

**ΟΙΚΟΝΟΜΙΚΟ  
ΠΑΝΕΠΙΣΤΗΜΙΟ  
ΑΘΗΝΩΝ**



ATHENS UNIVERSITY  
OF ECONOMICS  
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ΜΕΤΑΠΤΥΧΙΑΚΟ ΛΟΓΙΣΤΙΚΗΣ &  
ΧΡΗΜΑΤΟΟΙΚΟΝΟΜΙΚΗΣ  
MSc IN ACCOUNTING & FINANCE

# Stock returns and inflation

**Εργασία υποβληθείσα στο Τμήμα Λογιστικής & Χρηματοοικονομικής του  
Οικονομικού Πανεπιστημίου Αθηνών ως μέρος των απαιτήσεων για την  
απόκτηση Μεταπτυχιακού Διπλώματος Ειδίκευσης**

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ΒΕΒΑΙΩΣΗ ΕΚΠΟΝΗΣΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

«Δηλώνω υπεύθυνα ότι η συγκεκριμένη πτυχιακή εργασία για τη λήψη του Μεταπτυχιακού Διπλώματος Ειδίκευσης στη Λογιστική και Χρηματοοικονομική έχει συγγραφεί από εμένα προσωπικά και δεν έχει υποβληθεί ούτε έχει εγκριθεί στο πλαίσιο κάποιου άλλου μεταπτυχιακού ή προπτυχιακού τίτλου σπουδών, στην Ελλάδα ή στο εξωτερικό. Η εργασία αυτή έχοντας εκπονηθεί από εμένα, αντιπροσωπεύει τις προσωπικές μου απόψεις επί του θέματος. Οι πηγές στις οποίες ανέτρεξα για την εκπόνηση της συγκεκριμένης διπλωματικής αναφέρονται στο σύνολό τους, δίνοντας πλήρεις αναφορές στους συγγραφείς, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιήθηκαν από το διαδίκτυο».

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**ΜΗΤΡΟΠΟΥΛΟΣ ΒΑΣΙΛΕΙΟΣ**

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## **Abstract**

Theory suggests that stock returns are a good hedge against inflation. Though, the majority of the empirical evidence for industrialized economies suggests that the relation between stock returns and inflation is negative and not positive. This paper examines the relation between equity returns and inflation for 12 important developed markets, namely, Austria, Belgium, France, Germany, Italy, Netherlands, Portugal, Spain, Denmark, Sweden, the United Kingdom, and the United States of America during the periods of 1990-2016. The first test used is a simple regression between the stock returns and inflation rate for all countries and all different sub periods (six sub periods for each country). A second test was used in order to confirm the results from the regression, VAR tests were made for all countries but for the whole time period. To forestall the results, the relationship between stock returns and inflation, for the total of 72 sub periods for all the countries only 5 are statistically significant. The result may be because of inflation targeting from central banks in the more recent years, and the effect this practice has on how investors view inflation.

## **1. Introduction**

The question if stock returns are a good way in order to hedge against the inflation rate has troubled many researchers and investors in the past decades. The theory suggests that the relation between the two should be positive and therefore stocks should be used to hedge for the dangers of inflation. The empirical research on the other hand, points to a negative relation that seems to exist between stock returns and inflation which is the opposite from what the theory suggested. Most research done in order to evaluate this relation and to find out if the theory holds true was done in the past but mostly during periods of high inflation or after those periods, but very few research on the subject is noted during the last three decades since inflation seems to be under control.

The purpose of this paper is to fill this gap in research for the more recent years and to determine if the relation between stock returns and inflation rate has changed from what we saw in the previous years. More specifically we would like to find out if stock returns are a good hedge against inflation after 1990 as the original theory states or if nothing has changed in this relation and it remains negative, which means stock returns should not be used as a hedge for inflation. For this we used twelve industrialized countries, eleven being from Europe and the United States from North America. The rest of the paper is organized as follows: Section 2 a literature review to see the work done in the past, Section 3 examines the relationship between inflation and stock returns for the 12 countries, Section 4 Are the results of the VAR model, Section 5 attempts to explain the results, while in Section 6 are the conclusions.

## 2. Literature review

In this section we are going to see a review of previous work that is done on the subject by others. Many of these articles have different views of the subject, different approaches as to the causality of the results and also different methodologies as to how they approach the empirical part of the research, many of which examine unrelated time periods. The papers listed here are with a chronological order starting from the oldest one towards the most recent one. This was preferred in order for us to have a clearer view on how the theory and research was advanced in time and with what order, which paths it followed and what were the causes for the different results that were suggested by the authors.

In the paper 'common stocks as a hedge against inflation' by Zvi Bodie we face the issue as to which extent might common stocks actually minimize and reduce the risk an investor has on his real returns which is the result of the uncertainty that exists about the level of the prices of consumer goods. The author identifies inflation risk with the variance of the real return on a nominal bond, since it is the one type of security whose real return is a given but for inflation risk, namely single period, it is riskless in terms of default. Thus the author measures how effective the common stock is as an inflation hedge as the corresponding reduction in that variance obtainable by the combination of a well-diversified portfolio of common stocks and the nominal bond in their variance minimizing proportions. The optimal portfolio is done using the Markowitz Tobin mean variance model in order to choose it. In the end Zvi Bodie came upon the conclusion that in order to measure how good of a hedge is well diversified portfolio against inflation, there are two parameters that play a key role. The first one is the ratio of the stocks to the variance on the unexpected inflation, the bigger this ratio is the less effective is equity as a hedge. The other parameter depends on the difference of the nominal return of the nominal bond and the coefficient of the unexpected inflation. The greater the absolute value is, then common stocks are more efficient as a way of hedging inflation.

Fama and Schwert in their paper tried to estimate the range of which different assets could be used as a way to hedge both the expected and the unexpected components

of the inflation rate in the time period of 1953-1971. This research is based on Fisher's hypothesis that the expected real return is determined by real factor, for example the productivity of capital and investor time preferences, and that the expected real return and the expected inflation are not related in any way. After examining many different assets they came under the conclusion that only residential real estate is a complete hedge against both the expected and unexpected inflation rate for the time period of 1953-1971, in generally nominal real estate returns move in correspondence with both the expected and unexpected inflation moves. Also government debt in either bonds or bills, is also a perfect hedge method but only against the expected element of the inflation rate. Common stocks on the other hand are negatively related with expected inflation rate, even though the evidence is less consistent common stocks seem to also be negatively related to the unexpected inflation rate also, thus in contrary with the long held belief but in line with the empirical evidence present it seems that common stocks are a rather bad choice for a hedge against inflation.

