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THE EFFECT OF INFLATION ON THE SAVING RATE:

SOME EMPIRICAL EVIDENCE FOR CANADA

BY

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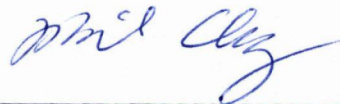
The undersigned certify that they have read, and recommend to the
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ABSTRACT

The primary objective of this study is to examine both the theoretical and empirical linkages between inflation and personal saving behavior in Canada over the period from 1968 to 1985. It focusses on the role played by uncertainty, and more specifically inflation-induced uncertainty, in the drastic jump in the saving rate in the mid-1970s and the persistence of high rates of saving into the 1980s. This issue is of particular interest in that the observed positive correlation between the rate of inflation and the rate of saving in the 1970s is not predicted by conventional theories of consumption and saving behavior.

The empirical models developed in this study incorporate, within a multi-period framework, the various institutional, demographic, psychological and economic factors which are hypothesized to influence the rate of saving. These models explain approximately 94 percent of the variation in the personal saving rate. Overall, the results are supportive of the uncertainty hypothesis as the primary transmission mechanism by which inflation influences saving behavior in Canada. The results also indicate that uncertainty arising from high rates of unemployment may have become a major

factor responsible for maintaining a high rate of saving in the presence of much lower rates of inflation.

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CHAPTER ONE

INTRODUCTION

Introduction

On the basis of the experience in Canada and in most OECD countries during the 1970s and 1980s it would appear that there is a positive relationship between the saving rate and the rate of inflation. For example, the annual rate of inflation in Canada increased from about 3.3 percent in 1970 to roughly 10.2 percent in 1980. Over the same period the saving rate (that is the ratio of personal saving to personal disposable income) doubled.[1]

Clearly, this behavior has important ramifications for overall economic performance and economic policy. The saving rate (or its complement, the average propensity to consume) plays a significant role in short-run variations in economic activity as well as in long-run economic growth. Moreover, there is an important theoretical dimension. For example, this positive relationship is not predicted by the standard theories of saving or consumption behavior. The objective of this study is to examine both the theoretical and empirical linkages between inflation and saving behavior (as indicated by the saving rate) in Canada.

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No single factor can be held responsible for the increase in the personal saving rate in Canada. Saving is determined by cultural, institutional, and psychological as well as economic factors. The associated diversity in the factors motivating individuals' saving decisions, combined with the wide range of saving instruments available, leads to difficulties in terms of using traditional economic theory to explain and predict personal saving behavior.[2]

Over most of the postwar period, a strong positive correlation between the rate of inflation and the personal saving rate has been observed. This is shown in Table 1.1. Until the early 1970s, personal saving in Canada consistently hovered around 5 percent of personal disposable income. By the mid-1970s, the rate of inflation began to rise, accompanied by increasing rates of personal saving to a peak of 10.9 percent in 1975.[3] The behavior of personal saving in Canada continues to be an important issue for the 1980s, since the personal saving rate has remained well above 10 percent during the first half of this decade. Over this period the saving rate has been more than double the average postwar rate of approximately 5 percent, attaining record levels of 15.5 percent in 1982.[4] The persistence of a high saving ratio in Canada indicates that the change in personal saving behavior in the 1970s has been more than a temporary phenomenon.

Table 1.1

Inflation and the Personal Saving Rate in Canada

Year	S/Y [a]	π [b]
1960	3.27	1.29
1961	2.76	0.64
1962	5.61	1.27
1963	5.43	1.88
1964	4.18	1.84
1965	5.51	2.41
1966	6.67	3.53
1967	6.34	3.69
1968	5.62	4.11
1969	5.36	4.47
1970	5.32	3.27
1971	5.87	2.93
1972	7.37	4.74
1973	9.03	7.69
1974	9.91	10.92
1975	10.95	10.80
1976	9.26	7.52
1977	9.05	7.95
1978	10.82	8.84
1979	11.31	9.20
1980	12.27	10.16
1981	14.20	12.49
1982	15.25	10.80
1983	13.31	5.78
1984	13.18	4.35
1985	12.12	4.01

Source: Data taken from Cansim University Data base. The data used are averages of quarterly or monthly figures.

[a] Personal saving (Cansim series identifier 001015.1.8) as a percentage of personal disposable income (Cansim series identifier 001015.2). Both flows are measured in millions of current dollars; seasonally adjusted at annual rates.

[b] Percentage rate of change in the CPI (1981 = 100; Cansim series identifier 001941.1).

According to conventional demand theory, inflation should not affect saving behavior. Fully anticipated inflation affects only nominal variables, leaving real variables and thus real consumption and saving behavior unaltered. Consumption and saving behavior is altered only when individuals mistake an increase in nominal variables resulting from inflation for an increase in real variables. However, most empirical studies undertaken in the 1970s showed that inflation has a significant positive effect on saving. This phenomenon has prompted a search for theoretical explanations for this "paradoxical" behavior.

There have been few attempts to empirically examine the effects of inflation on personal saving in Canada.[5] Although the issue has received much more journalistic attention in the United States, the empirical evidence does not demonstrate any clear agreement about how inflation affects saving behavior, or even if it affects saving at all.[6]

The divergence of empirical results is largely due to the differences in variables and data employed. Results are very sensitive to the source of the data and the definition of the variables used. The various factors which have been examined include: anticipated and unanticipated inflation; voluntary and involuntary saving; personal and private saving; the level and rate of saving; and saving as a proportion of disposable income and of Gross Domestic Product (GDP).

However, most studies adopt some variant of "personal" saving and generally find a significant positive inflation effect on saving.

Empirical evidence for Canada shows that part of the increase in the measured personal saving rate during the 1970s can be traced to a number of specific linkages to inflation. For example, the Department of Finance (1980) concluded that inflationary effects in capital, labor, and housing markets accounted for slightly more than 50 percent of the increase in the personal saving rate between 1962-1970 and 1971-1979.[7] Several other general factors account for the remaining increase in the saving rate. These include uncertainty resulting from high rates of unemployment, tax incentives offered for saving, and other general demographic factors and behavioral responses to inflation.[8] According to the study conducted by the Department of Finance (1980), there do exist specific links between the rate of inflation and personal saving that contribute to the explanation of the rising personal saving rate in recent years. Although there is no consensus as to how inflation affects saving, most of the studies undertaken in the 1970s for other OECD countries also generally show inflation positively affecting saving behavior.[9]

Objective of Study

The objective of this study is to investigate the effect of the rate of inflation (both anticipated and unanticipated) on the personal saving rate in Canada. The study concentrates on an economic explanation for the observed positive relationship between these two variables. A variety of psychological links are also incorporated.

There exists a lack of consensus as to the precise mechanism by which inflation influences saving behavior. Inflation can affect saving directly, via money illusion, intertemporal substitution, and/or uncertainty effects; or indirectly through its effect on the interest rate (in the short-run) and on real wealth.[10] This study investigates and empirically evaluates each of these transmission mechanisms in a Canadian context. It also examines to what extent the inflation uncertainty effect, which the bulk of the empirical evidence indicates had a major positive influence on saving behavior during the 1970s, contributes to the high rate of saving experienced in Canada so far in the 1980s.

Why the Rate of Saving is Important

The rate of saving is important in terms of both short-run economic activity as well as long-run economic growth. Empirical studies diverge regarding the desirability of a

high saving ratio. While most studies agree that saving is critical for economic growth to occur, others argue that a high rate of saving is undesirable. For instance, Feldstein (1977) is of the opinion that an increase in the saving rate in the United States would not necessarily result in a permanent increase in economic growth. His argument is that a higher saving rate causes a temporary increase in the rate of growth of income which is merely a transition to a higher level of income. In the long-run the rate of growth returns to its original value.[11]

The argument against a high saving rate is based on a short-run view of the world. In the short-run, saving is viewed as a leakage from the economy. The more that is saved out of income, the lower will be the income available for present consumption. As a result, the demand for currently produced goods and services is reduced.

In the long-run the level of savings in an economy is critical. Economic growth requires investment in new plant and equipment. In a closed economy at least, investment must be financed through savings.[12] Therefore, to support a high level of investment, it is desirable to have a high level of savings. If economic growth is seen as a desirable goal, then a high saving rate will, in the absence of foreign borrowing, be required.

Two factors are crucial in determining economic growth: the rate of saving out of current income and the form of investment financed by such saving.[13] In order to contribute to economic growth, savings must go toward financing capital formation. Although Canada has a high aggregate saving ratio, it does not fully contribute to economic growth as a portion of it goes toward financing the federal deficit.

