Chapter 2: Literature Review

2.1. Oil and the Macroeconomy

Hamilton (1983) makes a frightening observation that coincidentally or, otherwise, the rise in oil prices nearly always preceded a depression in the U.S. economy, particularly after the Second World War. The evidence is statistically significant and non-spurious. Typically, he finds that an increase in oil price is usually followed by a slower US economy about 3-4 quarters later, with a recovery seen in about 6-7 quarters later. This is not to say however, that oil shocks have been responsible for the post-war recessions nor, is it a precedence for one.

In search for an explanation, Hamilton sets out three hypotheses:
Hypothesis 1: The correlation is a historical coincidence; *Hypothesis 2:* The correlation is a result of a third endogenous explanatory variable i.e. perhaps, there exists some third variable which affects both oil prices and the U.S. economy; *Hypothesis 3:* At least some of the recessions in the U.S. were causally influenced by an exogenous increase in oil prices before 1973.

Hamilton (1983) believes that there is little support for the historical events like the Iranian nationalisation in 1951-52, the Suez Crisis 1956 –57, decline in U.S. reserves in the late 1960's, the trans-Arabian pipeline burst in 1970,

the OPEC embargo in 1973, the Iranian revolution, and the beginning a ten-year old war between Iran and Iraq in 1980, being responsible for the recession which followed. The timings of the events leading to a change in crude oil prices are largely exogenous developments specific to the petroleum sector, rather than within the economy. He rules out historical coincidence between oil price increases and the accompanying recessions that occurred.

In examining Hypothesis 2, he looks into the causal relationship between oil and six variables; GNP, employment, price levels, wages, money growth rates, and import prices by using "Granger-Causality" tests. His rationale is that if hypothesis 2 is true, then one should be able to identify some unusual behaviour in key macro series to *predict* oil price increases. Again, he finds a lack of statistical evidence that the above series are informative of oil price increases.

As for the third hypothesis, he discovers that more than ever since 1947 - the timing, magnitude and the duration of post-1973 recessions were more significant with oil price increases.

2.2. Oil Price Asymmetries

The Hamilton (1983) claims are later challenged by Mork (1989), by testing the same model for stability. That is, if the model still presented the same

results before and after a collapse. Mork (1989), subsequently finds that there is a price asymmetry in oil prices over the same period tested by Hamilton. He claims there is a large negative effect of oil price *increases* compared to the smaller coefficients for price *declines*. Mork(1989) disputes the stability of Hamilton's (1983) findings for the latter disregards price declines.

Extending studies on price asymmetries, Sadorsky's (1999) results also show that oil prices and oil volatility shocks have asymmetric effects on the economy. His results suggest both oil prices and oil price volatility increases having more pronounced negative impact on the economy, compared to decreases.

Works on oil price asymmetries are taken up by Reilly and Witt (1998) by using an error correction model for examining the short-run responses of retail petrol prices to changes in input costs in the U.K. They provide strong evidence of asymmetric behaviour in retailers in the U.K. as most increases are passed on within a month while price reductions taking a longer time.

2.3. Oil and Employment

There are considerable studies on oil prices in relation to employment because rising energy prices meant an increase in the cost of production hence,

thereby, manufacturers tend to decrease output. Substantial changes in relative prices of factors of production can also bring about sectoral shifts.

Gisser and Goodwin (1986) test what they call the three 'popular notions' about the so-called "energy crisis". The notions are:

1. The impact of oil prices is largely in the form of cost-push inflation;
2. Crude oil affected the U.S. marcoreconomy differently prior and after 1973;
3. Crude oil prices are determined very differently under post-1973 institutional regime and under post-1973 regime.

They employ a St.Loius-type equations for their study taken for the period between 1961 to 1982 in the U.S. The indicators used are real GNP, general price level, rate of unemployment and real investment. Their Granger causality tests show that oil does have a significant impact on a broad array of marcoeconomic indicators. However, they warn against the assumption that this impact is necessarily via cost-push inflation alone. It is possible that oil prices can work through other channels of the economy, other than prices.

On the second notion, contrary to Hamilton's (1983) study, they find no structural shifts before and after OPEC embargo of 1973. This means there is no difference in the way for the economy before and after the crisis.

A little background before we proceed to explain the third notion tested by Gisser and Goodwin (1986). Briefly, the pricing of crude oil in the early post world war period was dominated by the Texas Railroad Commission (TRC) and other such state regulated bodies. Since 1973, crude oil prices has been largely influenced by OPEC. They find that price level is indicative of oil prices prior to 1973 while GNP, employment rates and real investments do not. For the post-1973 period, none of the indicators show statistical significance when tested individually. Therefore, they conclude that what has been different about the OPEC era is the absolute size of the oil shocks compared to TRC-dominated era. The overall relationship between crude oil and the U.S. macroeconomy appears to be remarkably stable over the period of study.

Uri (1996) studies the relationship between oil prices and agricultural employment, covering the U.S. agricultural employment between 1947–1995, using Granger causality tests. Rising energy prices can increase the cost of production and thereby, decreasing aggregate supply of agricultural commodities. A reduction in agricultural commodities is coincident with a fall in the demand for farm work. It can also result in sectoral shifts between energy-intensive and less-energy intensive farm sectors. Uri (1996) finds that there is a unidirectional causality running from a change in crude oil price to a

change in agricultural employment, but only after a lag of three full years. His study indicates that an increase in real crude oil prices, on average, has accounted for an annual decrease in the agricultural employment of approximately 0.21%.

On the other hand, Darby (1982) argues that changes in the price of crude oil has *no effect* on changes in real GNP and hence, no impact on employment. He says that it is easy to blame the Oil Crisis of 1973 for the widespread recession which followed but this does not mean an empirical evidence in support of the cause of that recession. An alternative hypothesis in explaining world inflation and recession of the early 1970's could be the attribution of the final breakdown of the pegged exchange rates in 1973. The second alternative hypothesis is that in August 1971, the U.S. government adopted price controls, which was subsequently dismantled between 1973-1975. The controls would have initially overstated the GNP and when controls were relaxed, the measured real income fell back thus, giving an illusion of greater than the true inflation rate. Since the GNP deflator was larger, it made the real GNP smaller. Hence, there is yet a consensus on the issue of the relationship between changes in prices of crude oil and the aggregate employment rate in the US market.

On a more micro level, Hoag and Wheeler (1996) look into the impact of oil price on industries regarded as being closely related to the oil industry. They choose the Ohio state coal mining employment because coal is a substitute for oil in the production of electricity. Hence, when price of oil increases, coal or, other substitutes may be preferred. They employ a VAR model which also includes dummies for industrial strikes and then constructed variance decompositions thus, capturing the direct and indirect effects of oil shocks on employment in Ohio state. They find that oil price shocks have a larger impact on Ohio coal mining employment that do shocks in coal prices or, coal wages themselves.

2.4. Oil and the Financial Sector

Voluminous work has been done on the subject of oil price changes as well as its effects on the macroeconomy and employment. However, there is but a handful on the interaction of oil price and the financial sector. Even in Hamilton's (1983) pioneering paper, he touches on monetary growth (namely, M1) only as part of his six-variable representative macroeconomy, rather than looking into the finance sector per se. He finds that an increase in oil price tends to be followed by a slower money growth rates about a year later.

There are, however, many papers written on the relationship between inflation, money and stock returns for obvious reasons that inflation has

erosive effects on returns on investments – a la the Fisher hypothesis. A well-known but controversial paper would be the one by Fama (1981) in which he examines claims that the negative relation between real stock returns and inflation observed during the post-1953 period is a consequence of proxy effects. His study uses monthly, quarterly and annual data. Fama confirms that both stocks and bonds do indeed vary negatively with inflation rates. However, this is not through the monetary sector but through the real sector. That is, it is not a causal effect but a proxy effect induced by a negative relationship between real activity and inflation. This work is followed by researchers like Lee (1992) who uses a four-variable VAR for examining the causal relations and dynamic interactions among stock returns, interest rates, real activity, and inflation. Lee's work contradicts the Fisher hypothesis in that nominal stock returns and inflation are weakly-mildly correlated for all leads and lags. However, the positive correlation of nominal interest rates and inflation rates is consistent. Stock returns are also positively correlated to industrial production although inflation is negatively associated with industrial output. Real interest rates and real stock returns both exhibit positive correlation to industrial growth. By using variance decompositions, Lee also says that stock returns appear to explain a substantial fraction of the variance in real activity, which responds positively to stock return shocks. With the interest rate included in the VAR system, interest rate explains little variation in inflation. Inflation, on the other hand, explains very little in variation in

real activity. In his conclusion, Lee adds that for the purpose of prediction, the negative relations between inflation and stock returns is largely an unreliable one.

More recent works include those by Fabio and De Nicolo (2000) who analyze the interdependencies of stock returns, term structure, inflation and real activity from an international perspective. They use innovations in nominal stock returns and examine their impact on real activity and inflation for the U.S., U.K., Japan and Germany. The process is then reversed. They generally find that the innovations in nominal stock returns have negligible effects on inflation and real activity in all the countries studied, save for the U.S. However, innovations in the U.S. stock markets are quickly incorporated in nominal foreign stock returns but not for the other countries.

As mentioned earlier, there is little literature available specifically in connection with oil prices and the financial sector. One of the few is the work of Jones and Kaul (1996). They use both cash-flow/dividend model as well as regression to assess the impact of oil shocks on real stock returns across the U.S., Canada, United Kingdom, and Japan. Their results are consistent with Hamilton's (1983) in that the episodic volatility of oil prices is largely an exogenous event vis a vis the world economy. They are able to show that changes in oil prices has detrimental effect on output and real stock returns in

all the countries under examination when using regression models. However, results are mixed when using current and expected future cash flows. The U.S. and Canadian stock markets are found to be rational while the authors are unable to explain for the effects of oil prices on expected returns for the U.K. and Japanese markets.

Sadorsky (1999) not only looks into price asymmetries of oil price volatility but also the impact of oil prices on economic activity, interest rates and the stock market. First, he tests his data covering 1947:1 – 1996:4 for the U.S. market for structural breaks since it covered the somewhat turbulent era of the 1970's. He then, looks into the dynamics of oil prices and volatility and industrial output, interest rates and real stock returns. He then, tests the time series for unit root processes. To investigate if the variables had common stochastic trends, he uses the Johansen procedure where he finds no evidence of cointegration between industrial output, interest rates and real stocks returns. He also fitted a low order generalized autoregressive conditional heteroskedastic (GARCH) model to the rate of growth of oil prices. The GARCH is used to then build the conditional variation in oil price changes, which is in turn used to compute the normalized unexpected movements in oil prices. The normalized unexpected movements are tested for effects of oil price shocks and stock returns. His conclusion is: i) changes in oil prices impact economic activity but changes in economic activity have little impact

on oil prices; ii) impulse response functions are important in explaining movements in the stock market due to oil prices; iii) positive oil price shocks have a depressive effect on real stock returns while; iv) shocks to real stock returns have a positive impact on interest rates and industrial production.

Papapetrou (2001) also looks into the stock market, economic activity and interest rates but she also adds an employment specification as an alternative measure of economic activity to her model. Papapetrou's paper is different in that she looks into Greece, which is a medium-sized, oil dependent economy. Hence, she expects the impact on employment be more significant than in the U.S. She also utilizes the VAR, impulse responses and variance decompositions to test her hypotheses. She finds that oil price shocks do indeed explain a significant proportion in the variation in both economic activity growth and employment growth. Output and employment both respond negatively to oil price shocks without delay. She concludes that oil prices are also important in explaining movements in stock returns and that a rise in oil prices depresses real stock returns. At the same time, her results confirms her expectations that oil price changes having more drastic effects on the Greek economy than do Sadorsky's (1999) results on the U.S. economy.