Cohn and Lessard tried to investigate what are the effects of the high levels of inflation, of the past decade (1970), are on corporate profits and in stock prices. They investigated mainly the United States of America but also a number of other countries over this time period. According to their results, stocks in the 1970's are consistent with the first hint that stock prices are negatively related to nominal interest rates and the inflation rate in a number of countries. However, it is very difficult to trace these results to a specific view of investor behavior due to the difficulty in finding out precisely which adjustments should be made to reported earnings and which adjustment should investors take under consideration. What the authors consider to be an interesting point someone should explore in whether this negative relationship between interest rates, inflation and stock returns is the outcome of systematic errors in valuation from the investors or if it is linked between basic causes of inflation and factors that reduce long term earning potential for companies. Also the results suggested that during this decade, rising inflation tended to agree with a fall in stock prices beyond that accounted for by a decline in after tax profits.

‘Stock returns, Real activity, inflation and money’ from Eugene F. Fama. In his paper Fama tries to explain the anomalous negative relation between stock returns and expected and unexpected inflation. They hypothesis which is supported by the data that the negative relations of stock returns and inflation are proxying for positive relations between stock returns and real variables are more crucial elements of equity values. Also the negative stock return and inflation relations are caused by negative relations between inflation and real activity which are explained by the combination of money demand theory and also the quantity theory of money. As predicted from the proxy effect of the hypothesis, the anomalous part of the stock return- inflation relation disappears when real variables and measures of the expected and unexpected inflation are used in order to examine and explain stock returns. Fama’s first step in analyzing this was to document the negative relations of inflation and real activity, while controlling all other arguments for money demand function, and more importantly the money supply. The next step is to study the relations of the real variables which are presumed to be the central determinants of stock returns. Fama examined a simple empirical model of the capital expenditure process, which is very similar to the ‘flexible accelerator’ models. The tests demonstrate that both the output and the average real rate of return on capital lead to capital expenditures. The last of the tests had to do with relating real common stock returns, to other real variables, the with inflation measures and finally to different combinations of real variables and inflation measures. In his conclusion he finds that the empirical tests of this model are successful. The evidence supports that the real stock returns are positively related to measures of real activity (like capital expenditures). Persistent evidence exists of negative relations between inflation and real activity which is explained with the quantity theory of money and also the money demand theory. Furthermore, inflation rate and stock returns are strongly linked but with opposite signs, to measures of real activity. In the end Fama concluded that the evidence of negative relations between inflation and expected real return are bogus and that they are induced by an unexpected characteristic of the money supply process in general during the post 1953 period.

The paper of Robert Geske and Richard Roll ‘The fiscal and monetary linkage between Stock returns and inflation’ is supplementing and enhancing Nelson’s and Fama’s ideas and empirical results and conclusions. The authors argue that the puzzling

empirical results are in disagreement with the economic theory and common sense, these results being that stock returns are negative correlated with both the expected and unexpected inflation rate. They believe that stock returns are negative related to changes that occur in the element of the expected inflation, since these changes will begin a chain of events, the result of these events will be a higher rate of monetary expansion. Their first step was to offer a theory in which any dubious stock return will signal changes in expected inflation. Second they suggested that stock returns might be negative related with changes in the Treasury bill, which is the proxy for the expected relation. The questions of this paper were the following three relations of stock returns and the beginning of period short term interest rates, also the coexistent changes in short term interest rates and also the relation with the unexpected inflation. They argue that the second and third questions are really two different ways to measure the same thing. With the data the gathered, the authors examined all the links in the causality chained and have indeed found evidence to support each case. A fiscal and monetary link from stock returns to money growth exists and because of that, stock returns signal change in the interest rate and in expected inflation.

Gultekin investigated Fisher's hypothesis that the expected real return is determined by real factors such as the productivity of capital and time preferences of savers and it is completely independent of the expected inflation rate also he believed that the real and monetary sectors of the economy were completely separated and there was no relation between them. In reality Gultekin tries to find out what is the relation between stock returns and inflation. This was due to the high inflation rates in 1973 since interest for a hedge against inflation, namely stock returns, was revived. In order to test this, Gultekin, gathered data from 26 countries, for the post world war two time period, and analyzed the data using time series models. After using the time series regressions for the 26 countries, there is no evidence of a positive relation between nominal stock returns and inflation rates for the period of 1947 to 1979. The majority of the coefficients are negative, also he finds that the relation between stock returns and inflation rate is not stable over time and that differences exist among countries. He also noticed that countries with higher rates of inflation tend to have higher nominal stock returns, while real rates in most countries is in decline since the mid-1960s. In conclusion, it seems that the puzzling

findings regarding the relation of common stock returns and inflation in the U.S. are also repeated in other countries as well.

In his paper Bruno Solnik focused mainly on the relation between stock returns and inflationary expectations for different countries over the period 1871-1980, since for the US market this relation has consistently been observed to be negative. At this point the author makes a statement that the some previous research done by others was flawed due to model misspecification and that he finds that all major countries over the time period of 1971-1980 had a structural relation of flexible exchange rates. As a predictor for inflation Solnik used interest rates for these 9 countries like most other did for US research. Even though many countries at this time frame have their interest rates controlled by their governments, the Eurocurrency market has developed into a very efficient international free money market. Thus the one month rates that were used were collected from the Bank of International settlements for the nine different countries. The result of his research showed that the assumption of Fisher that any real returns are independent of inflation rates is completely rejected for all nine major stock markets. Also by using interest rates for the expected inflation the data supports Geske and Roll model that stock price movements signal negative revision in inflationary expectations. The negative relation amid returns and nominal interest rates would be compounded if ex ante real rates were to increase during a drop of the market, this is claimed in some theories relevant to the subject. The impact that stock returns have on real interest rate was always small, but also significant for four countries out of nine. In reality this relation seems to be a structural phenomenon since it was present to all the countries in the research. Thus to summarize, the results are very good in their consistency across countries, and the link between the relation on stock returns and inflation appears to be through inflationary expectations and especially revisions in expectations.

Theodore E. Day begins by stating the more general and accepted view as to how inflation was viewed as a proportionate increase in all prices and income, and as a result, the real rate of return which is a claim to production was considered to be unaffected by the rate of inflation. Even though this does not seem to be supported in the recent empirical research which turns out the puzzling result that stocks are not a good way to

hedge against inflation which is in complete disagreement with the theory that was supported. Day developed a multiperiod economy with production in which he tries to analyze and explore the relation that exists between real stock returns and the inflation rate. Investor demand for fiat money (this money is derived from the relationship between supply and demand rather than the value of the material than the money is made of), and therefore the potential for inflation, was introduced into this model with the help of a 'cash in advance' restraint. Also he planned for a government agency to be in charge and operate the money supply process, in order to gain control over the output of the economy gives inflation a more precise effect on the asset pricing mechanism in this model. With this addition, inflation is much more than just a monetary phenomenon in this paper. Also this model, unlike most work done in the past regarding this subject, emphasizes the joint dependence of both inflation and real stock returns on exogenous productivity and government policy stocks, and not just the rate of returns being a dependent variable, which responds to the changes that occur to the expected and unexpected components of the inflation rate. In conclusion this model seems to present the fact that a negative correlation between inflation and real stock returns is reliable with equilibrium in a market were the investors in it are rational. This relation in general will be ex post but under some specific circumstances of the economy's production function it will be ex ante. In the end the use of this model, which includes the role of production in determining share prices leads to the conclusion that the variability of asset prices is dependable with rational expectations and the market efficiency.

In the paper 'Inflation and asset prices in an exchange economy', Jean-Pierre Danthuine and John B. Donaldson discuss how the post 1950's stock market performance seems to counter the Fisherian view that the real rates of return in the world depend only upon real factors and therefore are completely independent from the rate of inflation and the growth rate of money. The main objective of their paper is to answer what relationship exists between inflation and asset returns and what should we expect in a general equilibrium model, and if this relation is in agreement with the empirical findings. They choose to add to the model of Lucas a monetary setting by inserting real money balances as an argument for the agent's utility function. They also added a government service which has the job of issuing new nominal money and to tax any

income to finance real spending. They went on by describing the economy, analyzing the agent's decision problems and later on they dived into the equilibrium by defining an appropriate expectation for it. In conclusion their findings are in line with many other researches, by highlighting the interdependence of economic variables in a general equilibrium. In addition their research also adds evidence as to why real returns appear to be negatively correlated with the rate of inflation. Resulting from this mini economy, the authors determined that common stocks are not a very efficient way to hedge against nonmonetary inflation, but in the other hand, stocks are a great protection over the long run against monetary inflations.

Gautam Kaul also expands on Jean-Pierre Danthuine and John B. Donaldson's idea and his main hypothesis on his paper 'Stock returns and inflation, the role of monetary sector' is that the post-world war 2 negative stock return and inflation relation can be explained by a combination of money demand and a counter cyclical money supply effect. In a more important note, they also argue that if money demand effect is answered by a response that is pro cyclical (as in the 1930's) then the relation of stock returns with inflation will either be positive or not significant. In order to test both of these assumptions they gathered data from four industrialized countries (the U.S.A, U.K, Canada and Germany) and for two different sets of time periods one for the post war period in order to analyze counter cyclical policies and one for 1930's in order to analyze pro cyclical. This analysis shows that the existence of negative relation between inflation and real return, reinforced by the use of counter cyclical monetary policies from the authorities, explains all three of the negative stock return and inflation relations that are consistent across all countries. From their analysis of the data they derived into the conclusion that, a counter cyclical monetary response does explain the existence of the negative relation between inflation and stock returns in the post war time period, in all four industrialized nations that were examined. On the other hand, when there is a pro cyclical monetary policy in effect, like it was in the 1930's, we notice that the relation between stock returns and inflation changes drastically because of this, also stock prices seem to either have a positive relation with inflation elements, as opposed to a counter cyclical monetary policy in which the relation was negative, or are not related at all in any way.

Three years later Kaul wrote another article called 'Monetary regimes and the relation between stock returns and inflationary expectations' unlike his previous paper on the matter, in which he analyzed that the relation of inflation and stock returns can be explained by the equilibrium process in the monetary sector and more specifically the money demand effects in combination with a counter cyclical response, in this article he made a different approach. In this paper he analyzed the impact that a monetary regime change has on the relation of stock returns with both the expected and the unexpected inflation in the post war period. He collected data for the post war era from four developed countries, the U.S., Canada, U.K., and Germany. Based on some official statements by the monetary authorities, different policy regimes are acknowledged in the four countries. His research reveals that a noteworthy negative relation between real stock returns and changes in expected inflation exists in all countries and also these relations seem to be the result of a counter cyclical monetary response by the central banks of each nation. More importantly, it seems that the evidence indicate for the post war time period, that this negative relation varies systematically depending on the operating targets of the monetary authorities. To be more specific Kaul noticed that the relation is considerably stronger with an interest regime as compared to money supply regime. It appears that interest regimes witness strong countercyclical monetary responses by the central banks, while throughout money supply control periods monetary policy is neutral. As a result, and in line with Kaul's hypothesis, the negative relation between stock returns and the expected inflation rate is stronger during interest rate regimes, also he noted the fact that when there is no change in this relation in countries that had only one monetary regime during his sample period.

The study of David P. Ely and Kenneth J. Robinson 'Stock returns and inflation: Further tests of the role of central banks', investigates whenever the negative relationship that exists between real stock returns and the unexpected inflation can be explained by the equilibrium process in the monetary sector. This approach incorporates into one single model all factors of the negative relationship between inflation and real returns that have anything to do with the monetary sector. Moreover this negative relationship is also calculated during different time periods depending on if during these time periods the Federal Reserve changed its behavior, this is in order to estimate if this change from the

Fed has any kind of impact in the relation of inflation and real stock returns. These tests are only made in order to explain the relation of the unexpected inflation and real stock returns, and not that of the expected inflation and real stock returns. At the end of their tests, they were able to analyze the impact of the long run debt growth on the growth rate of the monetary base and also they were able to detect that monetary policy is counter cyclical. Their results do not seem to be backing the debt monetization hypothesis, also in some cases there a counter cyclical monetary policy response obvious, but this response does not appear to be able to provide us with an explanation for the negative relationship between unexpected inflation and real stock returns.

Marshall devised a dynamic equilibrium monetary model so he could answer the following three questions. First, is this model able to predict negative co-movements between the expected inflation and ex ante real asset returns and also between the realized inflation and ex post returns? Second, can this model contest the detected weights of these correlations? And third, does the magnitude of these correlations depend on whether the inflation process is led by variations in real economic activity or by the change the rate of money growth. He decided to separate these two sources of fluctuations in inflation, he did this to find out if he can settle the negative relation between inflation and stock returns with the positive relation of money growth and equity returns. Also he examines the limitations that exist for this class of models, and by including in which parts the model fails empirically in order to see how these failures might help future research. At the end, this paper offers evidence that negative relation between stock returns and inflation do not enact proof of money illusion or any kind of market inefficiency since correlations of the observed magnitude are implied by this model. To be more specific, the Fisher hypothesis does not describe the implications of a dynamic economic equilibrium when the role of money is explicitly taken into account. Also the model is reliable in the conclusion that both negative equity returns as in response to inflation shocks and that of a positive response of returns in relation with monetary shocks because the main foundation of change in inflation is fluctuations in real economic activity.

From Jacob Boudoukh and Matthew Richardson the paper with the title ' Stock returns and inflation : A long Horizon perspective' they begun by making a note that the current empirical research done by most others is focused on short term asset returns with one year horizons or even less. These studies use the Fisher model which is expected to hold at all horizons, but this gap in the literature review causes some problems. First of all many investors will not hold stocks for only 1 year but for a longer period of time, and therefore it is important to know how stock returns react with inflation over several years, another problem since the results of short term horizons are anomalous, it is worth investigating the relation between inflation and stock returns when a specific interest is given in the long run. The second issue is the one the authors are trying to examine. They came across 2 major problems the first was the necessity for long term data which they solved by taking two centuries of data on stocks, both short term and long term bonds and the inflation for this time period for United Kingdom and United States of America. The second issue came from the inability to somehow model ex ante long term inflation with accuracy, in order to bypass this issue they used an instrumental variables approach. They choose instruments, past inflation rates and interest rates, that in theory support and measure ex ante inflation. In their conclusion they find it interesting the fact that even though USA and UK stock markets have a very low correlation the results describing the relations between nominal returns and inflation are quite similar. Considering the results across sub periods, the consistency of the results in both ex ante and ex post post inflation and the similarities using different instruments this paper gives a strong support for a positive relation existing between nominal stock returns and inflation at a long horizon.

In the article 'Are stocks a hedge against inflation? International evidence using a long run approach' David P Ely and Kenneth J Robinson used vector error correction models and different theories of cointegration in order to examine international evidence and find an answer as to if stocks in provide a good hedge against inflation. An important reason for the use of VEC models is the fact that they can incorporate different variables that might play a role about the relation of stocks and inflation. Also VEC models capture any long term relationship in 2 different ways, first by introducing error correction terms any variable revealed by the cointegration tests are imposed into the system and secondly VEC estimates any impulse response function in order to assess the effect of share and

good prices In both money supply and real output over different years. With this they are able to test if stocks keep their value relative to goods prices and if the performance of stocks as a way to hedge against inflation depends on whether the inflation innovation comes from real sector or from the monetary sector. In their conclusion they state that even though stocks are claims of ownership on real assets they should in theory offer hedge to inflation, but the empirical research points to a negative relationship between stock returns and inflation, even though most of this evidence comes from researches that might not capture any long run relationship that might exist between stock returns and good prices. Their own research they find that only in few of their tests is a long term equilibrium reached regarding stock prices, goods prices, output and money. With some exceptions they came under the conclusion that in the long run, stocks maintain their value in comparison with goods prices following both real and monetary shocks. One exception to this that is worth mentioning in that stocks fail to maintain their value when compared to relative goods prices following real output shock in the USA.

For the next paper we are going to examine the work of Fred C Graham ‘inflation, real stock returns, and monetary policy. One empirical puzzling result in financial economics is the negative relationship that exists between the rate of inflation and the ex post real rate of returns on equity. This negative relation holds true for both the expected and unexpected inflation rate. He finds evidence that this negative relation on real stock returns and inflation is not true throughout the post-World War 2 time period. In reality there are two periods 1953-1976 and 1982-1990 in which the relation was indeed negative and in between the relation was found to be positive. Furthermore the evidence shows that the monetary policy followed in the 2 sub periods of negative relation was counter cyclical or neutral, but it was strongly cyclical during the time period of positive relation. This supports the view that the real stock return relation with inflation is negative when the variation in money demand is not followed by offsetting variation in nominal money growth (pro cynical policy). His results support Fama’s explanation of the negative real stock return and inflation relation. Also the data support his premise that the negative relation appears only when the policy is neutral or counter cyclical and disappears completely when the policy is pro cyclical. Furthermore only in this sub period the granger causality test reject the null hypothesis that the money growth does not

cause inflation. Also the mechanism that has generating this changing relation between real stock returns and inflation does not appear to be linked to the degree of debt monetization which was hypothesized by Geske and Roll, but it seems to be a result from a change in Fed's response to changes in real activity. Even though the sample sizes are too small to have a conclusive result, the evidence so far backs Fama's hypothesis, and that the fact that the relation changes appears to happen from the change that the Fed responds to variations in real activity.

The last research paper we are going to examine is Spirou 'are stocks a good hedge against inflation? Evidence from emerging markets'. As the title suggests this paper focuses on the relation between stock returns and inflation but not in industrialized nations like most previous empirical work but on emerging markets. In order to test for this relation the paper examines data from emerging market countries, namely Chile, Mexico, Brazil, Argentina, Thailand, South Korea, Malaysia, Hong Kong, Philippines and Turkey, for all the above countries the time period was the 1990s. In this article it is clear that emerging stock markets have a different behavior to that of developed markets when it comes to the relation between inflation and stock returns. In detail, from the research one finds that the negative relation described in developed markets is less visible to the countries of this paper, and in many cases this relationship is actually positive and not negative. This relationship is negative and significant only for the country of Thailand, for the rest of the markets it is either positive or statistically not significant. Many others have suggested that the negative relationship that exists will be less visible during periods when inflation is generated primarily by money fluctuations, but according to the results from the sample countries (with the exception of South Korea and Turkey) consumer prices are related to both money supply as well as real activity. It seems that the main determinant of inflation is not output growth, one possible explanation of the results is the significant role of money. In conclusion, from the research done and the results presented in this article it seems that equity returns on emerging markets are a good hedge for inflation. An explanation for this is the significant relationship between money and consumer prices and by a possible positive relationship between output and prices. Thus, as it is predicted by the theory equity returns might actually be a good hedge against inflation at least in the emerging markets.

### 3. STOCK RETURNS AND INFLATION

The majority of the empirical research done over the years has focused on dates prior to 1990's, but what is the relation of inflation and stock returns, in developed markets, from 1990 to the present, has anything changed? In order to examine this question empirically, monthly observations on equity prices and consumer price indices are used from eight economies that are part of the Eurozone (Austria, Belgium, France, Germany, Italy, Netherlands, Portugal and Spain), three more from the European union that are not part of the common currency (Denmark, Sweden and the United Kingdom even though UK has voted to leave the union with a referendum in the summer of 2016, the country has yet to leave it and also all the data used here are prior to this decision), and one north American market (United States of America). All data cover the period between January 1990 and June 2016, also all data are collected from DataStream, and the growth rates of all the indices are defined as the first difference of the logarithmic price levels. Additionally, in order to examine how stable is the relationship between stock returns and inflation over time, the sample is split into 6 different sub periods, the first one starting at January 1990 and ending December of 1994 (normal period), the second one starting in January 1995 and ending December 1999 (the dot com bubble), the third starting January 2000 and ending in December 2006 (covers the last part of the dot com bubble and the real estate bubble in the USA), the fourth begins in January 2007 and ends in December 2009 ( the solvency crisis in the USA), the fifth one begins in January 2010 and ends in December 2012 ( the EU crisis), and the last period starts in January 2013 and ends in July 2016 (normal period). In the appendix one might see all the regressions for the USA as an example.

In order to examine the relationship between stock returns and inflation one estimates the following regression:  $\Delta P_{i,t} = a_0 + a_i \Delta CPI_{i,t}$ , where  $\Delta P_{i,t}$  are the returns on the equity portfolios,  $i =$  Austria, Belgium, France, Germany, Italy, Netherlands, Portugal, Spain, Denmark, Sweden, United Kingdom and United States of America, and the  $\Delta CPI_{i,t}$  is the rate of change of the corresponding Consumer Price Indices. The

coefficient  $a_0$  is a constant, and the coefficient  $a_i$  captures the sensitivity of stock returns to the changes in the consumer prices. As Graham argues in 1996, although this equation does not separate the expected and unexpected elements of inflation it still yields the same qualitative evidence.

<u>Austria</u>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	4.958819	2.262299
1/1995-12/1999	-0.610403	-.0291050
1/2000-12/2006	-0.187533	-0.099578
1/2007-12/2009	5.970528	1.457778
1/2010-12/2012	1.197423	0.657480
1/2013-6/2016	0.912818	0.726419

Starting with Austria we are able to see just by looking at the numbers and results from the regression that everything is not as it was supposed to be. The first time period 1990-1994 everything seems to be normal and as expected from Fisher's theory, a positive coefficient is in place for inflation and the t statistic shows that it is a significant parameter. In the 1995-1999 everything seems to change, the coefficient changed from a positive to a negative. Which in effect is in line with what previous researches has showed that a negative relation exists between inflation and stock prices, but what is astonishing is the fact that inflation is no longer statistically significant according to t statistic. We notice that the trend continues for the sub period of 2000-2006, a barely negative coefficient exists but it remains without importance by looking at -0.099578 t statistic. In the following period the coefficient changes again to the opposite form a

negative to a positive this time, but no change in the t test result it is still not significant. In the last two sub periods there is no variation in either the coefficient or the t statistic, the first remains positive and the later still shows that the inflation is not significant and therefore we cannot really interpret the coefficients and the impact they have in the stock prices in all but the first time period we investigated for Austria.

<b><u>Belgium</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	-0.894209	-0.393919
1/1995-12/1999	1.129263	0.58669
1/2000-12/2006	-2.420134	-1.696293
1/2007-12/2009	-2.631397	-0.993746
1/2010-12/2012	0.393904	0.156269
1/2013-6/2016	2.023740	0.592465

Next we examine the regression results for Belgium, here like before with Austria again we see peculiar results. To be more specific from the start we see negative coefficient for the inflation but again if we take into account the t test it is not significant in the 95% level. The coefficient seems to go back and forth between positive and negative since it changes to a positive in 1995-1999 and then back to negative in 2000-2009 and after it changes again, but like Austria with the exception of the first sub period and in Belgium the t test results show that the inflation rate is not significant for any of the time periods. Since we have these t test results it is not possible for us to interpret the coefficient since it does not matter if they are positive like Fisher stated in his theory or negative like previous empirical works suggest.

<b><u>Denmark</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	-2.202349	-1.020296
1/1995-12/1999	-2.450745	-1.035566
1/2000-12/2006	-2.028473	-1.142040
1/2007-12/2009	-1.803665	-0.671581
1/2010-12/2012	2.339539	1.087457
1/2013-6/2016	1.443161	0.787558

Moving on to Denmark we see the same pattern as in the previous two countries, even though the coefficients here seem to be more negative and switch towards the end of the time period, but for all sub periods we clearly see that the t statistic and therefore the relation seems to be statistically insignificant different from zero.

<b><u>France</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	-5,717566	-1.457742
1/1995-12/1999	4,0233475	0.829792
1/2000-12/2006	-6.360801	-2.065425
1/2007-12/2009	-4.054921	-0.827687
1/2010-12/2012	3.420229	0.606473
1/2013-6/2016	2.651072	0.562161

The results for France differ only in the sub period 1/2000-12/2006, where we see a -6.360801 coefficient for the relation of inflation and stock returns this is the only period where the coefficient is statistically significant. It seems that for that time period there is

a negative relation between stock returns and inflation rate which means that stocks are not a good hedge for inflation unlike what the theory suggested. For the rest of the time periods nothing changes compared to the results of previous countries the relation it seems is not statistically significant judging from the t statistic for these time periods.

<b><u>Germany</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	0.915701	0.764022
1/1995-12/1999	6.116537	2.209320
1/2000-12/2006	-1.129099	-0.557625
1/2007-12/2009	3.268268	1.156486
1/2010-12/2012	3.612915	1.114889
1/2013-6/2016	2.404356	1.401839

Germany has most of the coefficients being positive but only the one in the time period of 1/1995-12/1999 is actually statistically important. This positive coefficient of 6.116537 means that, according to the theory, stock returns are a good hedge against changes in the inflation rate. If we take into account that in all other periods the relation between stock returns and inflation is not statistically important in the overall it makes no difference if one sub period is positive.

<b><u>Italy</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	-0.461040	-1.702776
1/1995-12/1999	-0.112905	-0.977258
1/2000-12/2006	0.032328	0.403899
1/2007-12/2009	-0.006349	-0.149921
1/2010-12/2012	0.163648	2.050129
1/2013-6/2016	-0.020298	-1.198039

Italy also has only one positive relation in all periods, the one during 1/2010-12/2012 but it is barely positive with a coefficient of 0.163648, which signals a weak positive relation between returns and inflation and for this time period stocks are a good hedge for inflation. Overall Italy is in line with all the previous countries and it seems that the relation is not statistically significant.

<b><u>Netherlands</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	-1.176529	-0.726270
1/1995-12/1999	-2.203404	-1.248998
1/2000-12/2006	-2.352170	-1.906439
1/2007-12/2009	-0.787896	-0.311165
1/2010-12/2012	1.177253	0.72719
1/2013-6/2016	1.186639	1.046833

Moving on to the Netherlands we see that most of the coefficients are negative here, but in this case, like the ones before, the relation of stock returns and inflation is not statistically important in any of the time periods that were examined.

<b><u>Portugal</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	0.674763	0.383077
1/1995-12/1999	0.186595	0.068430
1/2000-12/2006	-0.882077	-0.544606
1/2007-12/2009	-0.082953	-0.039640
1/2010-12/2012	2.633165	1.701734
1/2013-6/2016	0.342599	0.324821

Portugal has no time period where the t statistic is important, which means all the coefficients have no real value and meaning, it has become apparent at this point that this is not anomaly of the data but it seems that the theory no longer has any hold in today's industrial markets.

<b><u>Spain</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	-0.315845	-0.143994
1/1995-12/1999	-3.842445	-1.127081
1/2000-12/2006	-1.013037	-0.819882
1/2007-12/2009	0.962321	0.656951
1/2010-12/2012	0.343732	0.198314
1/2013-6/2016	0.530908	0.560571

Spain also has not one statistically important time period all of the t statistics are in the 95% interval and therefore in this country we also see that the relation between inflation and stock returns is not important and no interpretation can be given to any of the coefficients.

<b><u>Sweden</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	-2.243157	-1.304238
1/1995-12/1999	-0.413956	-0.186578
1/2000-12/2006	-4.310086	-1.791844
1/2007-12/2009	1.1881740	0.458322
1/2010-12/2012	-0.437141	-0.197990
1/2013-6/2016	0.679410	0.364101

For all time periods examined for the country of Sweden the results seem to be the same as in previous countries. The relation between inflation and stock returns is not statistically significant here either.

<b><u>United Kingdom</u></b>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	0.191782	0.225076
1/1995-12/1999	0.049348	0.041297
1/2000-12/2006	-1.345089	-1.31693
1/2007-12/2009	-1.805878	-1.172365

1/2010-12/2012	1.692297	1.616621
1/2013-6/2016	0.824297	0.674351

The United Kingdom as one of the largest economies in the European market shows no different results from the previous countries. We notice that in all six different time sub periods the regression results show that the relation here is also statistically insignificant from zero.

<u><b>U.S.A.</b></u>		
<b>Time period</b>	<b>Coefficient</b>	<b>T-Statistic</b>
1/1990-12/1994	-7.089568	-2.570404
1/1995-12/1999	-2.798440	-0.660802
1/2000-12/2006	-1.263860	-0.691584
1/2007-12/2009	2.115029	1.106507
1/2010-12/2012	4.546079	1.310212
1/2013-6/2016	1.284857	0.556641

The United States is the country that most of the past research on this subject was focused on. Many papers use data from the U.S, from many different time periods, in order to explore Fisher's theory about the relation of stock returns and inflation. Unlike those previous results, most of which showed a negative relation between stock returns and inflation, here we see something different. It seems that the U.S is no different from all the other industrialized countries we examined on this paper. Specifically we see that for all time periods starting from 1994 and ending at 2016, the relation of inflation rates and stock returns is insignificant with the exception of the sub period of 1990-1994 where a negative relation exists between stock returns and inflation with a coefficient of -7.089568 which means for this time period it is not a good idea to hedge against inflation

using stock returns. Never the less these results are in complete contradiction for the US market when compared to research done for different time periods before 1990.

These are strange results if we take into account all previous empirical results that have been expressed over the past years. Previous research on industrial markets has yielded mostly a negative relation between stock returns and inflation rate. Also the results are not in line with what has been found for emerging stock markets either where the relation was negative, it seems that something has changed after 1990 to this relation in industrialized countries. The results from the regressions show no statistical significant evidence that a relation between stock returns and a change in inflation rate exists, looking more carefully we see that out of the 6 time periods for all countries and a total of 72 regressions only in 5 of them is there strong evidence of a relation existing among stock returns and inflation, either a positive or a negative relation.

## 4. Vector autoregression model

As a consequence from the previous regression results, the need to confirm and further examine the validity of these results arose. In order to do this a Vector autoregression (VAR) model was used. The VAR model reveals any linear interdependencies among several time series, it is a more general model than the autoregressive model by taking into consideration more than just one evolving variable. All variables enter the model the same way, each one has an equation explaining its development and its own lags and the lags from the other variables in the model.

Using the VAR model gives us the opportunity to explore the possibility that the relation between stock returns and inflation (that we did not detect in the previous test) is hidden and we might be able to see it in the lags of the VAR model. The two variables used here are the same as before stock returns of each country and the inflation rate of each country, two lags were included in the model in order to explore the possibility that a relation exists two steps back and not only one. The reasoning for using VAR model, is that investors might react to changes in inflation a month or two after the actual change has occurred, meaning they need time in order to analyze the data and decide what the best action they should take is. The only difference in this model from before, is that this time the data for each country is not going to be divided into six sub periods, we are going to run one VAR model for each country with all the data starting from 1/1990 and ending 7/2016. All the results for all the countries are going to be presented at one table, again looking at the coefficient and the t statistic for the relation of inflation rate towards stock returns. The USA VAR model results are in the appendix as an example for all the VAR models.

<b><u>VAR MODEL RESULTS TABLE</u></b>				
<b>Country</b>	<b>Coefficient 1 lag</b>	<b>T-Statistic 1 lag</b>	<b>Coefficient 2 lags</b>	<b>T-Statistic 2 lags</b>
Austria	-0.735402	-0.84850	-2.409483	-2.78598
Belgium	-1.504447	-1.73023	-0.678728	-0.77601
Denmark	-1.867550	-2.11702	1.552885	1.76327
France	-0.027185	-0.01569	-0.797039	-0.46057
Germany	-0.475192	-0.54807	0.308212	0.35602
Italy	-0.017457	-0.83924	0.008855	0.42550
Netherlands	-0.971711	-1.46377	0.442411	0.66485
Portugal	0.766889	1.13491	-1.356225	-2.05421
Spain	-0.510479	-0.78871	-0.452408	-0.69816
Sweden	-0.568954	-0.64963	1.619307	1.85196
United Kingdom	-0.363204	-0.83461	0.706287	1.62692
United States	-0.488362	-0.46743	0.727484	0.70759

Looking at the results from the VAR we see the same pattern as in the earlier regressions, mostly there seems to be no significant statistical evidence of a relation between inflation rate and stock returns for most countries. More specifically, Austria seems to have a statistically significant relation in two lags but not in one, with the t statistic at -2.78598, and the coefficient at -2.409483, it means that a negative relation between stock returns and inflation exists for this country. One possible explanation for this is that investors take time to adjust to the news about the inflation change, but from the coefficient we see that the stocks are not a good way to hedge against inflation in Austria. Belgium has both lags statistically insignificant which means there is no evidence for an important relation existing between stock returns and inflation. Denmark shows a statistically significant result for the first lag but not the second one, like Austria, here investors might need time to interpret the news about inflation but less than in Austria, also we see that the relation between inflation and returns is negative in

Denmark also for this lag. For all the rest of the countries in our sample, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom and the United States, the results of the VAR model are in line with the general results we found before on the regressions. To be more precise, we notice that in all of the lags for all the above nations we find no evidence of a statistically important between stock returns and inflation rates for the time period. Out of the total of 12 countries with 2 lags each, total of 24 lags, we only find statistical significant results for only 2 lags in total. With the VAR model we now have tested the possibility that the relationship between inflation and stock returns was hidden, the data does not support this assumption and it seems that no relation is hidden from the original regressions.

## 5. How can we explain these results?

What changed after 1990 and we see results different from previous decades especially from the 1960's and 1870's? Why the results are different in regards of the relation between stock returns and inflation rate, originally the theory suggested a positive relation, the empirical research of previous decades showed a negative relation, but now we find no statistical evidence of a relation between stock returns and changes in inflation rate. A possible explanation for this is a monetary policy used by central banks call inflation targeting. Inflation targeting is a policy in which the central bank sets a specific target for the inflation rate for a medium term. The instrument that a central bank uses in order to manipulate the inflation rate is the interest rate it sets, the central bank will raise the interest rates when the inflation rate is above the target level or will lower interest rates when the inflation rate is below the sought levels. The idea behind this is that if the central bank lowers interest rates it cools the economy to sway in inflation, and by lowering the interest rate it will usually accelerate the economy, and as a result boost inflation rate.

We are going to have only a quick look into the theory and research behind inflation targeting as it is not subject of this paper but only a possible way to explain the results that appeared. Inflation targeting is essentially used by a central bank because it is believed it might improve macroeconomic performance by reacting to asset price misalignments. The central bank should try to maintain inflation rate as close as possible to a clear target level, while simultaneously trying to limit the fluctuations of real economic activity. A view that is believed to be more helpful is that the central bank should try to reach to asset price misalignments, instead of policy makers focusing on how to target asset prices in order to most effectively fulfill their objectives about inflation targeting. Either way in order for any central bank to react or predict or target inflation rates it needs to have very good knowledge of the information contained in asset prices and all that information should be taken into account if it has either a direct or an indirect impact on inflation rate in the future. The concept of flexible inflation targeting is considered better than strict inflation targeting because in this case the monetary policy

aim at stabilizing both inflation at a specified target level and the real economy, and by stabilizing real economy we mean the resource utilization which should be kept around a normal level. Also flexible inflation targeting is much more effective if it relies on forecasts and information regarding future inflation and real economy.

Inflation targeting might give a clue as to why we see no statistical evidence for the relationship of stock returns and inflation rate. When central banks constantly try to have a steady inflation rate and a target around which they want the inflation should be moving, it means that inflation is no longer a problem for investors of that country. If an investor knows that inflation is no longer an issue or at least he feels secured that the central bank is trying to regulate the rate, then the investor has no motive to try to hedge against inflation. As a result it seems that stock returns are no longer considered a hedge against inflation, it no longer seems to matter if stock returns are a good way against inflation as the theory suggested, or a bad one as the empirical results of previous decades concluded, since investors do not find inflation rate to be a danger they need to hedge against.

## 6. Conclusion

The findings of this paper seem to suggest that something has changed in the developed equity markets and that the relation of stock returns and inflation rate is not what it used to be. To be more specific, for the total of 11 European countries, a total sum of 66 regressions, one for each sub period for every country, we see only in 4 is there a statistical significant result. In Austria for the time period 1/1990-12/1994, there is a positive significant relation with a coefficient of 4.958819, for France for the period 1/2000-12/2006, there is a negative relation with a coefficient of -6.360801, for Italy during 1/2010-12/2012, there is a barely positive but significant relation with the coefficient being at 0.163648, Germany during the time period of 1/1995-12/1999, with a statistically positive relation with a coefficient of 6.116537. As for the United States of America only in the first of the six sub periods tested we find a statistical significant result with a coefficient of -7.089568, for the rest of the periods we find that no statistically significant relation exists between inflation rate and stock returns. Also after using the Vector autoregression model in order to test if the relation between stocks returns and inflation was actually hidden due to the delayed reaction from the investors towards the inflation news. From the total of 12 Vector autoregression model, one for each country with 2 lags for each one, we find that only 3 out of 24 lags are statistically significant. To be more precise we find statistically significant the following: the second lag of Austria with a coefficient of -2.409483, for Denmark we find the first lag to be statistically important with a negative relation and a coefficient of -2.11702, and the last one we find statistically significant is in Portugal for the second lag with a negative coefficient of -2.05421.

Many authors have argued against what the theory suggested, that the relation that exists between the inflation rate and stock returns is negative and not positive, especially for the more developed markets in industrialized countries, and it seems that the results from their research would confirm a negative relation. In the past it was obvious that stock returns were not a good hedge against inflation, and should not be used as such in the developed markets. There are many different opinions as to why this was, for example this relation has been linked to the policies of central banks regarding counter

cyclical or pro cyclical monetary policies, or that this negative relation will be less obvious when inflation is created mainly by monetary fluctuations. In the emerging markets on the other hand the theory seems to hold true since most research done points to a positive relation between equity returns and the inflation rate. Which means that the anomaly noted for the developed markets is not spilled over to the emerging markets.

Overall the results of this paper seem to suggest that there is no statistically significant relation between stock returns and the inflation rate any more. One possible explanation for this change might be inflation targeting policies used by the central banks in our data sample. Furthermore one more possibility linked to this is the fact that investors no longer need to hedge for inflation since they know that central banks will try and keep the rate at a steady level. As a result of this when inflation changes are announced investors do not tend to react to them even at a later time. Thus it is possible that stocks should not be used for hedging inflation in the developed markets any more since there is no obvious relation between the two either positive or negative. Further research should be done in order to conclude if the relation has also changed at all in the emerging markets or is this a phenomenon that exists only for the developed ones.

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## Appendix

Here are the 6 time periods for the United States of America.

1/1990-12/1994

Dependent Variable: RUS				
Method: Least Squares				
Date: 11/14/16 Time: 16:31				
Sample (adjusted): 1990M02 1994M12				
Included observations: 59 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.027051	0.008821	3.066717	0.0033
RUSI	-7.089568	2.758153	-2.570404	0.0128
R-squared	0.103872	Mean dependent var		0.007443
Adjusted R-squared	0.088150	S.D. dependent var		0.035623
S.E. of regression	0.034017	Akaike info criterion		-3.890620
Sum squared resid	0.065957	Schwarz criterion		-3.820195
Log likelihood	116.7733	Hannan-Quinn criter.		-3.863129
F-statistic	6.606978	Durbin-Watson stat		2.254140
Prob(F-statistic)	0.012795			

1/1995-12/1999

Dependent Variable: RUS				
Method: Least Squares				
Date: 11/14/16 Time: 16:51				
Sample: 1995M01 1999M12				
Included observations: 60				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.026857	0.009858	2.724340	0.0085
RUSI	-2.798440	4.234913	-0.660802	0.5114
R-squared	0.007472	Mean dependent var		0.021381
Adjusted R-squared	-0.009640	S.D. dependent var		0.041159
S.E. of regression	0.041357	Akaike info criterion		-3.500384
Sum squared resid	0.099203	Schwarz criterion		-3.430572
Log likelihood	107.0115	Hannan-Quinn criter.		-3.473077
F-statistic	0.436660	Durbin-Watson stat		2.136853
Prob(F-statistic)	0.511355			

1/2000-12/2006

Dependent Variable: RUS  
 Method: Least Squares  
 Date: 11/14/16 Time: 16:51  
 Sample: 2000M01 2006M12  
 Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000147	0.006552	0.022490	0.9821
RUSI	-1.263860	1.827485	-0.691584	0.4912
R-squared	0.005799	Mean dependent var		-0.002636
Adjusted R-squared	-0.006325	S.D. dependent var		0.047234
S.E. of regression	0.047383	Akaike info criterion		-3.237576
Sum squared resid	0.184104	Schwarz criterion		-3.179699
Log likelihood	137.9782	Hannan-Quinn criter.		-3.214310
F-statistic	0.478289	Durbin-Watson stat		1.985034
Prob(F-statistic)	0.491152			

1/2007-12/2009

Dependent Variable: RUS  
 Method: Least Squares  
 Date: 11/14/16 Time: 16:52  
 Sample: 2007M01 2009M12  
 Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.006572	0.010067	-0.652793	0.5183
RUSI	2.115029	1.911447	1.106507	0.2763
R-squared	0.034759	Mean dependent var		-0.002589
Adjusted R-squared	0.006369	S.D. dependent var		0.056591
S.E. of regression	0.056410	Akaike info criterion		-2.858378
Sum squared resid	0.108192	Schwarz criterion		-2.770405
Log likelihood	53.45081	Hannan-Quinn criter.		-2.827673
F-statistic	1.224357	Durbin-Watson stat		1.488844
Prob(F-statistic)	0.276275			

1/2010-12/2012

Dependent Variable: RUS  
Method: Least Squares  
Date: 11/14/16 Time: 16:53  
Sample: 2010M01 2012M12  
Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.11E-05	0.009122	-0.005598	0.9956
RUSI	4.546079	3.469729	1.310212	0.1989
R-squared	0.048063	Mean dependent var		0.007791
Adjusted R-squared	0.020065	S.D. dependent var		0.041724
S.E. of regression	0.041303	Akaike info criterion		-3.481816
Sum squared resid	0.058002	Schwarz criterion		-3.393842
Log likelihood	64.67268	Hannan-Quinn criter.		-3.451110
F-statistic	1.716655	Durbin-Watson stat		2.153394
Prob(F-statistic)	0.198907			

1/2013-07/2016

Dependent Variable: RUS  
Method: Least Squares  
Date: 11/14/16 Time: 16:53  
Sample (adjusted): 2013M01 2016M06  
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009401	0.005200	1.807792	0.0782
RUSI	1.284857	2.308233	0.556641	0.5809
R-squared	0.007687	Mean dependent var		0.010525
Adjusted R-squared	-0.017121	S.D. dependent var		0.030796
S.E. of regression	0.031058	Akaike info criterion		-4.059461
Sum squared resid	0.038584	Schwarz criterion		-3.976715
Log likelihood	87.24869	Hannan-Quinn criter.		-4.029132
F-statistic	0.309849	Durbin-Watson stat		2.504783
Prob(F-statistic)	0.580874			

USA VAR 1/1990-06/2016

Vector Autoregression Estimates  
 Date: 11/05/16 Time: 00:28  
 Sample (adjusted): 1990M04 2016M06  
 Included observations: 315 after adjustments  
 Standard errors in ( ) & t-statistics in [ ]

	RUS	RUSI
RUS(-1)	0.052570 (0.05671) [ 0.92700]	0.010316 (0.00303) [ 3.40961]
RUS(-2)	-0.012129 (0.05775) [-0.21002]	-0.000773 (0.00308) [-0.25089]
RUSI(-1)	-0.488362 (1.04479) [-0.46743]	0.498647 (0.05574) [ 8.94562]
RUSI(-2)	0.727484 (1.02812) [ 0.70759]	-0.183492 (0.05485) [-3.34518]
C	0.005879 (0.00332) [ 1.76953]	0.001290 (0.00018) [ 7.27808]
R-squared	0.004636	0.234021
Adj. R-squared	-0.008208	0.224137
Sum sq. resids	0.591211	0.001683
S.E. equation	0.043671	0.002330
F-statistic	0.360942	23.67767
Log likelihood	541.8437	1465.057
Akaike AIC	-3.408531	-9.270201
Schwarz SC	-3.348967	-9.210637
Mean dependent	0.006631	0.001980
S.D. dependent	0.043493	0.002645
Determinant resid covariance (dof adj.)		1.04E-08
Determinant resid covariance		1.00E-08
Log likelihood		2006.910
Akaike information criterion		-12.67880
Schwarz criterion		-12.55967