Since saving is an important determinant of economic growth, an understanding of long-term saving behavior is fundamental to understanding differences in long-term growth rates. Internationally there exists a strong positive correlation between rates of saving and rates of economic growth.[14] Japan's growth rate, and correspondingly its saving rate, has consistently been higher than that of most industrialized countries. Although not as high as that of Japan, Canada has a high saving ratio and high rates of economic growth relative to most industrialized countries. Canada's capital-intensive economy requires a high rate of saving out of income.

Outline of Study

The study proceeds as follows. Chapter two examines a number of hypotheses regarding the effects of inflation on saving behavior. It begins with a summary of the relationship

between inflation and saving within conventional demand theory. Following this is an examination of the direct and indirect effects of inflation on saving which have been put forth in an attempt to explain the divergence between the observed relationship and that based on traditional theory. Chapter Three reviews the relevant literature on the effects of inflation on personal saving. Chapter Four sets out a model which incorporates the effects of inflation on saving in Canada. Chapter Five summarizes the data used and the results obtained. The last chapter consists of a summary of the results, the conclusions of the study, and suggestions for further research.

NOTES TO CHAPTER ONE

1. Jarrett (1981), p. 1.

2. Department of Finance (1980), p. 27.

3. Ibid., p. 1.

4. OECD Economic Outlook, no. 34, (December, 1983), pp. 100-102.

5. The major studies undertaken in Canada are by the Department of Finance (1980), Jarrett of The Conference Board of Canada (1981), and Davidson and MacKinnon (1983).

6. While most studies do find some inflation effect on saving, Jump (1980) claims that the increase in saving observed in times of inflation is due to overmeasurement, not inflation per se. As saving is determined residually, measured income increases in response to inflation, thereby increasing measured saving. In other words, the observed increase in saving behavior in the 1970s and 1980s is merely a "statistical mirage." Davidson and MacKinnon (1983) arrived at this same conclusion using both Canadian and U.S. data.

7. Department of Finance (1980), p. 45.

8. Ibid., p. 4.

9. This positive association between inflation and the saving rate has been reported for Australia by Freebairn (1977), Ouliaris (1981), and Bladen-Hovell and Richards (1983); for Great Britain by Deaton (1977), and Howard (1978); and for the United States in numerous studies. According to Bladen-Hovell and Richards (1983), Juster and Shapiro (1979) reported this positive relationship for 15 OECD countries. Jarrett (1981, pp. 23-24) reports this significant positive relationship for Canada, France, Italy, Japan, Sweden, the United Kingdom, and the United States.

10. The classification of transmission mechanisms into direct and indirect effects borrows from Wachtel (1977a).

11. Feldstein (1977), p. 119.

12.   In a closed economy, investment must be financed solely through domestic savings, while in an open economy the foreign sector provides an additional source of funds.

13.   Johnson and Chiu (1968), p. 321.

14.   Jarrett (1981), p. 2.

15.   Ibid., p. xii.

CHAPTER TWO

EFFECTS OF INFLATION ON SAVING

Introduction

The purpose of this chapter is to provide the theoretical basis for the relationship between inflation and saving. It begins by looking at conventional demand theory which postulates that fully anticipated inflation will leave unchanged or discourage personal saving. The bulk of the empirical evidence contradicts this conventional view. The next part of the chapter provides a theoretical rationale for the observed positive correlation between the rate of inflation and the personal saving rate. Here, the focus is on the various direct and indirect causal mechanisms put forth to explain this divergence from traditional theory. The effects which will be examined include money illusion, intertemporal substitution, uncertainty, real wealth, and the interest rate effect.

Conventional View

There are three ways of looking at the conventional view, all of which maintain that (anticipated) inflation has no effect on the rate of saving in the economy. The Keynesian-type model which ignores the microeconomic

foundations, includes a saving equation where aggregate saving depends on the rate of interest and income. Prices are not included in the model and thus cannot affect saving behavior.[1]

Another way to approach the conventional view is by examining the microeconomic foundations of saving behavior. From the individual demand functions to aggregate demand functions, anticipated inflation is assumed to have no effect on the rate of saving. The quantity demanded of any particular commodity is a function of real income and of the relative price between this commodity and all other commodities. The assumption underlying this conventional microeconomic theory is that demand functions are homogeneous of degree zero in prices and income.[2] Hence, any equiproportional change in all prices and income will leave quantities demanded by the consumer unchanged. If the consumer is aware that his money income increases in the same proportion as the increase in the general price level, he will not alter his behavior as he is no better or worse off in real terms. This is a very stringent condition. In order for the conventional view to hold, inflation must be perfectly anticipated. Any unanticipated inflation would result in money illusion, thereby altering consumption and saving behavior.[3]

Aggregating over all commodities purchased by the consumer, the conventional theory leads to the conclusion that an individual's total real consumption demand is homogeneous of degree zero in all prices and money income. This result would imply that when aggregating over all consumers, the economy's aggregate real consumption should be a function of aggregate real income but not the price level.[4] Therefore, since fully anticipated inflation has no effect on real economic variables, it will leave aggregate consumption and saving behavior unaltered.[5]

The third type of traditional view is based on the two-period intertemporal model.[6] For simplicity, only one commodity is considered, and it can be either consumed or saved. What is not consumed in the first period is saved for consumption in the second period. Consumption between the present and the future depends on the (real) rate of interest. Therefore, the rate of interest can be considered a relative price between consumption in the two periods.[7]

This approach is analagous to the microeconomic foundations approach. The amount of the commodity which is demanded for consumption is a function of the individual's income and the relative price (i.e. the interest rate) between present and future consumption. As long as the real rate of interest remains unchanged (i.e. that nominal interest rates adjust for anticipated inflation), and real income is

held constant, the consumption-saving decision will remain unaltered.[8] All three approaches to the conventional view conclude that inflation should have no effect on the rate of saving, and moreover that all inflation is fully anticipated.

A world where perfectly anticipated inflation has no impact upon real decisions faced by consumers is an inflation-neutral world. For neutrality to hold (in the long-run), "all" prices in the economy must increase at the same rate; only then will inflation not alter real variables. In an inflation-neutral world, nominal interest rates include an inflation premium. Therefore, there is no change in the real rate of return due to inflation, and there will be no incentive to switch holdings from financial assets to physical assets.[9]

Traditional economic theory indicates that the only long-run impact of inflation on the saving rate would be a readjustment in the components of household wealth. Campbell and Lovati (1979) obtained results consistent with this traditional theory. They found that the only impact of inflation on saving was through altering the forms of saving. Since fully anticipated inflation is expected to have no lasting effect on saving behavior, unanticipated inflation would be the only possible source of a positive relationship

between the two variables according to traditional theory, and only in the short-run.[10]

The standard view also allows for inflation to have a negative impact on personal saving behavior. The most frequently mentioned rationale for this negative impact is the so-called "flight from currency."[11] When consumers anticipate inflation that was previously unanticipated, consumer goods become more attractive while nominal assets become less attractive. Consumers will consequently tend to increase their expenditure and reduce their saving to do so, thereby substituting real assets for financial assets.[12]

The results obtained by Juster and Wachtel (1972a) and Burch and Werneke (1975) suggest that fully anticipated inflation indeed has a negative impact on saving since consumer expenditures will be encouraged. On the other hand, completely unanticipated inflation will increase household saving, most likely due to uncertainty and pessimism regarding the future, and particularly uncertainty regarding real income expectations. According to their results it is the positive impact of unanticipated inflation on saving which is the dominant explanation for the changing personal saving behavior of the 1970s. Furthermore, the severity and duration of the anticipated rate of inflation will affect its impact on the rate of saving, thereby rendering the a priori effect of anticipated inflation on saving indeterminate.[13]

Contrary to the conventional view of inflation encouraging the substitution of physical assets for financial assets, Dorrance (1980) found for the United Kingdom that individuals have responded to inflation by increasing their holdings of precisely those financial assets "whose potential purchasing power declines most directly as a consequence of inflation." [14] This observation points to the existence of other factors involved in explaining the relationship between inflation and personal saving.

There are two major reasons why conventional demand theory has not been able to explain the changing saving behavior of households throughout the industrialized world during the 1970s. Firstly, conventional theory is based on the stringent assumption of fully anticipated inflation. However, empirical evidence indicates that most of the inflation experienced in the 1970s was of the unanticipated variety.[15] Secondly, several studies have found that the portion of inflation that was anticipated during this time period generally had a positive effect on the personal saving rate, contrary to traditional theory.[16] As will be subsequently discussed, psychological links to inflation, in particular uncertainty regarding the future, primarily account for this "paradoxical" saving behavior relative to the conventional view. The interaction between conventional economic factors and psychological factors is responsible

for the indeterminate a priori effect of anticipated inflation on the rate of saving.

