GDP and annual inflation, or all data are stationary, a result that allows the regression to be implemented.

Table 10: The augmented Dickey-Fuller test for annual GDP growths and inflation rates from 1986 to 2015

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>GDP</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-value</td>
<td>0.039</td>
<td>0.000</td>
</tr>
<tr>
<td>Lag length</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: (*), (**), and (***), mean that the value is statistically significant at the level of 10%, 5% and 1%, respectively.

The model to explore the impact of inflation on the GDP is:

\[ Y = \alpha + \beta_1 X_1 \]  

(12)

Where: Y is annual GDP growth, \( \alpha \) is the intercept, \( \beta_1 \) is the slope of inflation, and \( X_1 \) is the annual CPI.
Regression results

The regression analysis is implemented in the whole period from 1986 to 2015, with the annual GDP growth as a dependent variable and the inflation as an independent variable. The result shows that inflation negatively affects the annual GDP growth. In detail, the coefficient is -0.0078 with the statistical significance at 1%. However, the value of R squared is low at 0.346, meaning that only 34.6% of variance of the dependent variable is explained by the independent variable.

Table 11: Regression result of annual GDP growth and annual inflation rate, 1986-2015

<table>
<thead>
<tr>
<th>CPI</th>
<th>Coefficient</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>α</td>
<td>6.9318</td>
<td>26.7324</td>
</tr>
<tr>
<td>β_1</td>
<td>-0.0078</td>
<td>-3.8480</td>
</tr>
</tbody>
</table>

R-squared         0.3459
Adjusted R-squared 0.3225
F-statistic       14.8072
Prob (F-statistic) 0.0006
Number of Obs     29

Note: (*), (**), and (****) mean that the value is statistically significant at the level of 10%, 5%, and 1%, respectively.

Table 12: Performance of rebalancing with taxes and transaction costs

<table>
<thead>
<tr>
<th>Deposit</th>
<th>Stock</th>
<th>Gold</th>
<th>Sharpe</th>
<th>R</th>
<th>Sortino</th>
<th>R</th>
<th>Omega</th>
<th>R</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% deposits and 50% stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>0.50</td>
<td>0.00</td>
<td>0.13</td>
<td>4</td>
<td>0.17</td>
<td>4</td>
<td>2.00</td>
<td>4</td>
<td>-0.32</td>
</tr>
<tr>
<td>0.38</td>
<td>0.38</td>
<td>0.25</td>
<td>0.25</td>
<td>3</td>
<td>0.33</td>
<td>3</td>
<td>2.99</td>
<td>3</td>
<td>-0.17</td>
</tr>
<tr>
<td>0.25</td>
<td>0.25</td>
<td>0.50</td>
<td>0.38</td>
<td>2</td>
<td>0.59</td>
<td>2</td>
<td>3.91</td>
<td>1</td>
<td>0.11</td>
</tr>
<tr>
<td>0.13</td>
<td>0.13</td>
<td>0.75</td>
<td>0.43</td>
<td>1</td>
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NOTES

1 See the documents from website of Federation of American Scientists, Central Bank of Nigeria, and Bank of Jamaica at the links:

https://fas.org/sgp/crs/misc/RL30344.pdf


2 See Marc E. McDill (1999), Forest Resource management, chapter 3 at the link:

Figure 1 shows the identity between the result from 2000 to 2015 and the result from 1965 to 1998 of monetary authority of Singapore (1999). The document is available at the link: http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN005221.pdf

5 See the document from the Monetary Authority of Singapore at the link: http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN005221.pdf

6 Details in Parker’s coursebook, chapter 2, available at the link:
http://www.reed.edu/economics/parker/s11/314/coursebook.html

7, 8 See http://people.stern.nyu.edu/nroubini/NOTES/CHAP8.HTM

9 See the document from the Monetary Authority of Singapore at the link: http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN005221.pdf

10 Figure 3a and Figure 3b depict the pure demand -pull theory and the pure supply-push theory, respectively. The models for the two theories are built with the vertical axis representing the price of the goods and the horizontal axis representing the real income, the total supply curve slopes down while the aggregate demand curve slopes up but not elastic at one time certain corresponding to full employment (Bronfenbrenner and D. Holzman, 1963)

11, 12 See Bronfenbrenner and D. Holzman (1963)


14 See Bronfenbrenner and D. Holzman (1963)

15 Based on the review of empirical studies of Vietnam’s inflation in the study of Hang and Thanh (2010)

16 On the link: http://www1.vpbs.com.vn/Images/Research/POWER_IR_2014_12_13_V.pdf, electricity price / kWh in Vietnam is among the lowest in Southeast Asia and only equals 60% of that of Thailand and 24% of that of the Philippines. Meanwhile, according to the website of the ministry of finance, gasoline price prior to September 2008 has very few adjustments, as the
policies of the government are to maintain the price low and to subsidize for corporates and customers. From 2008 to now, petroleum price is more market-oriented with the control of the government through a funds to stabilize fuel prices with the purpose of avoiding the adverse impact of global oil price on the economy.

17 See details for the reasons to adjust exchange rate in 2015 from the website of Vietinbank, one of 4 biggest state-owned banks in Vietnam at the link:


19 See the study of Kaul (1985) about the summary of Fama (1981)


23 Details of transaction costs in websites of commercial banks:

