The Effect of Monetary Policy on Real Growth Cycles

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The average citizen understands that every developed country in the world relies on a central bank to conduct monetary policy. However the reliance on a central bank to control monetary policy variables may have greater consequences than most realize. The danger, as Austrian and Monetarist economists have pointed out, stems not only from the fact that the central bank may be politicized, but more importantly that the central bank will create errors through its' monetary policy, causing signal problems that would not naturally occur in the market. These contrived signals will be looked at as they pertain to the cause and exacerbation of the "boom-bust" cycle.

Many believe that monetary policy variables such as the money supply, interest rates, and inflation, should all correspond with real market signals. The money supply in a completely free economy should fluctuate solely from the demand and the amount of wealth in a nation. Interest rates should be a factor of time preferences, corresponding with the savings rate. Inflation should be nothing more than the rate of the increase in the money supply less the increase of the rate of productivity which should naturally drive prices down. According to several views on macro-economics, the control and fluctuations of these variables can be seen to have detrimental effects on an economy, primarily through the exacerbation of the cyclical nature of an economy.

Five economies with central bank controlled monetary policy variables will be compared so as to see whether the changes in monetary policy variables have any effect on the variance of their economic growth. When a country produces beyond its capabilities, the resulting boom is by definition unsustainable. The debate of whether the boom is caused by the irrational investor as Keynes proposes or by the misplaced capital resulting from government manipulation of monetary policy, as the Austrians and Monetarists claim, will be the main focus of the analysis. The correspondence of fluctuations in monetary policy to the boom-bust cycles of several different economies is an important step in determining the validity of the various macro theories.

I.   Literature Review

Most literature examines what causes the growth to end; however what causes the growth to begin may be of equal concern. Monetary policy variables are commonly examined when researching the cause of these booms and busts. It is popular thought (Keynes, Krugman) that if an economy is thrust into a recession (or time of slow growth), that an increase in the money supply and a decrease of the interest rates are necessary to combat falling prices and contracting credit. When the recession is over, the liquidity theoretically can be reabsorbed before inflation takes over. These fluctuations in monetary policy variables, according to several different business cycle theory models, cause the so called capitalistic problem of the boom-bust cycle. With recent bailouts and unprecedented actions regarding monetary policy as a result of the global recession, analyzing the effect of the fluctuations of monetary policy variables on real growth volatility should be vital in analyzing the soundness of the governments' actions.

Prior to the 1900's (disregarding some wartime and pre-collapse of the empire exceptions), the majority of the world was on a gold or commodity standard. This meant that money had real value that would fluctuate accordingly with the demand and supply for that specific commodity. In fact, most ideas on monetary policy did not exist in the distant past, for gold certificates were used rather than notes, and interest rates were a function of savings, set by banks. The original monetary policy variable that governments began to control was the money supply itself. They did this so that they could then print more receipts (for gold back then) in order to pay off debt. This increase in the money supply (not real money, but fiat money) led to an overvalued dollar and the need for a market correction. According to Dr. Douglas French, Professor of Economics at the University of Nevada Las Vegas, "It is the central bank's facilitating and encouragement of the creation of "un-backed" bank notes and deposits that is the ultimate cause of the inflationary and transitional deflationary problems"(French 1992). In the early 1900's and before, the main argument for increasing the money supply was to pay off war debts, or was just the greed of some king clipping coins and collapsing the nation (French 1992). During the early 1900's though, economic theory began to shift, as those in control now began to think that increases in the money supply, and new controls over other free market mechanisms, were necessary not only to combat recessions, but also to stabilize growth and prices.

It is common thought that an increase in the supply of money is necessary corresponding with the growth rate of an economy or the Gross Domestic Product (GDP). This rate should correspond directly with the idea that most economists agree on an inflation rate of between 2-3% to maximize growth and prevent deflation. In the traditional term of the word, inflation actually referred to the increase in the supply of money, since credit markets did not dilute the effects of government policy. Some disagree with the notion of necessary increases in the money supply, stating that the base money supply does not need to increase in order to facilitate an increased demand for money. As Peter Schiff, author of *Crashproof* and *The Little Book of Bull Moves in Bear Markets* concludes, as an economy grows, the credit terms will adjust with respect to the growth of the economy, allowing for the money supply to be as flexible or inflexible as needs be, with no need for a centralized planner (Schiff 2007). This occurs for instance in several money supply measures, where credit increases the money supply during booms, and decreases it during the bust. The only concern here is how much of this demand for money is caused by government set interest rates. Despite the fact that the credit cycle takes care of most requirements for the demand of money, most economists believe that growth and production rates are the key factor in determining the demand for money and what the government should set rates at. For instance in the Federal Reserves' goal (to maximize growth and minimize unemployment), nothing is stated about whether this growth is sustainable; they only shoot for the maximum growth possible at any given moment. On a basic level concerning growth and production, "unsustainable growth develops when the economy attempts to produce outside its Production Possibility Frontier (PPF) and the mix of output shifts towards investment without a corresponding change in time preference"(Cochran 2001). In other words, if this change in monetary policy were to push an economy outside of its PPF (or ability to produce at a sustained level), the growth would be unsustainable and result in a bust.

The other reason governments push for control of monetary policy, is its belief that it can fight a recession. Keynes taught that once an economy was thrust into a recession, that unemployment would rise, and as people had less money to spend, demand for goods goes down

leading to more unemployment and falling prices. This aggregate demand based cycle propelled Keynes to advocate for large government deficits and public works spending in order to pull the economy from its' stagnant state, often causing fluctuations in the money supply and pushing interest rates from their market levels. As Keynes describes, a positive shock to money growth will have two effects on nominal interest rates, the liquidity effect and the anticipated inflation effect. The problem however, is not in what the effect of increasing the money growth rate or supply on the interest rate or prices is, but rather the effect on the economy as a whole. Much empirical data has been gathered that has proven the relationship between the money supply and inflation as well as interest rates (Evans 2008)(Sumner 1990). Since the time of the Great Depression, most of the world still ascribes much of the same thought as Keynes did when proposing such drastic fluctuations in the supply of money and national debt, as well as keeping interest rates artificially low.

Following Keynes theory, once the recovery begins to take place (assuming a growth in the money supply to accommodate the recovery), it is then necessary to remove the liquidity from the economy before it becomes inflationary. Whether or not this usually happens, it is still important to know that this would be the ultimate goal of those who created the theory (French 1992). Joseph Salerno, Professor of Economics at Pace University, researched the money supply from the angle of the pre 1971 United States (and most other countries), when the world was still de facto on a gold standard. He believed that the dollar was overvalued, and that a deflationary monetary policy was actually beneficial at times because it lessened the imbalances in the system created from having a fiat currency. Either way, there are reasons (or so economists believe) to both increase and decrease the money supply. The attempt of this analysis will be to look at the effect of these policy decisions in relation to the boom-bust cycle.

The Austrian Business Cycle Theory- (Evans 2008)(Cochran 2001)- According to the Austrian Business Cycle Theory, booms and busts (not ones tied to exogenous circumstances (e.g. 9/11)) are created by a "signal-extraction" problem which occurs when governments meddle with the interest rate. Austrian economists believe consumer time preference is the ultimate measure that should determine interest rates. If consumers have a lower or more delayed time preference, they will choose to save more money which in turn will lower the interest rates on borrowing, "signaling" to producers to undertake longer term projects (projects in the earlier stages of production). If the government however increases the money supply in order to lower interest rates (or for whatever other reason), this will send a false signal to producers and will in effect have consumers not saving (buying currently) and producers engaging in projects based on the assumption that consumption will increase when the savings(or lack of) begin to cease. The limited resources of the economy will then become scarce as it is similar to burning a match on both ends. As resources are depleted, asset prices will rise in certain sectors of the economy, causing unnatural rates of return in these sectors which will push prices even higher.

Along with raising prices, the increased lending will also create unnecessary risk, as those who are now able to borrow (that were not before) are the "marginal borrowers" or the ones least likely to pay the money back. As the marginal or risky borrowers are now involved (e.g. as in the sub-prime crisis), the rate of return on these investments will also rise correspondingly. The market will now be forced to compete at these higher risk levels and with the interest rates artificially low, banks and businesses will become more and more leveraged to

seek a higher rate of return, leading to even more risk. The interest rate being held too low for too long will also create international problems. Similar to the Yen carry trade that developed in the 1990's, if a bank can borrow from a country at a very low interest, it can then convert those dollars or yen into another currency, where it can gain a higher rate of return (Callahan and Garrison 2003). Often this rate of return is not extremely large, but it is almost risk free and simply arbitrage for those involved. Risks such as these stemming from the lowering of the interest rate, along with the signal of resources that are not there, will create imbalances in the system that will come crashing to an end whenever either the producers realize that there are no savings (future consumption) or the easy credit is pulled back from the market.

Austrian economists, despite having a powerful theory on business cycles, do not perform econometric analyses. Therefore all previous literature on the topic written by Austrian economists is purely theoretical and does not support techniques for proving significance of their ideas. Their theories are unique however and provide a completely free-market insight into the relationship of monetary policies on the boom bust cycle.

The Monetarist Theory (Plucking Model Theory)-(Clark 1990),(Cochran 2001),(Poole 2007) Developed by Milton Friedman during the 1960's, the Monetarist movement believed in a theory of a natural growth rate that stemmed from real variables (labor, capital, productivity, etc), and that although governments can help to maximize growth, that policy makers are most of the time either too incompetent or too political that they actually makes things worse. Following this, Monetarists do believe in some government action, however this action is predictable and constant. For instance, a constant growth rate in the supply of money would be the best of both worlds (compared to Keynes idea of increasing and decreasing), as it would prevent deflation and at the same time maximize the growth of the economy. This view in a way stemmed from Friedman's view of the rational consumer, in which if a consumer could predict the actions of the Federal Reserve, the actions would have no negative effect on the economy (either hindering growth or causing shocks). The term plucking comes from the "pluck" of the money string downward (Cochran 2001). These plucks are random policy errors (either a decrease in the supply of money or a failure to increase with demand) that result in a recession and are followed by an expansionary period, leading economies straight back into their normal growth rate, just waiting for another error (Clark and Keeler 1990).

The economy, in the view of the Monetarist, is one that will constantly return to its natural equilibrium of growth, a possibility that the Austrian view denies due to the fact that the capital structure of the economy will be shifted by the long term projects that busted. The Monetarists unlike the Austrians also hold that the Fed is necessary to increase the money supply above that of the demand for money. Monetarists believe that the Fed's actions should be preceded by market signals and that any further action will simply increase the instability in the market and/or be purely inflationary. If the Fed does fail to increase the money supply with demand (Friedman believes in the Keynesian multiplier effect), there will be a scarcity of credit, which will lead to stunted growth, the cause he believes lengthened the Great Depression. As Cochran explained however (in recapping Hayek), this Keynesian multiplier is overstated in that it describes a process with no real scarcities or rising prices as a result of the policy induced credit expansion (Cochran 2001).

This monetarist view is accompanied by research both empirically and theoretically in order to back the ideas of Friedman. The most notable studies of this school of thought are those used to back theories proposed by Monetarists. For example, Friedman and the Chicago school did much research on the benefits of a constant growth in the money supply as well as a constant inflation rate, both at around 2-3%, something most main stream economists today prescribe to for the benefits of their theory of price stability. The Austrian view however disclaims this theory on the ground that the signal problems and increased risk due to government induced inflation takes out any benefit of price stability. Friedman's plucking model has also proved significant; however it will be the Monetarist idea of the natural growth rate that will lead the theoretical aspect of this analysis.

Real Business Cycle Theory (Neoclassical) This theory is different from the others in that it believes that cycles are simply results of an economy's reaction to exogenous productivity shocks. In other words, policy errors are irrelevant as far as signal errors are concerned and are purely inflationary. These Neoclassical economists, like Monetarists, also believe in a natural growth rate, or one that stems from real variables. The Solow Model is the main indicator in this theory of this level. According to the Solow Model, the natural growth rate should not fluctuate greatly due to the slow changing variables used in the equation (depreciation, savings rate, labor force, labor productivity, capital). In this theory, no shocks to productivity (the fastest changing variable) means no cycle. Neoclassical economists measure these shocks to productivity by the unique "Solow residual", a shift parameter representing the technical progress or exogenous productivity shock. It is dangerous however to say that an increase in productivity, often times due to technological process, is a bad thing. Simply because the car put the horse and buggy out of business does not make increased productivity a bad thing. Also like the monetarist theory, if an increase in productivity occurs, there may be a short cycle to account for the shifting of the natural growth rate, yet it will stabilize as the variables do. "Proponents of the model conclude that it can account for about 70% of the post-war business cycle" (Cochran 2001). While this theory can be used to explain certain events, it can also be seen as complimentary to either the Austrian or Monetarist views. In fact, a "productivity shock" may simply be a boom in productivity resulting from expanded credit inherent in the expansionary monetary policy. This view of the business cycle however seems very vague and can act almost as an error term in many models since there is always some way to explain a shift in productivity. There have been several empirical studies on the Solow Model or neo-classical theory, however with so many variables, most of the benefit of the model comes from the theory, since in the real world, real variables and monetary policy variables are changing.

Rational Expectations School vs. The Keynesian School -The rational expectations school believes that consumers are completely rational, and that they predict the future to the best of their abilities, and in some cases of the theory, even beyond what most of us would consider within our ability (errors are free of systematic mistakes). This view is most prevalent among the Real Business Cycle Theorists while Austrian economists are not far from it. They simply believe that what one person's preference is may not be another's, so classifying something as rational or irrational is not always the case since we do not live in a perfect economic world with homogenous, perfect competition.

On the other side of the rationality spectrum is Keynes. Keynes simply looked at the reckless speculations of humans and concluded that they act almost completely irrationally, or upon "animal spirits". Government regulation would then be necessary in Keynes mind to prevent one person from jumping off of a bridge and the rest of the population following. Now although it is easy to see how these "animal spirits" cause bubbles (i.e. Tulip craze or dot-com bubble), simply saying that humans are irrational is not a valid argument. "He focuses on the results, but does not recognize the root causes of the episodes" (French 1992). For instance, the dot-com bubble collapsed the economy, but the large fluctuations in the price of gold in the 1970's due to speculation of the dollar brought about nothing but some losses on the part of certain investors. The real question must be how so many people suddenly have the money to partake in such risky investments.

Either way, both theories of human behavior are important for looking at the effect of fluctuations in monetary policy upon growth volatility, for the idea of rationality (whether pro or con) will greatly influence how one views the causality of monetary policy on the economy. One's view of the boom-bust cycle, especially if prescribing to Keynes' view, should go hand in hand with the theories one deems valid. Ideas of a "political business cycle", that economic stimulation can help or bust an economy, or even the idea that bubbles are random, unstoppable events all stem from one's view of the rational consumer/investor (Callahan and Garrison 2003).

II.   Theory

The main focus of this analysis will be on whether or not fluctuations in monetary policy cause or exacerbate the boom-bust cycle**.** In order to model this relationship, one must first develop a definition of the boom-bust cycle. The hard part about defining the boom-bust cycle mainly comes from defining the boom. Most economists find it easy to see when the growth stops; however telling investors and politicians that the economy is in a bubble and is growing too fast for some reason, poses a harder task. However, the Monetarists and Neoclassical economists prescribe to the idea of a natural growth rate, or one that is exogenous of short term monetary policy fluctuations. This growth rate should be a function of real variables, not factors such as consumer demand or the stock market. Keynesians would disagree, saying that the "animal spirits" of individuals cause irrational investing in things such as tulips, tech-stocks, or housing, which then become overvalued, bust, and take down the rest of the economy with them. Although this could be the case, Austrian economists counter with the fact that Keynes does not look at the root cause of these malinvestments. In all of these cases (tulips, tech-stocks, or housing), there is a government induced increase in the money supply either by printing directly or the artificial lowering of interest rates or by government programs designed at funneling money to one sector of the economy over another (e.g. housing programs) (French 1992). Either way, whether in the Keynesian or Austrian view, the bust is simply a correction of the misplaced economic activity.

If the Keynesian theory of animal spirits holds true, monetary policy should have no effect as to the cause of the boom and subsequent bust. Rather, monetary policy in the Keynesian view will be reactionary to the uncontrolled booms/busts that free market capitalism would produce. Austrians and Monetarists would in no way argue that monetary policy is not reactionary, however they would state that the misallocations due to this even reactionary

monetary policy is exactly what causes the next boom and bust. It must be noted though that the central banks of today's economies do not follow a Keynesian, Monetarist, or Austrian framework. With enormous national debts, large entitlement programs, and political motives influencing almost every decision, Keynes, Friedman, and Mises would all shun the actions of today's leaders.

In the Austrian view, monetary policy variables should simply be left to the free market. Interest Rates would be set by the market, the money supply would be issued by private banks and have real value (i.e. backed by gold), there would be no national debt, and inflation would be negligent since prices would actually go down over time as technological and capital increases allow for greater productivity. Friedman and the Monetarists would prescribe to simply a more predictable, transparent central bank. Although the government would still be in control of monetary policy, they would be completely independent and follow the market, except for in a few cases where they must use their powers to prevent a massive decline (i.e. Great Depression).

Despite Austrians and Monetarists agreeing that monetary policy is harmful to an economy, there are many other variables that one would expect to effect the boom-bust cycle. The first of these would be changing government policies. If for instance, a government were to double the corporate tax rate or enact a new VAT, there would be little doubt that they would have a negative effect on the economy. A temporary tax-credit or stimulus would be on the other side of the spectrum, and cause the economy to produce above its natural rate (or outside of its PPF). As Friedman said of monetary policy though, if the actions are predictable, the market should be able to adjust to the changes before hand, so no short term booms/busts should be realized. The next effect on boom-bust cycles is the credit cycle. With fractional reserve banking, especially with non-commodity backed dollars, as the economy strengthens, the amount of money in the system goes up as banks begin to lend at an increased rate. When, for whatever reason, these loans are called back or the economy goes sour, the money supply shrinks, and in relation, prices fall from their "boom" levels (i.e. housing). Austrian economists would subscribe to the idea that this increase of the money supply (or credit supply) above the level the market demands is due to government control over the money supply. If the currency were backed and redeemable (without the FDIC), banks would never loan out as much as they do, especially to people who could not pay it back. In most views, the artificial increase in the credit supply is the main reason as to why a country can produce outside of its PPF, most likely misallocating capital to either a politically or investor favored sector. Examples of this include the credit induced housing bubble in the United States and the incredible rise of the foreign credit funded Tiger economies of the late 1990's. The credit cycle does go hand in hand with the interest rate and broader money supply variables, which will be included in the analysis.

The last factor to be considered that may affect the boom-bust cycle is the idea of exogenous shocks to an economy. These could be anything like a war, natural disaster, political regime change, or nuclear meltdown. Anything that cannot be accounted for, but has a definite effect on the real variables or attitudes of a nation could be considered significant. Although this analysis will not take into account these shocks, they will serve as an explanation if certain time periods have unusually large residuals. Variables such as exogenous shocks or non-monetary policy government action will be difficult to account for. Since there is no 'control economy' or rather a completely free market economy as which to compare monetary policy variables to, the

Keynesian versus Austrian argument will have many chances to explain why their respective theory does not hold up to the data.

III.   Data

To model the influence of monetary policy variables on the boom-bust cycle requires a lengthy time series of data. Unfortunately, most countries besides OECD members did not begin to keep reliable central government records on monetary policy until the late 80's or 90's. Considering this, five OECD countries were identified that did keep extensive records on monetary policy data. The countries are Canada, Denmark, Japan, Korea, and the United States. These countries represent various styles of monetary policy and government regulation throughout the time frame.   Data was collected mainly from OECD Stat and IMF Stat, however several central bank websites were used as well.

Data employed in the study include: Real GDP, Interest Rates, Inflation, Money Supply Variables (M1, M2, and M3), National Debt, Balance of Payments, and Unemployment. All data found were quarterly from 1968 I to 2009 III. A description of the variables can be found in Table 1 and all Descriptive Statistics in Table 2.

Table 1- Variable Descriptions

Difference in Real GDP (d)- The Dependent variable is modeled as the change in Real Gross Domestic Product from the previous quarter annualized minus the average Real GDP for the entire time period (natural growth rate). Real GDP is a measure of a nation's overall economic output accounting for inflation. The Expenditure method (the most common measurement of GDP) is the sum of private consumption, gross investment, government spending, and net exports.

Unemployment (u)-The Dependent variable of Equation 4 is a measure of the amount of people in the work force of an economy who are willing yet unable to find work. Although there are different measures for each country, the fact that each country remains consistent will suffice.

Interest Rates(i)- The Interest Rate observed will be the overnight rate or commonly called the Federal Funds Rate. It refers to the rate banks pay to each other when partaking in short term (overnight) loans.

Inflation(π)- In this paper, inflation will refer to the rise in the general level of prices over a particular quarter annualized. It is measured by the Consumer Price Index for each country.

Money Supply Variables(M(1-3)S)- The money supply variables used will be M1, M2, and M3. M1 refers   to the Monetary base which includes all currency and all demand and checkable deposits. M2 refers to the M1 plus all close substitutes for money such as savings and time deposits. M3 refers to M2 plus all large time deposits and institutional money market funds and short term repurchase agreements and large liquid assets. All numbers are percentage change from previous quarter.

National Debt(ND)- In this paper refers to all money or credit owed by only the central government. Although several countries are in different currencies, importance lies in consistency for predicting purposes.

Balance of Payments(BOP)- Will use the common definition that refers to the Current account (balance of trade) minus the Capital account (net change in ownership of foreign assets including central bank operations).

Table 2- Descriptive Statistics

Canada

	CHANGEGDP	I	π	M1	M2	M3	ND	BOP	u
Mean	0.03	0.07	0.02	0.01	0.02	0.01	255241.20	4997.31	0.09
Median	0.03	0.07	0.02	0.00	0.02	0.01	292947.40	3651.48	0.09
Maximum	0.10	0.20	0.03	0.03	0.03	0.03	353625.30	15149.80	0.13
Minimum	-0.06	0.02	0.00	-0.01	0.01	0.00	79390.20	555.62	0.07
Std. Dev.	0.03	0.04	0.01	0.01	0.01	0.01	83305.54	3659.96	0.02
Observations	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00

Denmark

	CHANGEGDP	I	π	M1	M2	M3	ND	BOP	u
Mean	0.02	0.06	0.03	0.01	0.02	0.01	91335.54	1162.34	0.06
Median	0.01	0.06	0.02	0.01	0.02	0.01	94718.28	1323.00	0.06
Maximum	0.05	0.11	0.11	0.09	0.09	0.10	137642.50	2750.07	0.10
Minimum	-0.01	0.02	0.01	-0.02	-0.07	-0.06	33770.09	-416.86	0.04
Std. Dev.	0.01	0.03	0.02	0.01	0.03	0.02	27691.85	869.03	0.02
Observations	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00

Japan

	CHANGEGDP	I	π	M1	M2	M3	ND	BOP	u
Mean	0.02	0.02	0.01	0.01	0.05	0.01	4109608.00	22.77	0.03
Median	0.02	0.01	0.01	0.01	0.03	0.01	3127390.00	23.58	0.03
Maximum	0.16	0.06	0.04	0.10	0.13	0.05	8602557.00	37.17	0.05
Minimum	-0.12	0.00	-0.02	-0.03	-0.01	-0.08	1161671.00	-5.56	0.01
Std. Dev.	0.05	0.02	0.01	0.01	0.04	0.02	2484221.00	9.06	0.01

Observations	109.00	109.00	109.00	109.00	109.00	109.00	109.00	109.00	109.00

Korea

	CHANGEGDP	I	π	M1	M2	M3	ND	BOP	u
Mean	0.06	0.04	0.01	0.03	0.03	0.01	112420.60	2989.09	0.03
Median	0.06	0.03	0.01	0.03	0.04	0.01	76422.57	2755.30	0.03
Maximum	0.13	0.08	0.05	0.20	0.09	0.03	327710.00	11470.40	0.08
Minimum	-0.07	0.02	0.00	-0.18	-0.01	0.00	29768.45	-5554.40	0.02
Std. Dev.	0.04	0.02	0.01	0.06	0.02	0.01	93146.17	4383.37	0.01
Observations	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00

USA

	CHANGEGDP	I	π	M1	M2	M3	ND	BOP	u
Mean	0.02	0.06	0.01	0.01	0.02	0.01	3631831.00	-48.47	0.06
Median	0.02	0.06	0.00	0.00	0.02	0.01	2952994.00	-25.08	0.06
Maximum	0.06	0.19	0.06	0.06	0.05	0.05	11545275.00	17.74	0.11
Minimum	-0.01	0.00	-0.06	-0.01	-0.01	0.00	370094.00	-229.89	0.04
Std. Dev.	0.01	0.04	0.03	0.01	0.01	0.01	2900597.00	62.12	0.01
Observations	157.00	157.00	157.00	157.00	157.00	157.00	157.00	157.00	157.00

The difference of real GDP from the average acts as the dependent variable in the study. Unemployment will also be used in the model as the dependent variable as another way of modeling the boom-bust cycle. It first seemed that endogeneity or multi-collinearity may be present in almost all of the variables since they are all so closely related. For example, an increase in the money supply due to increased credit may lead to an increase in GDP, but an increase in GDP may also boost consumer or credit confidence which will lead to an increase in the money supply (assuming fixed interest rates and inflation). In a free market economy, most of the variables counteract one another (leading to a steady growth). For example if there was an increase in the money supply (credit in the system), inflation would soon follow, raising interest rates and thus taking money (or credit) out of the system. This departure from completely free markets toward a more central authority however is precisely the purpose of the study; so endogeneity is not a problem since it is spurred by government action/ reaction rather than by the markets or a true causality. The other problem that may come about due to the dependent is the

ability of Real GDP growth to be used as an indicator of economic growth. The reason, is that GDP does not measure national wealth or even national welfare, but rather simply money spent. For instance, Hurricane Katrina could have actually boosted US GDP due to the fact that so much money needed to be spent rebuilding New Orleans. The money spent rebuilding New Orleans, or the famous broken window example, may raise GDP because the person now must spend their money rather than save it (Schiff 2007).

Regarding the other dependent variables, balance of payments should be self-correcting, for exchange rates should fluctuate and create a naturally even level over the long run, assuming that there are no currency manipulations. National debt does not naturally exist in a completely free economy, and should in theory have a lagged negative effect on Real GDP, for in the future the debt will eventually have to be paid off. For Keynesians, the national debt growth rates should be almost directly inverse to real GDP growth rates, and could lead to an endogeneity problem where national debt is actually a product of GDP growth. The data for national debt however shows that there is an increase of national debt during times of low growth, however over the time frame, many of the highest growth rates of national debt can be seen during economic booms, as shown in Figure 1. This fact however may be attributed to political/monetary regime changes which switch strategies rather than the validity of Keynes theory.
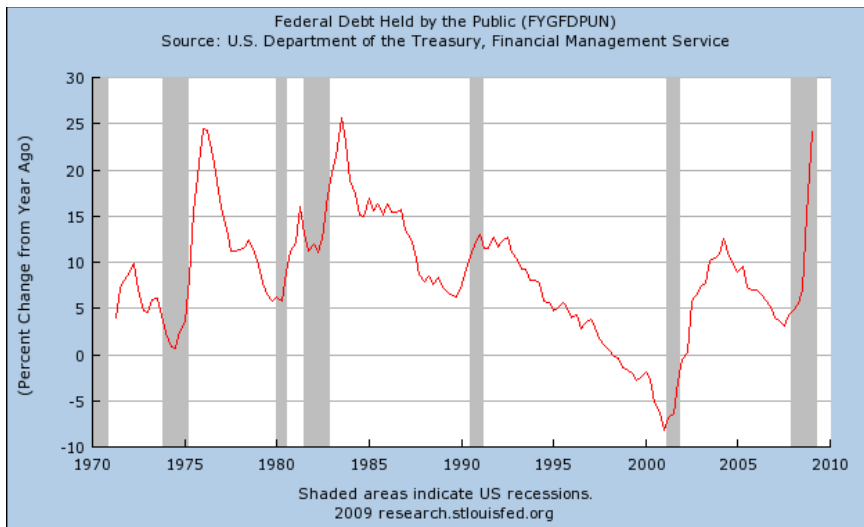

Figure 1-National Debt Graph with Recession Bars

For the money supply variable, different measures will be used in order to account for the existence of a credit cycle. M1 (or the monetary base) should follow the direct control of government monetary policy, for it should not fluctuate with the state of the economy (besides basic increases and decreases in the amount of currency in circulation). When the government does decide to increase the money supply, M1 should increase at a much more noticeable amount than M2 or M3. M3 is on the other side of the spectrum and follows credit cycles in the economy much more than monetary policy. Credit will contract during a recession. However the government will push to increase the money supply (to offset the credit contraction). M2 which is in the middle of the credit/policy tradeoff will experience more of a cancelling out of the effects, however M3 will more closely follow credit cycles, which may have endogeneity

issues with interest rates, and M1 will display more of the characteristics of the policy makers since measures of credit are not included in the number.

Different countries are used in the analysis in order to compare data across several styles of monetary policy with varying levels of political (or other) controls. The results should be of concern as several different central bank structures were used. Canada has a private, independent central bank, yet the government is the only shareholder and can override (though has never done so) monetary policy decisions. The Bank of Canada's primary goal is economic and financial stability, mainly focusing on a target inflation rate of 1-3% with low unemployment. Denmark had an independent central bank for most of the time period, however in 1997 became a member under the European Central Bank, which has been criticized for being too political (Crowe 2008). Japan's central bank also changed in 1997, giving the bank its first taste of independence. It is still under complete government control though (despite now less oversight), and the government is an avid supporter of the political central bank (Roach 2007). With Japan stuck in a deflationary mode for most of the 1990's, their monetary policy actions greatly exceeded that of any other nation in the study (until 2009), and the political ties of their central bank may be the culprit. Korea's central bank is also similar to Japan's, but has a primary goal of price stability as it was set in place during the Korean War to deal with fluctuating prices. Korea was also a key player in the Asian Financial Crisis in 1997/1998 and experienced the largest GDP drop of any country in the data set. The United States of America's central bank is the Federal Reserve. Although it is a self-proclaimed independent central bank, 94% of its profits go to the treasury, its chairman is appointed by the president, and besides the Volcker years in the 1970's, which will be noted, has gone along with the basic idea of Lord Keynes.

Table 3 shows the sum of the absolute value of the difference for each country. This number represents the total deviation from the average (*natural) growth rate. Interestingly, Japan has the largest deviation, however most of the number is due to the fact that there was high growth in the 1970's versus very low and even negative growth starting in the 1990's. Many of the other countries face similar problems, still this should not affect the results due to the fact that economies over decades should grow, not contract. The main reason is that the technological advances through the last two decades should have done anything but lower the growth rate of these developed countries.

Table 3- Absolute Value of Sum of Difference

Canada	Denmark	Japan	Korea	USA
4.138	1.785	5.457	3.733	1.148

IV.   Methodology

A Polynomial-Distributed Lag-Model (PDL) and a Vector Auto Regression (VAR) were used to analyze the effects of Monetary Policy variables on GDP. In order to model the boom-bust cycle as a function of GDP, the average GDP growth rate over the time period was taken and then assumed to be the natural growth rate. This idea of a natural growth rate stems from work by Friedman and Solow, and allows the analysis to show that any variation from the growth rate is of concern, not simply those monetary policy changes that cause the bust. With

this difference as the dependent variable, a lag length was necessary in order to model the boom bust cycle as a result of monetary policy.   The number of lags included in the model was based on Irving Fisher's study of inflation versus real growth cycles, where he found that output lags inflation by about four to six quarters (Sumner 1990). Also Thoma's analysis found that money growth affects inflation and changes in nominal interest rates and causes cyclical growth over an 11-24 month range (Thoma 1994). Based on these studies, the number of lags chosen was 10 quarters, giving even a little leeway from Fisher and Thoma's conclusion. Although each variable should actually require a different amount of lags, too many lags would result in decreased degrees of freedom. This plus the lack of observations prior to 1968 lead to the chosen number of lags.

A polynomial distributed lag equation (PDL) was used to model the boom-bust cycle as a function of lagged monetary policy variables. The PDL is useful because it allows a large number of lags to be used, yet at the same time generating a reduced number of coefficients which coincide with the smoothed polynomial line designated in the equation, making it easier to show what the coefficient for each variable is over a series of time. For choosing the degree polynomial, the level of constraint as well as the degrees of freedom were taken into account; the larger the degree, the less the constraint, but also the lower the degrees of freedom. For the analysis on the boom-bust cycle, a third degree polynomial was chosen as a middle ground (it must be between zero and the number of lags), mainly considering the small sample size of the study and the results of the coefficients and cyclical movements of the lags. The polynomial distributed lag model for time period t is shown below in Equation 1:

(1) $d_t = \alpha + \beta_0 i_t + \beta_1 i_{t-1} + \cdots + \beta_{10} i_{t-10} + \beta_0 \pi_t + \beta_1 \pi_{t-1} + \cdots + \beta_{10} \pi_{t-10} + \beta_0 MS_t + \beta_1 MS_{t-1} + \cdots + \beta_{10} MS_{t-10} + \beta_0 ND_t + \beta_1 ND_{t-1} + \cdots + \beta_{10} ND_{t-10} + \beta_0 BOP_t + \beta_1 BOP_{t-1} + \cdots + \beta_{10} BOP_{t-10} + \varepsilon$

(where each $\beta_i = (a_0 + a_1 3 + a_2 9)$ since the lag is to the third degree)

The other method used in the analysis was a VAR. VAR allows the modeling of each variable symmetrically by explaining the variable by use of all of the other variables, including its own lags. This method is appropriate because of the endogeneity problems that seemed apparent in the theory, as well as the fact that the interdependence and causality of the variables is laid out in the results. Although it will give each lag its own coefficient, the theory dictates that any pull from the natural growth rate is problematic, thus making coefficients less important. There is no one VAR equation since each variable is run as a dependent and an independent to other variables. The equation for predicting our GDP growth rate however will look very similar to the PDL, except it will also include lagged variables of GDP and will not be subject to the polynomial constraint. The VAR equation for the GDP growth rate at time period t is shown in Equation2.

(2) $d_t = \alpha + \beta_0 d_t + \beta_1 d_{t-1} + \cdots + \beta_{10} d + \beta_0 i_t + \beta_1 i_{t-1} + \cdots + \beta_{10} i_{t-10} + \beta_0 \pi_t + \beta_1 \pi_{t-1} + \cdots + \beta_{10} \pi_{t-10} + \beta_0 MS_t + \beta_1 MS_{t-1} + \cdots + \beta_{10} MS_{t-10} + \beta_0 ND_t + \beta_1 ND_{t-1} + \cdots + \beta_{10} ND_{t-10} + \beta_0 BOP_t + \beta_1 BOP_{t-1} + \cdots + \beta_{10} BOP_{t-10} + \varepsilon$

The PDL equations were run four separate times for each country. In the first equation, M1 was used as the money supply variable, M2 in second equation, M3 in third, and unemployment was the dependent variable in equation four with M2 as the money supply (M2 is

the traditional money supply variable). The VAR equation was only run with M2 as the money supply variable for simplicity of interpreting results.

V.   Results

Table 4 shows results for PDL equation 2 (M2 as money supply), with Tables 6-8 showing remaining equation results. VAR results are shown in Table 5 and graphs of Actual versus Fitted with Residuals were included for equation 2. For the PDL equations, all of the countries had significant   F-statistics for every equation. The corresponding P-values were also extremely low, with all of the equations statistically significant at the 99% confidence level. T-statistics varied for each country; however interest rates and inflation were the most significant, with significant T-statistics in at least three of the five countries for every equation. It is also interesting to note that national debt has a negative coefficient for all but three of the fifteen national debt coefficients. This is evidence against most Keynesian stimulus theories, due to the fact that national debt increases do not increase GDP growth rates for over 10 quarters. As shown in Figure 1 though, the US and many other countries may pay lip service to Keynesian ideas of national debt control, yet in practice simply increase it regardless of current economic growth rates.

The most significant PDL equation by far was equation 4, which differed because it used unemployment as the dependent variable. The reason for this is due to the fact unemployment moves inversely to GDP growth rates, yet is smoother, with less variation from quarter to quarter, which is more similar to the characteristics of the independent variables.

Not surprisingly, the largest residuals for every country and equation occur during the 1970's. In the United States, this was the time period where Volcker raised interest rates in order to combat the high inflation present in the country. There were oil shocks, stagflation, the Vietnam War, and most importantly for all of the countries, the loss of the international gold standard. All of the countries besides Denmark also experienced their highest growth rates in the 1970's, which may also cause some discrepancy. Large residuals however may not be a bad thing for an economy, mainly because it could mean that they are not currently in a monetary policy induced boom or bust.
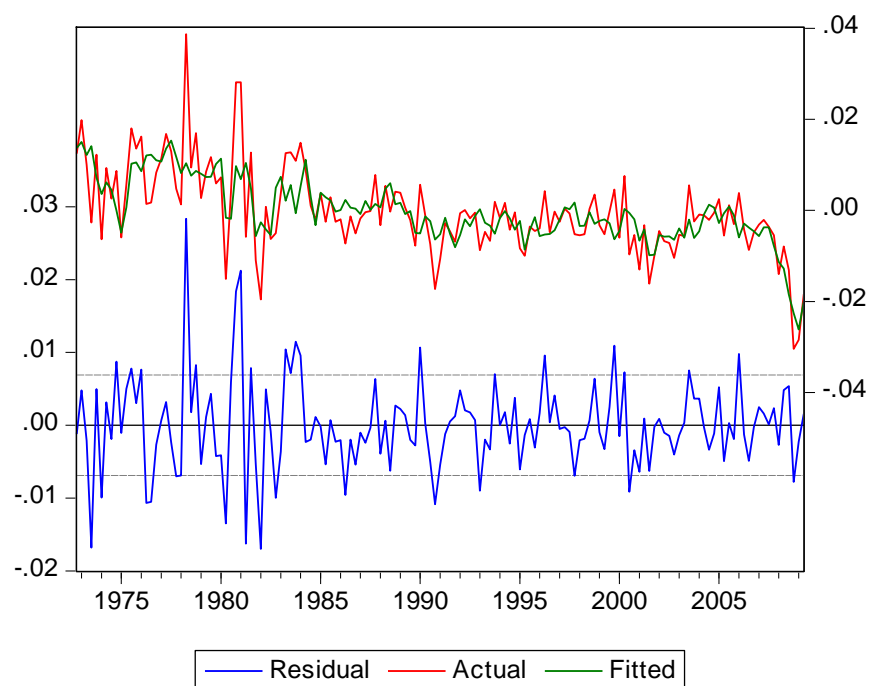
Table 4- PDL Results for Equation 2

Variables	Canada	Denmark	Japan	Korea	USA
n	99	97	99	108	147
F-Statistic	4.66**	2.39**	4.40**	13.02**	7.72**
Prob.(F-Stat)	0.000	0.003	0.000	0.000	0.000
Adjusted R-squared	0.428	0.225	0.410	0.692	0.479
interest rates	-.692**	-.036	2.798**	-.005	-.100**
	(-2.819)	(-.380)	(2.874)	(-.710)	(-2.367)
inflation	3.186**	.316	-1.362	.005	-.056
	(2.721)	(.900)	(-.906)	(.3636)	(-.606)
Money Supply	1.393	.493	.411	1.132	.557**
	(1.085)	(1.744)	(1.125)	(1.691)	(2.510)
National Debt	-1.9E-07**	2.4E-07	3.4E-09	-4.2E-07**	-2.4E-09
	(-2.434)	(.893)	(.629)	(-5.158)	(-1.948)

Notes: Coefficients are above t-statistics in parenthesis. For PDL results on other Equations, see Tables 6-8.
**Significant at the 5% level

Figure 2-USA Actual vs. Fitted Equation 2 with Residuals

VAR results proved similar to PDL results, with F-Stats being significant in all 5 countries at the 95% confidence level. The results are not as significant as with the PDL,

however it does vary greatly by country, with the VAR showing monetary policy more significant in Korea and the United States, but less significant in the other three countries. The main difference could have come from the reactionary relationship between GDP and previous quarterly GDP data, or the fact that only M2 was used as the money supply variable. As the PDL results revealed, M2 had the least significance of the monetary policy variables. This could be due to the cancelling out effect of pure monetary policy action (reflected greatest in M1) versus the movement of the credit cycle (most prevalent in M3). If a government prescribes to Keynesian ideas of stimulation, as the credit cycle reduces the broader money supply, policy action will be taken to counteract this, which will lead to a more stable money supply, which may be shown in M2.

Table 5-- VAR Results

	Canada	Denmark	Japan	Korea	USA
Adj-R-squared	0.361	0.239	0.219	0.752	0.498
F-Statistic	1.921	1.502	1.459	7.819	3.415

Notes: Results are only of VAR output using difference (d) as the dependent variable

Although the R-squared may seem low in most of the countries, much of the variation has to do with short term fluctuations in the dependent variable rather than overall predictability of the equations/VAR. With the F-stat consistently significant, one can conclude that monetary policy definitely pulls an economy away from the natural growth rate of an economy. After the 1970's, the PDL model, as seen clearly in Figure 6 (in Appendix B) and Figure 3, predicts both the Asian financial crisis in Korea and the current housing crisis in the United States almost perfectly. The Austrian economists would find this as no surprise since both recessions were due to classic examples of low interest rates fueling long term, unsustainable investments. Keynesians though would disregard the significance as a mere collinearity problem that stems from the fact that most of the variables are interconnected and set mainly by market forces and human behavior which in themselves are pro-cyclical.

VI.   Conclusion

The original analysis conducted found that lagged monetary policy significantly affects the change in Real GDP growth rates. These results should help economists see the correlation between government control of monetary policy and the boom-bust cycle. If the idea of a natural growth rate, one based on real variables is held, monetary policy can be seen to pull an economy away from this rate, which in the view of both the Austrian and Monetarist economists will result in a boom and inevitable bust. Keynes view of 'animal spirits' could technically still be a viable solution if one could identify the irrational investment in each case of a bust due to the relatively short time frame of the study. Keynes in fact might even call the boom bust nature of these economies a success, as despite cyclical nature of real growth; the imperfect monetary policy still did advance these economies to a higher standard of living.

For a more perfect study, more countries could be included; if only there was a completely free market economy that could be used as a control group. Some error could also be accounted for if a function of real variables such as savings rate, productivity, capital, labor supply, depreciation, and technology could be used as the natural growth rate, rather than simply

an average of GDP over the time period. For further research, if more data can be gathered, more lags on the variables, as well as exchange rate variables connecting the countries would give the study greater ability to compare results from country to country. Other government variables such as taxes, total percent of economy that is part of the government sector, and a regulations variable could also give insight into the lowering of growth rates over the time series. Since the predictability of the long term GDP growth rates is relatively high, it may also be of interest to run the stock market as the dependent variable. Overall, the significance of the study should give policy makers another factor to consider when conducting monetary policy. It also should give econometric support for Austrian economists and show that the Monetarist idea of government incapability may be more prevalent than commonly thought.

VII.   References

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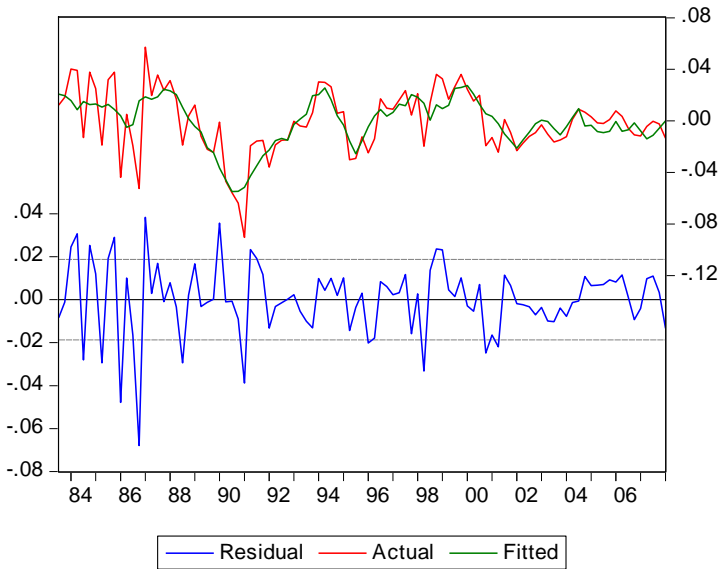
VIII.   APPENDICES

APPENDIX A

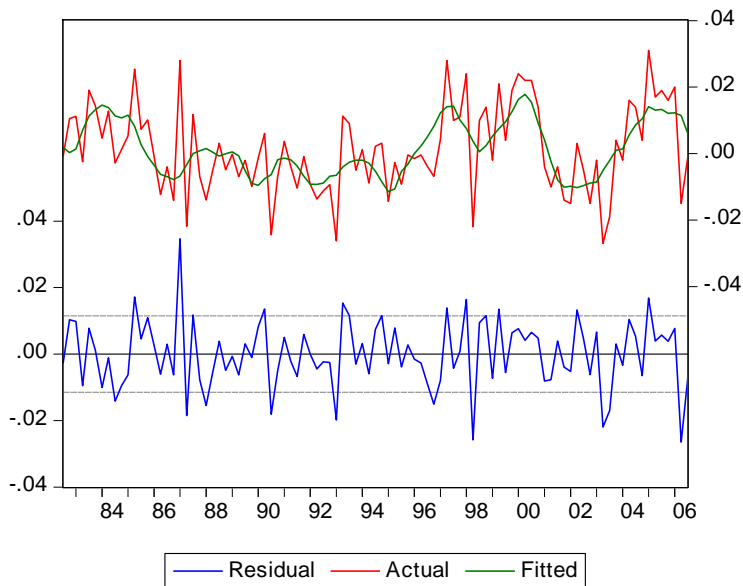**Figure 3- Canada Actual vs Fitted Equation 2 with Residuals**

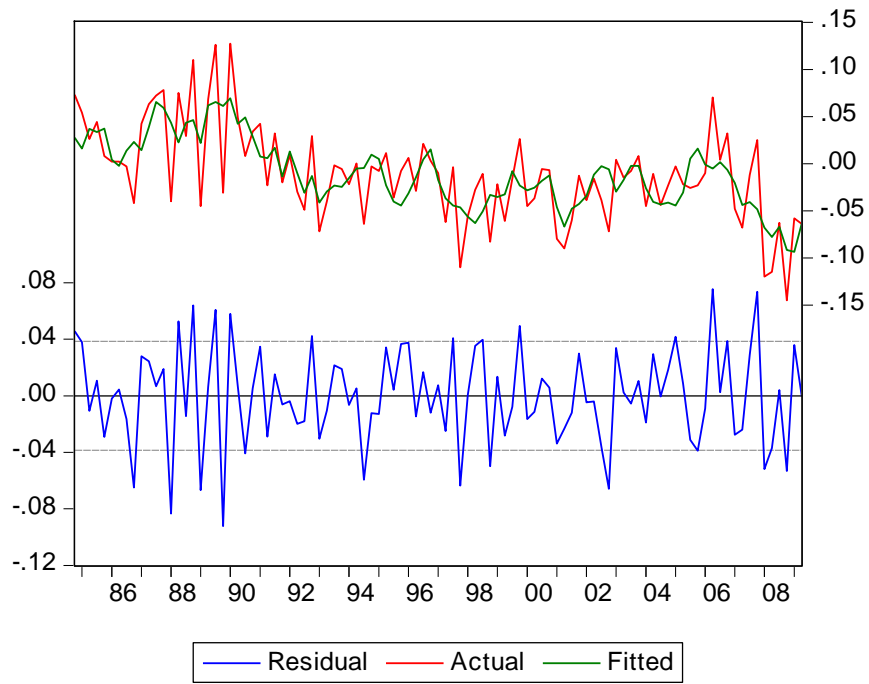**Figure 4- Denmark Actual vs Fitted Equation 2 with Residuals**

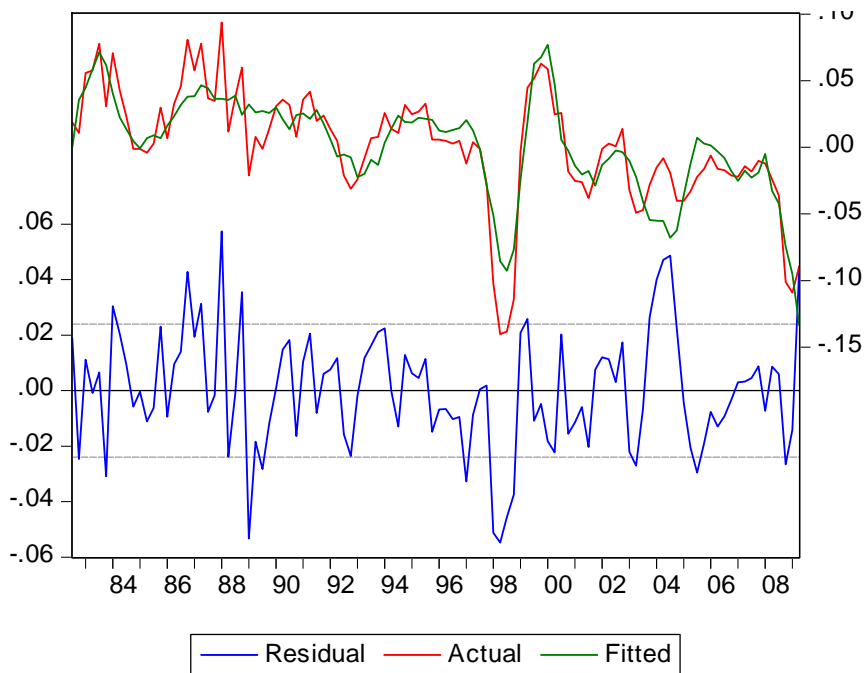**Figure 5- Japan Actual vs Fitted Equation 4 with Residuals**

Figure 6-Korea Actual vs Fitted Equation 2 with Residuals

APPENDIX B

Table 6- PDL Results for Equation 1

Variables	Canada	Denmark	Japan	Korea	USA
n	88	107	99	108	147
F-Statistic	4.09	5.06	3.96	16.47	6.95
Prob(F-Stat)	0.000	0.000	0.000	0.000	0.000
Adjusted R-squared	0.415	0.434	0.376	0.743	0.451
interest rates	-1.344	.0016	2.386	.0025	-.104
	(-4.079)	(1.362)	(2.599)	(.610)	(-2.405)
inflation	2.727	-.004	-4.098	-.005	-.0873
	(1.963)	(-1.104)	(-2.901)	(-.3830)	(-.931)
Money Supply	.0144	-.001	-1.572	1.318	-.309
	(.446)	(-.127)	(-1.109)	(4.662)	(-1.701)
National Debt	-2.8E-07	-4.7E-07	-8.8E-09	8.4E-09	-4.5E-09
	(-3.042)	(-1.703)	(-2.018)	(.085)	(-4.601)
Balance of Payments	-1.1E-05	7.1E-06	.00064	-4.4E-06	-8.3E-05
	(-2.782)	(1.111)	(.557)	(-2.388)	(-2.08)

Table 7- PDL Results for Equation 3

Variables	Canada	Denmark	Japan	Korea	USA
n	86	107	99	89	147
F-Statistic	4.14	5.59	4.31	16.59	7.55
Prob(F-Stat)	0.000	0.000	0.000	0.000	0.000
Adjusted R-squared	0.425	0.464	0.403	0.744	0.473
interest rates	-1.912	.0255	-.436	-1.426	-.156
	(-4.594)	(.215)	(-.273)	(-2.164)	(-3.112)
inflation	3.664	-.405	-.368	4.030	-.0745
	(2.335)	(-1.178)	(-.185)	(2.408)	(-.791)
Money Supply	2.712	-.689	4.663	-2.795	.963
	(1.144)	(-2.505)	(2.035)	(-3.916)	(2.088)
National Debt	-5.4E-07	-6.9E-07	5.4E-11	-5.1E-07	-4.8E-09
	(-4.703)	(-2.836)	(.010)	(-5.406)	(-4.763)
Balance of Payments	-1.2E-05	1.3E-05	.0001	-2.9E-07	3.5E-05
	(-2.593)	(2.512)	(.141)	(-.191)	(.559)

Table 8- PDL Results for Equation 4

Variables	Canada	Denmark	Japan	Korea	USA
n	99	97	99	80	147
F-Statistic	41.50	56.34	84.48	22.63	30.15
Prob(F-Stat)	0.000	0.000	0.000	0.000	0.000
Adjusted R-squared	0.892	0.920	0.945	0.846	0.800
interest rates	.578 (7.899)	.737 (20.570)	-.004 (-6.75)	-.939 (-4.367)	.098 (2.508)
inflation	.07887 (.226)	.338 (2.524)	-.001 (-4.381)	1.282 (2.630)	-.2777 (-3.26)
Money Supply	-3.365 (-8.790)	.319 (2.958)	-.001 (-5.309)	.790 (3.993)	-.119 (-.580)
National Debt	1.7E-08 (.742)	3.6E-07 (3.503)	-1.5E-11 (-4.178)	-7.8E-08 (-3.274)	-6.7E-09 (-5.952)
Balance of Payments	-1.9E-06 (-5.613)	8.7E-06 (4.736)	-1.0E-05 (-10.605)	4.4E-06 (8.740)	-8.8E-05 (-1.895)