The failure of conventional theory to explain the saving behavior of the 1970s prompted a search for alternative theories consistent with the positive correlation between inflation and the personal saving rate. Several hypotheses have been advanced to explain this relationship, some of which indicate reduced saving, but most of which lead to increases in it. These transmission mechanisms from inflation to saving are discussed in the following sections. They are classified according to whether the effects of inflation are direct or indirect.

Direct Effects

Money Illusion

Money illusion occurs when prices are changing yet these changes are not fully recognized. The conventional view is that money illusion will discourage real saving. However it is equally plausible for saving to increase. If consumers misinterpret increases in nominal income as increases in real income they may overestimate their purchasing power and feel financially better off. As a result they would respond by consuming more and saving less. On the other hand, if consumers are aware of increases in the price of commodities but unaware of increases in nominal income, they

may feel financially worse off, as they perceive their real income to be falling, and respond by increasing their rate of saving.[17]

Another form of money illusion which positively affects saving is proposed by Deaton (1977). He suggests that consumers lack sufficient information necessary to distinguish between relative and general price increases. An increase in the general price level is misinterpreted as an increase in only the price of the goods he traditionally purchases.[18] It will take time to learn the true price level and in the meantime the consumer puts off buying the goods he perceives as being relatively more expensive. Consequently, real consumption declines and real saving is increased. Using U.S. and U.K. data for the period 1954-1974, Deaton (1977) found some support for his "money illusion" saving function. Based upon data for ten other OECD countries over the period 1961-1978, Koskela and Viren (1982) also obtained results supporting Deaton's saving function.

The money illusion argument is contingent upon inflation being both unanticipated and remaining unrecognized. This is a very stringent condition which could only hold in the very short-run. Although inflation is often unanticipated, it is rarely unrecognized once it is taking place. This is especially true during periods of high inflation. Branson and Klevorick (1969) tested whether money illusion affects

consumption behavior and found the money illusion effect to be very large. Wachtel (1977a) questioned this result and concluded that while it is possible for money illusion to exist in periods of low inflation, it has tended to disappear as inflation has become more severe.[19] Although results obtained by Deaton and Koskela and Viren have lent some support to the view that money illusion leads to increases in the saving rate, the bulk of the literature does not regard money illusion as an important causal link between inflation and personal saving during the 1970s.

Intertemporal Substitution

Whereas money illusion concentrates on the effects of unrecognized and unanticipated inflation, intertemporal substitution focusses on the effect of anticipated inflation on saving. Although both of these effects generally predict that increases in rates of inflation will reduce the rate of saving, and in this way support the conventional view, an equally plausible argument can be made in favor of an increase in saving. For example, anticipated inflation may encourage expenditure on consumer durables in advance of their expected price increase. As a result present consumption is substituted for future consumption thereby reducing present saving.[20] Only if the expected price increases are sufficiently large and certain will it be worthwhile for

consumers to buy goods in advance, as doing so involves opportunity costs. In a stable economy, this occurs infrequently and hence, as noted by Wachtel (1977b), this mechanism is viewed as having limited applicability.[21]

Another type of intertemporal substitution effect resulting from anticipated inflation is incorporated in what Howard (1978) refers to as "search theory." According to this theory, an increase in the rate of anticipated inflation produces an increase in the saving rate. That is, consumers postpone purchases of consumer goods until a search of the market verifies that the nominal prices for all goods have increased, and that the goods they wish to buy are not relatively more expensive than other relevant goods. Since searching the market takes time, consumption is postponed, thereby increasing the rate of saving.[22]

Both money illusion and intertemporal substitution are rarely observed. They are both based on stringent conditions and generally suggest a negative relationship between inflation and personal saving, contrary to the observed experience of the 1970s and 1980s. Money illusion requires inflation to be both unanticipated and unrecognized at the time of its occurrence. However this is an unlikely situation. Intertemporal substitution requires fully anticipated inflation, which is also unlikely, in order for consumers to beat price increases. Both of these factors can generally

be dismissed as explanations for the long term relationship between the rate of inflation and the rate of saving experienced in the 1970s.

Uncertainty

Unlike money illusion and intertemporal substitution, the uncertainty effect is not incorporated in traditional theory as a link between inflation and saving. The uncertainty hypothesis began appearing in the early 1970s in studies attempting to explain why the rate of saving seemed to be increasing in response to inflation. The uncertainty effect, stressing the psychological factors involved in saving behavior, was an idea which originated with George Katona.[23] Juster and Wachtel (1972a, 1972b), Juster (1973), Wachtel (1977a) and Howard (1978) were among those who considered uncertainty as the major factor accounting for the increase in the saving ratio during the 1970s. Widespread support has been found in the literature for the uncertainty hypothesis.

Following Katona's psychological approach, inflation causes pessimism regarding the future which in turn encourages precautionary saving. This view is based on the public's distaste for inflation and their belief that inflation is an undesirable phenomenon. For example, Juster and Wachtel (1972a) note that according to survey data, rising prices

tend to be associated with weaker consumer confidence.[24] When consumers lose confidence and become uncertain about future economic conditions they are motivated to increase their rate of saving for precautionary purposes.

Economists recognize the psychological link between inflation and uncertainty, but put more emphasis on economic factors which affiliate the two. More specifically, it is the uncertainty over economic variables that they are concerned with. Two major types of uncertainty through which inflation is hypothesized to encourage precautionary saving [25] are uncertainty regarding real income and money income.

Real income expectations depend on both the expectation of price increases and money income increases. With regard to expected real income, the basic uncertainty is whether or not increases in money income will keep pace with expected increases in prices, since wage rate changes often lag behind cost of living changes.[26] Even if future levels of nominal income could be predicted with certainty, the inability of households to accurately forecast prices results in uncertainty regarding future prices and therefore real income. Hence, there is greater saving for precautionary purposes.[27]

The rate of saving is not only determined by the expected level of real income but also by the degree of certainty which is attached to these expectations. Empirical evidence has shown that as inflation increases it tends to become

more variable. Therefore at higher rates of inflation, predicting inflation becomes much more difficult. If inflation cannot be accurately predicted, the expected value of real income becomes more uncertain. As a result, uncertainty regarding the expected level of real income varies positively with the rate of inflation, thereby positively influencing the saving rate.[28]

The increased variance of expected real income generated by unanticipated inflation has asymmetrical effects on behavior. Juster and Wachtel (1972a) note that although it is equally probable for real income to decline as it is to rise, the prospect of declining real income has a stronger influence on consumer decisions than does the prospect of rising real income.[29] As a result, consumers will behave conservatively in order to avoid a decline in real income. Therefore, on average, they will end up with a higher level of real income and saving than what they had expected.

The other type of uncertainty hypothesized to encourage precautionary saving is uncertainty regarding money income. This is often reflected in uncertainty regarding job security and future employment. Expectation of future money income is dependent on the expectation of becoming unemployed or reemployed. If consumers feel that their money incomes may fall, as would be the case if they become unemployed, it is likely that they would increase their rate of saving so

that they would be able to continue to make necessary purchases in the event they do become unemployed. However, once unemployed, money incomes are falling, and thus the amount saved is drastically reduced as consumers attempt to maintain their customary standard of living. This results in a reduction in the aggregate saving ratio.

The uncertainty effects with respect to future income can be proxied by variables representing the unemployment rate and the change in the unemployment rate. The rate of unemployment can influence the saving rate in two different ways. Firstly, an argument can be made in favor of the unemployment rate exerting a negative influence on saving behavior, as it represents a negative transitory income effect. When unemployment is high, it tends to be associated with high aggregate consumption relative to income and thus the aggregate rate of saving is low. However, this effect is contingent upon the concentration of the unemployment rate in the high income groups which typically do most of the saving. Since the rate of unemployment and the rate of inflation are generally found to be inversely related, their separate uncertainty effects on the saving rate are consistent with each other.

On the other hand, it is also plausible for a high rate of unemployment to promote feelings of uncertainty regarding job security, thereby positively influencing the

rate of saving for precautionary purposes. The change in the unemployment rate is also expected to influence saving positively. For example, fear of becoming unemployed probably rises in response to a rising rate of unemployment. Therefore, increasing rates of unemployment cause an increase in uncertainty about job security thereby encouraging precautionary saving.[30]

However, since high and rising rates of unemployment have often been associated with falling rates of inflation, finding a positive relationship between uncertainty arising from changes in the unemployment rate and the rate of saving would contradict the hypothesized positive association between inflation-induced uncertainty and the saving rate. As a result, these two types of uncertainty may offset each other to some extent. There have been instances when relatively high rates of inflation and rising rates of unemployment have occurred together, thereby exacerbating the uncertainty effect on the rate of saving.[31]

It would seem that in general, uncertainty, whether it is caused by high rates of inflation or by rising rates of unemployment, is consistent with high saving rates. For example, increasing rates of inflation may have explained the rising saving ratio of the 1970s in Canada, while high and rising rates of unemployment may explain why the rate

of saving has remained high during the 1980s, even with falling rates of inflation.

While the psychological explanation for inflation encouraging precautionary saving via general uncertainty and pessimism about future economic conditions has been met with some acceptance, the preferred explanation is the economic link between inflation and uncertainty. The majority of the empirical results support the conclusion that uncertainty regarding real income and money income, by encouraging precautionary saving, is responsible for the observed increase in the saving rate throughout the industrialized world.

Indirect Effects

Real Wealth

Put simply, the real wealth effect involves attempts by consumers to guard against declining real income resulting from inflation by increasing their rate of saving. The basic premise underlying this effect is that consumers will increase their saving rate in order to maintain the real value of assets whose purchasing power is being eroded by unanticipated inflation, and also by anticipated inflation to the extent that financial instruments are fixed in nominal terms. Assuming consumers wish to maintain a desired stock of real wealth, any change in the real value of their financial

assets brought about by inflation will be met by an increase in saving to restore purchasing power.[32]

The real wealth effect is clearly a short-run phenomenon, existing only as long as inflation remains unanticipated and rates of return fail to incorporate an inflation premium. In the long-run the nominal interest rate adjusts to include an inflation premium. As a result, any long-run effect of inflation on the rate of saving is more likely to reflect uncertainty.[33]

The real wealth effect will always exist to the extent that households save a portion of their disposable income in the form of liquid assets which are fixed in nominal terms. Households will continue to hold financial assets whose purchasing power declines in the face of unanticipated inflation. This is because of the desirability of having liquid assets on hand for transactions and precautionary purposes. Hence they will attempt to maintain a relatively constant ratio of liquid assets to income which is insensitive to the rate of return.[34]

Tait and Burnell (1976) obtained empirical evidence for the U.K. which supports the real wealth effect. Their results indicate that not only did people desire to hold precisely those financial assets whose purchasing power declines in the presence of inflation, but almost 75 percent of those surveyed continued to do so in the face of low and

even negative rates of return. They were aware that the real value of their savings was declining, yet the motive to save continued to be strong.[35]

Although the real wealth effect generally suggests that saving is increased to guard against declining real income, Fortune (1981) offers an interesting variation on this hypothesis. His argument is that the effect on saving will depend on whether inflation is expected to be concentrated on durables or on nondurables and services, subsequently determining whether savings will be increased or rearranged as a result.

Durables are considered a form of real wealth. Therefore if their prices are expected to increase, consumers will be encouraged to purchase durables now and store them for future use, resulting in dissaving. Consequently, to maintain the desired level of real wealth, nominal wealth is rearranged. Real assets (durables) are accumulated while holdings of financial assets are reduced. Therefore, anticipated inflation of the price of durables results in a reduction in saving.

On the other hand, nondurables and services are not considered a form of real wealth and are non-storeable. When consumers expect the future price of these items to increase, they will expect to pay more for them in the future. To maintain levels of consumption of nondurables

and services in real terms, an increasing proportion of income will be saved to build up wealth in the form of financial assets. Consequently, the effect of inflation on the personal saving rate via the real wealth effect will depend on the type of inflation that is anticipated.[36]

As with the uncertainty effect, the real wealth effect relies on unanticipated inflation. Unanticipated inflation results in an unexpected decline in the real purchasing power of income and in real wealth. As a result of the increased uncertainty in the value of personal income and wealth, consumers will increase their precautionary saving balances. This would lead one to conclude that the larger the unanticipated inflation relative to anticipated inflation, the greater would be the personal saving rate.[37]

Interest Rate

The consumption-saving decision is an intertemporal problem. Consequently, changes in the rate of interest which affect the relative cost of present and future consumption will affect saving.[38] However, the a priori effect of the interest rate on saving is indeterminate because of offsetting income and substitution effects.

The substitution effect with respect to current consumption is assumed to be negative, while the income effect is positive. An increase in the rate of interest

increases the cost of present consumption relative to future consumption and hence, reduces present consumption and increases present saving. In other words, the substitution effect with respect to saving is positive. At the same time, assuming consumers desire a given level of future income, an increase in the rate of interest allows them to save less money in interest-bearing assets to attain some given level of future income. Thus the income effect with respect to saving would be negative. Determining the overall effect is an empirical problem since the relative sizes of the two effects cannot be determined a priori. Although there is a lack of unanimity, it is generally believed that the substitution effect outweighs the income effect resulting in an overall positive effect on saving.[39]

Given the difficulty in determining the net effect of interest rates on the rate of saving, the addition of inflation clearly complicates the analysis, particularly since nominal interest rates do not typically completely adjust for inflation.[40] When examining the effect of inflation on saving via the interest rate, two separate effects are actually at work. There is the effect of inflation on the interest rate, and the effect of the interest rate on saving.[41] As both of these effects are difficult to determine theoretically and empirically, it is understandable that this is the most

controversial of all the transmission mechanisms between inflation and saving.

There has so far been no consensus as to whether the interest elasticity of saving is positive, negative, or of any significance at all. The diversity of the results are largely due to the variety of definitions of the variables, functional forms and estimation methods employed. While some studies deal with nominal rates of interest, others deal with real rates. Studies are also divided over whether to use post-tax or pre-tax rates of return. There are also a variety of definitions of saving which have been looked at. Saving is generally treated as either the residual between income and consumption or as the increase in real asset holdings. Furthermore, the majority of the studies examine aggregate saving which, as noted by Wachtel (1980):

> ... may well obscure important aspects of the relationship since different saving components may respond to changes in interest rates in very different ways. Furthermore, inflation can affect the structure of interest in the economy which affects the composition of saving and perhaps the aggregate as well.[42]

Although the literature does not show complete agreement concerning the interest elasticity of saving, it may be said that the majority view the effect of interest rates on saving as positive.[43] Since inflation generally increases nominal interest rates, "the positive nominal interest

elasticity of saving may be viewed as an indirect positive inflation effect."[44]

Summary

The purpose of this chapter was to examine the various direct and indirect transmission mechanisms between inflation and saving which have been put forth to explain the "paradoxical" behavior of this relationship since the 1970s relative to that predicted by conventional theory. Of the direct and indirect effects [45] discussed, the real wealth, and in particular the uncertainty effect, have received the most widespread support. The money illusion and intertemporal substitution effects have generally been dismissed as major factors affecting the saving rate. Finally, the interest rate effect has been the subject of controversy and as a result no firm conclusion exists as to its importance in explaining saving behavior.

Before undertaking an empirical analysis of the relationship between inflation and saving in Canada, it will prove useful to examine the results obtained for other countries. The following chapter surveys this literature in an attempt to determine which variables have been most responsible for the increases in the rate of saving observed during the 1970s in the industrialized world.

NOTES TO CHAPTER TWO

1. For example, see Hansen (1970), pp. 127-128.

2. Henderson and Quandt (1971), pp. 23-24.

3. Since anticipated inflation does not change real income or real saving, any changes in "measured" income and saving resulting from inflation would have to be regarded as spurious. Since saving is determined residually, any change in measured income would correspondingly change measured saving while leaving real saving unaffected. See Jump (1980). He concludes that the inflation of the 1970s had only spurious effects on measured saving.

4. Branson and Klevorick (1969), p. 832. See also Henderson and Quandt (1971), pp. 105-107; and Quirk (1976), p. 94.

5. The bulk of the recent literature examining the effect of inflation on saving generally refers to the microeconomic foundations of consumption and saving behavior when mentioning that traditional theory predicts no change in the rate of saving resulting from perfectly anticipated inflation. For example, see Branson and Klevorick (1969), p. 832; Juster and Wachtel (1972a), p. 86; Bisignano (1977), p. 6; Wachtel (1977a), p. 560; Campbell and Lovati (1979), p. 3; and Jump (1980), p. 990.

6. For example, see Baird (1973), pp. 95-100.

7. For intertemporal consumption decisions under uncertainty, see Deaton and Muellbauer (1980), pp. 405-409.

8. See Juster and Wachtel (1972a), p. 86.

9. Jump (1980), pp. 992-993.

10. Campbell and Lovati (1979), pp. 3-6.

11. Howard (1978), p. 547. Other explanations for anticipated inflation having a negative impact on household saving have been put forth by Burch and Werneke (1975) and Steindl (1982). According to Burch and Werneke, anticipated inflation may reduce saving via buying consumer goods in advance of the expected increase in price, via money illusion resulting from an increase in nominal income giving the consumer an "artificial" sense of financial well-being, or some combination of money illusion and

buying in advance. (Burch and Werneke, 1975, p. 143.) The explanation offered by Steindl is that a fall in "real" incomes during a recession (prices rising faster than nominal income) is met by a reduction in savings as consumers attempt to maintain their customary standard of living. However, Steindl concludes that the positive effect of inflation on saving is due to uncertainty about real incomes outweighing the negative impact of anticipated inflation on saving behavior. (Steindl, 1982, p. 81.)

12. Juster and Wachtel (1972a), p. 86.

13. According to Burch and Werneke (1975), p. 145, fully anticipated inflation expected to be long lasting will encourage present consumption on durables at the expense of future consumption, thereby reducing the present saving rate. Anticipated inflation which is expected to be only moderate or temporary is expected to have the opposite effect. Present saving will be increased in order to take advantage of lower costs in the future.

14. Dorrance (1980), p. 18.

15. For example, see Bisignano (1975), p. 21.

16. For example, see Jarrett (1981), pp. 87-88 for Canada; Howard (1978), pp. 550-551 for Japan and the United States; and Fortune (1981), p. 140 for the United States.

17. Ouliaris (1981), p. 207.

18. Bulkley (1981), p. 133.

19. Wachtel (1977a), p. 560.

20. Ibid. If however, the advance expenditures are on investment goods, then the level of measured saving will increase.

21. Wachtel (1977b), p. 53.

22. Howard (1978), p. 548. Although Howard classifies search theory as an indirect effect, it can be considered as a type of intertemporal substitution and therefore is listed under direct effects in this study.

23. According to Katona, one area in economics in which psychological factors have been found to be effective is in explaining behavioral responses to inflation. (Katona, 1975, p. 132.)

24. Juster and Wachtel (1972a), p. 86.

25. "Precautionary" saving which is hypothesized to increase as a result of uncertainty caused by inflation, is referred to as the additional saving "caused by future income being random rather than determinate." (Leland, 1968, p. 465.)

26. Juster (1975), p. 8.

27. Campbell and Lovati (1979), pp. 3-4.

28. Wachtel (1977a), p. 561. For a more detailed explanation of the strong positive association between the rate of inflation and its variability during periods of high inflation, see Logue and Willett (1976), pp. 151-158.

29. Juster and Wachtel (1972a), p. 87.

30. Juster and Wachtel (1972b), p. 767.

31. For example, Canada's peak saving rate of 15.5 percent occurred in 1982 when a high rate of inflation (10.8 percent) was accompanied by a high rate of change in the unemployment rate (a 3.4 percentage point increase of 1982 over 1981). See the OECD Economic Outlook, no. 34, (December, 1983), p. 102; Table R10, p. 161; and Table R12, p. 163.

32. Bisignano (1975), pp. 21-23.

33. Wachtel (1977a), p. 562.

34. Freebairn (1977), p. 210.

35. Tait and Burnell (1976), p. 254.

36. Fortune (1981), pp. 134-135. As Fortune's hypothesis is able to explain either an increase or decrease in savings in response to inflation, it appears on the surface to be better able to explain the U.S. saving behavior of the 1970s than the other hypotheses which have been put forth. With the high rates of inflation experienced in the 1970s, the saving rate increased in the mid-1970s yet plunged by the late-1970s.

37. Bisignano (1975), p. 24.

38. For a detailed theoretical exposition of the relationship between consumption and the interest rate in a

two-period model see Wright, "Saving and the Rate of Interest" in Harberger and Bailey (1969), pp. 276-284.

39. Jarrett (1981), pp. 40-41.

40. Wachtel (1977a), p. 575.

41. Wachtel (1980), p. 161.

42. Ibid., p. 162.

43. See survey by Gylfason (1981), pp. 233-235, particularly Table 1, p. 234, which provides a comparison among empirical studies of the effects of interest rates and inflation on aggregate consumption and saving in the United States.

44. Wachtel (1977a), p. 569.

45. Several other indirect effects of inflation on saving which have been mentioned in the literature can be found in Howard (1978), pp. 547-548. One such effect is the change in the distribution of income among households caused by inflation. Differing propensities to save of the various groups will thus alter the aggregate saving rate. Another indirect effect through which inflation affects saving is the progressive income tax system.

CHAPTER THREE

LITERATURE REVIEW

Introduction

This chapter surveys the recent literature relevant to
an investigation of a relationship between inflation and
the saving rate. There are certain inherent difficulties
in categorizing the various studies and comparing their
results. One reason for this arises from the observation
that competing theories seem to perform equally well; another
arises from differences between long-run and short-run
consumption (saving) behavior.

The approach taken here is to outline the basic structure
of each of the traditional aggregate theories of consumption
and saving behavior. Following this is a summary of the
studies which have investigated the inflation-saving rate
relationship within one or a combination of these theories.
The last sections provide an overall assessment of existing
research in this area and a short summary.

Conventional Theories of Aggregate Consumption/Saving Behavior

Absolute and Relative Income Hypotheses

The formal theory of the consumption function originated with Keynes in 1935. He proposed that consumption (C), and thus saving (S), were simply a function of the level of current income (Y). Namely:

(3.1)   C = a + bY

where b is the marginal propensity to consume. The constant term (a) picks up the effect of all factors other than income which influence consumption. According to Keynes' "fundamental psychological law" an increase in income leads to a positive but smaller change in consumption. Therefore, as real income increases, a greater proportion of income is saved.[1]

By stressing consumption, the Absolute Income Hypothesis (AIH) treats saving as a residual and as such no formal motive for saving exists. The saving ratio can be derived from (3.1) to give the following:

(3.2)   S/Y = -a/Y + (1-b)

The AIH is a simple one-period model which assumes certainty and the absence of inflation.

The Relative Income Hypothesis (RIH), generally associated with Duesenberry (1949), stresses a consumption function in which consumption, and thus saving, depends on relative income rather than on the level of current income. The RIH marked the emergence of psychological motives for consumption and saving. It stresses the tendency for households to imitate others and to continually strive for and maintain a high standard of living.

In addition to comparing their consumption to that of their neighbors, households also compare their current consumption to their previous level of consumption. With respect to saving, the RIH states that the saving rate (S/Y) is a function of the ratio of current income (Y) to the previous peak level of aggregate income (Y').[2] That is:

(3.3) $S/Y = a + b(Y/Y')$

Like the AIH, the RIH is based on the assumptions of certainty and the absence of inflation. Any inflation which does arise is assumed to be perfectly anticipated and as a result has no effect on real consumption or saving. Although the RIH received support in the late 1940s and early 1950s, attention shifted to the concept of permanent income in explaining consumption and saving behavior.

Permanent Income Hypothesis

The Permanent Income Hypothesis (PIH) developed by Friedman (1957) marked the emergence of the wealth approach to the study of consumption and saving behavior. Here wealth (proxied by permanent income), as opposed to current income, is considered to be the major variable explaining consumption and saving. The primary motives for holding wealth are to smooth out the consumption stream over the individual's lifetime and to earn interest. Once uncertainty is introduced, another motive becomes the holding of precautionary reserves for emergencies. According to the PIH, an individual plans his consumption expenditures for a given time period on the basis of his long-run expected income rather than his current income.

There are several features underlying the PIH.[3] Both current income and current consumption expenditure are divided into permanent and transitory components. Permanent consumption is postulated to be proportional to permanent income. A simplifying assumption of the PIH is that the transitory and permanent components of both income and consumption are uncorrelated with one another and that transitory income is uncorrelated with transitory consumption. The latter assumption implies that all transitory income is saved. This is the most fundamental assumption of the PIH and the one which has been the most criticized. It follows

the Keynesian tradition of treating saving as a residual. Since the PIH asserts that consumption is determined by long-term factors, and that individuals attempt to maintain a planned level of consumption, deviations of current income from expected long-term income will not affect current consumption and will therefore be entirely reflected by changes in measured savings.

To the extent that saving depends on the ratio of measured to expected income, the PIH is similar to the RIH. In both cases saving is a function of relative income. The major difference between the two theories is that the RIH stresses past income, with the lag mechanism based on habit persistence, whereas the PIH stresses future income using a distributed lag based on rational utility maximization.[4]

Based on the above assumptions and the definition of saving as the residual between measured income and measured consumption, the following saving function can be derived[5]:

(3.4) $S = (1 - k)YP + YT - CT$

This saving function can be generalized as[6]:

(3.5) $S = k0 + k1YP + k2YT + u$

where S represents the level of saving and YP,YT and CT represent permanent income, transitory income and transitory consumption respectively. According to the strict version

of the PIH, the marginal propensity to save (MPS) out of transitory income (k2) should be equal to one. The error term (u) in equation (3.5) is assumed to reflect transitory consumption, a variable which is often ignored in empirical analysis.[7]

None of the recent literature being reviewed in this chapter involves empirical analyses based solely on the PIH. Those studies which do incorporate permanent income usually do so in combination with one or more other general frameworks such as the life-cycle hypothesis and the stock-adjustment model.

Life-Cycle Hypothesis

A further development of wealth theories takes into account demographic factors in addition to the economic factors stressed by the PIH. The Life-Cycle Hypothesis (LCH) began in the 1950s with Modigliani and Brumberg, but is most associated with Ando and Modigliani (1963). The LCH is similar to the PIH in several respects. Like the PIH, the underlying basis of the LCH is that individuals plan to smooth out their consumption expenditures or, alternatively, plan their saving decisions over their lifetime based on their long-run expected income. Thus, saving behavior is described within a multi-period framework. At any point in time any excess of current income above permanent income

will be saved. Like the PIH, the LCH divides income into transitory and permanent components, and it is assumed that they are uncorrelated.

The LCH differs from the PIH by stressing the importance of age on saving. The different age groups have different patterns of saving behavior. The LCH distinguishes three stages in an individual's life-cycle: a net borrower in his youth, a net saver during middle age while current income is at its peak level, and a dissaver during retirement. The aggregate saving rate will vary with the relative importance of the saver and dissaver groups in the population. Hence, the rate of population growth is an important demographic determinant of the saving ratio.[8]

The concept of multi-period analysis of saving in the life-cycle model has its roots in the idea of "hump saving" developed by Harrod in 1948. In a stationary economy Harrod assumed that aggregate saving is zero; that is, the positive saving of the middle aged group is just offset by the dissaving of the old and the borrowing of the young.[9]

The major determinants of saving according to the LCH are income and wealth. Unlike the PIH, the LCH explicitly incorporates a term for wealth, which in addition to real and financial assets, is defined to include the potential earning capacity of the individual. Planned savings of a household are revised in response to variations in accumulated

wealth.[10] As a result of maximizing his multiperiod utility function:

> ...the current consumption of the individual can be expressed as a function of his resources and the rate of return on capital with parameters depending on age.[11]

To make the theory more precise, two simplifying assumptions are made. The first is that there is no estate motive. Thus saving is only undertaken for the purpose of future consumption. The LCH, unlike the PIH, assumes that the MPS out of transitory income is less than unity and is a function of age. The second assumption, namely the proportionality hypothesis, is that consumption is a constant proportion of lifetime income. Thus, consumption in each time period is independent of the level of income in the same period.[12]

According to the LCH, the total consumption, C(t), by an individual is proportional to the present value of total resources accruing over the remainder of his life. The total resources are the sum of an individual's wealth from the previous period, A(t-1), present non-property income, Y(t), and expected future non-property income, $Y^e(t)$. To obtain an aggregate consumption equation, consumption for all individuals within a particular age group must be totalled and then aggregated over all age groups. The aggregate

consumption function which is employed in time-series analyses of consumption and saving behavior is as follows:

(3.6) $C(t) = b1A(t-1) + b2Y(t) + b3Y^e(t)$

The personal saving rate may be derived by subtracting equation (3.6) from income, $Y(t)$, and dividing through by $Y(t)$:

(3.7) $S(t)/Y(t) = -b1[A(t-1)/Y(t)] + (1-b2) - b3(Y^e(t)/Y(t))$ [13]

Like the two previous conventional models examined, the LCH does not incorporate a term representing the price level or inflation. Thus, an implicit assumption underlying this model is that if inflation exists it is fully anticipated and as a result has no effect on the saving rate. The strict versions of both the LCH and PIH have not performed well in empirical studies. A major simplifying assumption made by both models, the proportionality hypothesis, has been thoroughly refuted. The assumption that the MPS out of transitory income is equal to unity has also been refuted.[14] However, modifications to the basic hypotheses have performed better than the stricter versions.[15] One such modification is to explicitly incorporate a price term to capture the effect of inflation on saving behavior.

Stock-Adjustment Model

The general stock-adjustment model developed by Houthakker and Taylor in 1966 (hereafter referred to as the H-T model) considers all consumer decisions to be explained by a dynamic model in which current decisions are influenced by past behavior. The H-T saving model is a distributed lag model in which current consumption and saving behavior depends on current as well as past values of the explanatory variables.[16]

In the case of the saving decision, current saving, $S(t)$, depends on the current stock of financial assets, $A(t)$, and current income, $Y(t)$, as follows:

(3.9) $S(t) = a + bA(t) + cY(t)$

where c is the instantaneous marginal propensity to save.

This theory is a combination of two views regarding stock adjustment, each having an opposite effect on the sign of the coefficient b.[17] In the case of a consumption decision, habit persistence implies that b is positive, as the link between current and past purchases is one of habit formation. The stock adjustment effect incorporates depreciation and applies to durable goods. The more stock one has of a particular commodity, the fewer current purchases will be required, and thus the coefficient b will be negative. The overall sign of b depends on the relative importance of

the two effects concerning the particular consumer decision (consumption or saving) in question.

To simplify the model, Houthakker and Taylor assumed the stock of assets to be nondepreciating, and thus the H-T model is often referred to as the "zero-depreciation" theory of saving. Since the stock of financial assets is nondepreciating, the rate of change of this stock, $\dot{A}(t)$, is equal to current saving at time t:

(3.10) $\dot{A}(t) = S(t)$

The reduced form of equation (3.9) is as follows: -

(3.11) $S(t) = B1S(t-1) + B2 \Delta Y(t) + u(t)$

with an error term, u(t), added.[18]

The underlying basis of the H-T model is that "the consumer adjusts his saving so as to bring his stock of financial assets into line with his level of income."[19] By assuming zero-depreciation, saving must be zero in a long-run, steady-state equilibrium.

Like the other traditional models, the H-T model does not formally incorporate a term for the rate of inflation. As will be seen in the section which reviews the studies based on the H-T framework, the models which explicitly included an inflation term explained the saving rate better

than those which were based on the strict form of the H-T model which did not include a price variable.

Effects of Inflation in a LCH Framework

Branson and Klevorick (1969) based their empirical work on the life-cycle model, using a price term to test for the existence of money illusion. Real per capita consumption, C, was regressed on real per capita net labor income, y, real per capita wealth, w, and price, P, defined as the Consumer Price Index (CPI). A distinguishing feature of their study was the inclusion of each of the independent variables in the form of a distributed lag. The estimating equation used was:

$$(3.12) \quad \ln C(t) = B0 + \sum_{i=0}^{I} B1 \ln y(t-i) + \sum_{j=0}^{J} B2 \ln w(t-j) + \sum_{k=0}^{K} B3 \ln P(t-k) + e(t)$$

The lagged independent variables were estimated using the Almon technique with third degree polynomials. Quarterly U.S. data for the period 1955:1 to 1965:4 was used in the estimation. The existence of money illusion, whereby "a proportional increase in money income, money wealth, and the price level leads to an increase in the level of real consumption," would imply a positive coefficient on the price variable.[20]

The coefficients for all three explanatory variables were found to be positive as expected and highly significant,

with a goodness-of-fit coefficient (R squared) of 0.9984, and a Durbin-Watson statistic (DW) of 1.757. The results were found to be insensitive to the choice of price and income series used.

Branson and Klevorick concluded that the price level had a significant positive effect on the level of real per capita consumption. In other words, their results supported the existence of short-run money illusion in the United States during the period 1955 to 1965. From this it may be deduced that the price level had a negative effect on saving.

A major study of saving behavior in Canada based on the life-cycle model was undertaken by Jarrett of the Conference Board of Canada (1981). As well as looking for an inflation effect on saving, the uniqueness of this study is reflected in the attempt to incorporate institutional factors (namely tax designed savings incentives) as explanatory variables of the saving rate, in addition to the traditional economic and demographic factors associated with the LCH. The institutional factors were incorporated through the use of participation rates for the Registered Retirement Savings Plan (RRSP) and the Registered Home Ownership Savings Plan (RHOSP).

The saving rate was regressed on the ratio of financial wealth to personal disposable income (PDI), the ratio of nonfinancial wealth to PDI, expected inflation, unexpected

inflation, the RRSP participation rate and the RHOSP participation rate. The expected inflation rate was calculated as a twelve quarter lag on actual past inflation rates. Alternate measures of the expected inflation rates were calculated using lagged values of the rate of change in the stock of the money supply. The inflation variables capture the effect of consumer uncertainty regarding future income levels on the saving rate.

The regression was run using quarterly Canadian data for the period 1965 to 1978. Further, the equation was estimated in rate form in an attempt to reduce the problem of multicollinearity which often occurs in time-series analysis.[21] Because of the high degree of correlation between the RRSP and RHOSP variables, they were included separately in two regression equations.

In both equations all of the coefficients had the expected sign (those for the wealth variables were negative, while those for the inflation and institutional variables were positive) and all were statistically significant with two exceptions. These were the coefficient for the financial wealth ratio in both equations, and the coefficient for unanticipated inflation variable in the RRSP equation. Both equations had an R squared of approximately 0.9 and a DW of approximately 2.0. Overall, the results supported the positive influence of inflation on the saving rate via the

uncertainty effect, as well as the hypothesis that personal
tax incentives for saving contributed to the increasing saving
ratio experienced in Canada during the 1970s.

Effects of Inflation in the H-T Framework

Houthakker and Taylor (1970) extended their basic model
of saving (see equation(3.11)) to include a price variable
and an interest rate variable. The rationale for including
inflation as an explanatory variable is that many financial
assets are fixed in nominal value. Thus the real value of
such assets is negatively affected by general price increases.
Since the real wealth effect is based on the notion that
individuals wish to maintain a constant wealth-income
relationship in real terms, the rate of saving is hypothesized
to be positively related to the rate of inflation.[22]

The other explanatory variable added to the model is
the rate of interest which reflects the motive to save income
earned from assets.[23] The extended H-T model of saving
gives the following reduced-form estimating equation:

$$(3.13) \quad S(t) = B1S(t-1) + B2\Delta Y(t) + B3\Delta P(t) + B4\Delta i(t) + u(t)$$

where the variable $\Delta P(t)$ represents the first difference
changes in prices and $\Delta i(t)$ represents the first difference
changes in the nominal interest rate. The coefficient B3
is expected to be positive for the aforementioned reasons.

However, the offsetting income and substitution effects makes it difficult to determine the sign of B4 a priori. It will depend upon the relative strengths of the two effects.

Houthakker and Taylor (1970) tested this extended equation for the U.S. and found the coefficient of the inflation variable to display a positive sign and the coefficient of the interest rate variable to display a negative sign. Both coefficients were statistically significant at the 5 percent level. The equation performed well with an adjusted R squared of 0.828. Houthakker and Taylor reported a DW statistic of 2.12 and concluded that autocorrelation was not a problem. However, in order to test for autocorrelation in a model which includes a lagged dependent variable, the h-statistic must be calculated. The DW approach is strongly biased against finding autocorrelation in this type of model as the DW statistic will often be close to 2.0 whether or not autocorrelation is present.[24]

Since the sample period used (1953 to 1966) covered a period of relatively low and stable rates of inflation, the results obtained cannot be considered as strong support for the hypothesized positive influence of inflation on the saving rate during the 1970s. However, it did make an important contribution in that it was one of the earliest studies to explicitly include an inflation variable within a traditional framework.

Taylor (1971) modified the basic zero-depreciation saving model he and Houthakker developed by disaggregating income to test the influence of the various types of disposable income on personal saving. Since different marginal propensities to save are attached to the different types of income, the specific composition of income is hypothesized to have some effect on saving. Disposable personal income was disaggregated into the following components: labor income, property income, transfer payments, personal contributions for social insurance and personal tax and nontax payments. Taylor regressed total personal saving on lagged saving, the first differences of the components of disposable income, and the first difference of the nominal interest rate.

Two models were tested, one in aggregate form and one in per capita form. Both models performed better when disposable income was disaggregated than when it was not. All of the coefficients displayed the correct signs and were statistically significant, with the exception of the property income variable, at the 5 percent level. Taylor found the coefficients on the different types of income to be substantially different from one another. Another finding was that the interest rate variable was more significant when using disaggregated income than when using disposable income alone in the equation.

Taylor also tested the stability of the model by splitting the sample period into two subperiods and then applying the F-test.[25] The hypothesis that the two subperiods have a common structure was not rejected.

Taylor's basic conclusion was that a major explanation for the high saving rate in 1970-1971 was the sharp increase in transfer payments, of which a large proportion is saved. This implies that the rate of saving rises when the composition of income shifts toward transfer payments. Although this study was undertaken before the dramatic change in saving behavior of the 1970s, and does not examine the effect of inflation on saving, it makes an important contribution to the study of saving behavior. It is one of the few studies to examine what effect different components of disposable income have on saving.

In a later study, Taylor (1974) included inflation in his analysis. In this study he investigated the effect price expectations have on the level and distribution of household saving, using both cross-section and time-series data. The model used in this study was based on that in his 1971 study. Three measures of saving were used -- personal saving, net saving, and gross saving -- as well as eleven dependent variables representing household investment.

Using quarterly U.S. data for the period 1954 to 1970, the coefficient for the price expectations variable was found

to be positive and significant for all three measures of saving. These results are consistent with the view that inflation increases uncertainty regarding the future and thus leads individuals to increase their saving rate. The time-series results consistently indicated that price expectations had a significant impact on the level of household saving as well as on the household's decision to hold particular types of assets. As in his earlier study, these results indicated different coefficients for the various components of income, with a very high MPS out of transfer payments, and a substantial negative coefficient on personal contributions to social insurance and personal taxes.

The first study which formally incorporated inflation into the consumption-saving decision based on the H-T stock-adjustment framework was undertaken by Juster and Wachtel (1972a). They examined the effect of inflation on saving indirectly by looking at the role of anticipated and unanticipated inflation on consumer "spending" behavior. In their analysis saving was treated as a residual rather than as a decision per se.

They concluded that over the sample period 1953:4 to 1971:2, the primary effect of unanticipated inflation was to reduce spending and encourage saving because unanticipated inflation increases uncertainty regarding real income expectations. Although focussing on consumption, this study

makes an important contribution in the sense that it is one of the first studies to introduce the link between inflation and uncertainty and its effects on the consumption-saving decision.

In their second article, Juster and Wachtel (1972b) focussed entirely on saving to investigate the effect of anticipated and unanticipated inflation on the decision to save. Two types of models were tested -- a forecast model developed by the authors (J-W model) and the H-T model. In their forecast model, Juster and Wachtel regressed the saving rate (the ratio of personal saving to personal income) on three general sets of independent variables: personal taxes and transfer payments, levels and changes of the unemployment rate, and anticipated and unanticipated inflation. In this and subsequent studies, they measured inflationary expectations by the mean expected price change obtained from the Survey Research Center (University of Michigan) consumer opinion survey data.[26] Uncertainty regarding inflation was generally calculated as the standard deviation of the observed distribution of expected price changes.[27] Several versions of this basic model were estimated for the U.S. for the period 1954:1 to 1972:3.

One variation of the model included the nominal interest rate as an independent variable along with the variables mentioned above. The coefficients for the level of

unemployment, taxes, and the expected rate of inflation were all negative as expected. The coefficients for the change in the unemployment rate, transfer payments, and the actual rate of inflation were all positive as expected. All variables with the exception of the rate of interest were statistically significant at the 5 percent level. The positive coefficients of unanticipated inflation and change in unemployment both support the uncertainty effect. This equation performed quite well, explaining 70 percent of the saving rate. However the DW statistic of 1.02 indicated a problem with autocorrelation. When the equation was reestimated with the Cochrane-Orcutt iterative technique to correct for the autocorrelation, the t-statistics were all reduced and the coefficients of both inflation variables became statistically insignificant.

Dropping the interest rate variable from the basic model resulted in statistically stronger inflation effects. Anticipated inflation was found to have a small positive effect on the saving rate while unanticipated inflation had a large positive effect.[28]

A shortcoming of the J-W model is that it does not take account of the fact that many of the independent variables are expected to have a lagged influence on the saving rate. The results of this model were compared to the dynamic H-T model which incorporates these lagged effects. The level

of real personal saving was regressed on the first differences of various components of income and the nominal interest rate.

The results were similar to those obtained by Taylor (1971). All of the coefficients displayed the correct sign and all were significant, with the exception of that on the first difference of the interest rate and that on the first difference of property income. When the rate of price change was added to the equation, it's coefficient was found to be positive and significant only when the interest rate variable was excluded.

Both of the Juster and Wachtel studies were undertaken in 1972 prior to the dramatic jump in the saving rate which accompanied high rates of inflation in the mid-1970s. However, these studies have made important contributions to this field by formally incorporating inflation as well as unemployment into the traditional H-T model of saving. Juster and Wachtel were the first to attempt to quantify the impact of uncertainty on consumption and saving behavior. In many subsequent studies, including inflation and unemployment as explanatory variables to reflect uncertainty has become standard procedure in the investigation of the changing saving behavior of the 1970s.

Juster (1975) examined the role of inflation in creating uncertainty and their joint influence on the spending and

saving behavior of U.S. households. The intention of his study was to examine short-run or impact effects of inflation on saving. He estimated two kinds of uncertainty: uncertainty regarding future money income which was proxied by changes in the level of unemployment, and uncertainty regarding real income which was proxied by the rate of change in money income and the rate of change in prices.

The equation was estimated for various sample periods from 1949 to 1973. The personal saving rate was regressed on the ratio of personal tax payments to income, the ratio of social security taxes to income, the ratio of transfer payments to income, the unemployment rate, the four quarter change in the unemployment rate, the percentage change in CPI, the mean expected price change, and the variance in expected price change. The results were consistent with a priori expectations. The results supported the uncertainty effect of inflation on saving, with the variance term the strongest statistically of the price variables employed. The model was tested for stability and found to be stable over the entire sample period.

Juster and Taylor (1975) collaborated on a study in which they combined the role of uncertainty with disaggregated income to test for uncertainty effects. The model used was based on the H-T framework with lagged saving and the first differences of the various components of disposable income

as explanatory variables of the level of personal saving. This was precisely the model used by Taylor (1971). Added to this equation were a number of variables including the interest rate and change in the interest rate, and various direct uncertainty measures to test the inflation-saving hypothesis -- the first difference of the expected rate of inflation, the mean of expected price change, the variance of the expected price change, and the rate of unemployment. The price expectations data were obtained from the Survey Research Center survey.

Two of the equations estimated interacted the interest rate and uncertainty variables with the level of disposable income "to allow for the possibility that the effects of uncertainty on saving vary systematically with the level of income."[29] Juster and Taylor concluded that the results did not support this view.

Using U.S. data for the period 1953 to 1973, the uncertainty measures, with the exception of the unemployment rate, displayed the expected signs. Of the four uncertainty measures tested, the variance mean expected price change had the strongest effects statistically. Juster and Taylor interpreted this measure as the uncertainty regarding "plausible upper limits to the amount of price inflation." By including the uncertainty variables the statistical significance of the income coeficients was not altered.

The coefficient for the change in transfer payments remained large. The results obtained in this study strongly supported the conclusion that uncertainty regarding future nominal and real income positively influences saving behavior.

Another study based on the general framework of the H-T stock-adjustment model was undertaken by Wachtel (1977a) for the purpose of identifying the existence of gross inflation and uncertainty effects. The estimating equation was the reduced-form of the H-T model assuming the stock variable follows a proportional depreciation, rather than a zero-depreciation scheme. Personal saving was regressed on lagged saving, real disposable income and inflation induced uncertainty. The estimating equation was:

$$(3.14) \quad S(t) = b0 + b1S(t-1) + b2_Y \Delta Y(t) + b3_Y Y(t-1)$$
$$+ b2_V V(t) + b3_V V(t-1)$$

where S is real saving per household, Y is real disposable income per household, and V represents a proxy for the direct measure of inflation uncertainty, measured by

> ...the variance among households in the expected rate of inflation derived from the Survey Research Center surveys. V is the average variance in the surveys conducted during the two quarters prior to the current period.[30]

Various definitions of saving were used -- National Income Accounts (NIA) personal saving (PS), Flow of Funds

(FOF) net saving (NS), components of net saving (acquisitions of financial assets, increases in liabilities, and net physical investment), and net financial investment.

The strongest results were obtained for the regression employing the NIA definition of personal saving as the dependent variable. All of the coefficients displayed the correct signs and all, except for lagged income, were statistically significant at the 5 percent level of significance. This regression had the highest long-run uncertainty effect of all the regressions.[31] The long-run effect was negligible for FOF saving. Wachtel concluded that autocorrelation was not present based on the DW statistic, which he incorrectly used to test for autocorrelation.

The model was tested for stability by dividing the sample in half for the subperiods 1955:1 to 1964:4 which was characterized by relatively little inflation, and 1965:1 to 1974:3 which saw the acceleration of inflation. The F-test could not reject the null hypothesis of no significant structural change, suggesting that uncertainty generally had the same effect throughout the entire sample period. Significant structural change at the 5 percent level, did however, show up in the NS equation.

The remaining equations tested the various components of FOF saving. Wachtel concluded from the results of these regressions that the major reaction to uncertainty caused

by inflation was to increase saving by reducing future liabilties, rather than to increase precautionary balances.

Wachtel's results strongly supported the hypothesis of a positive relationship between saving and inflation through the uncertainty effect for real NIA saving over the period 1955:1 through 1974:3. Although the uncertainty effect showed up in most of the equations estimated, the size of the effect was sensitive to the source of saving data used. This can be attributed to the statistical discrepancies and conceptual differences which exist in the NIA and FOF accounts. However, it is not clear which data source is the correct one to use. The general model was modified to include the actual and expected rate of inflation, instead of the variance term, as well as the real rate of interest. Inflation was found to exert a doubly strong positive effect on saving through both the uncertainty and interest rate coefficients. The uncertainty effect was found whether uncertainty was represented by either the survey variance or the actual rate of inflation. Using the actual rate of inflation led to a significant positive influence of inflation on both NIA and FOF saving. Wachtel's results are consistent with the previous studies surveyed which support the uncertainty effect of inflation on saving.

Campbell and Lovati (1979) respecified Wachtel's estimating equation to include measures of both unanticipated

and anticipated inflation. By testing the long-run effect of inflation on saving, they examined whether the positive influence of inflation on saving was more than a temporary phenomenon. Fully anticipated inflation is expected to have no significant long-run effect on saving. Unanticipated inflation is expected to have a positive long-run effect resulting from the uncertainty concerning future prices and real income created by higher levels and greater variability of inflation.

The variables used were the same as those used by Wachtel (i.e. personal saving regressed on lagged saving, real disposable income and inflation uncertainty), with the exception that inflation was separated into anticipated and unanticipated components. Anticipated inflation was initially proxied by a 20 quarter rate of change in money supply as measured by M1. When unanticipated inflation was proxied by the difference between a four quarter rate of change in the CPI and the M1 variable above, the results of the regression were generally consistent with the a priori expectations.

For NIA saving, the coefficient for anticipated inflation was found to be statistically insignificant for the sample periods 1955 to 1974 and 1955 to 1978, as was the long-run inflation effect. The unanticipated inflation coefficient was positive and significant; however, in neither period

was its long-run effect significantly different from zero at the 5 percent level.

The equation was reestimated using lagged and first differences of the actual rate of inflation, measured by a four quarter rate of change in the CPI, rather than separate variables for unanticipated and anticipated inflation. The results were identical. Although inflation did exert a positive and significant influence on NIA saving, this relationship was statistically insignificant in the long-run. Therefore, with respect to NIA saving, the existence of a long-run positive effect of inflation on saving was not supported.

When the equation was estimated for FOF saving, neither anticipated nor unanticipated inflation had a significant impact on saving in either sample period. Substituting actual inflation for the unanticipated and anticipated inflation variables did not alter this result.

Campbell and Lovati found no conclusive evidence to support a positive long-run effect of inflation on saving. They suggested that the positive effect of unanticipated inflation found on NIA saving merely reflected a temporary phenomenon. Their results were also highly sensitive to the choice of saving data and the measure of anticipated and unanticipated inflation used. No inflation effects whatsoever were found for FOF saving. Unanticipated inflation

was found to have a positive and significant long-run effect on the "components" of FOF saving only, over the 1955 to 1978 sample period.

Unlike the previous studies reviewed based on the H-T framework, Campbell and Lovati did not support the uncertainty effect caused by high and variable rates of inflation as a major factor contributing to the rising saving rates in the U.S. over the period tested. However, it should be noted that most of the studies which have found a positive relationship between inflation and saving were undertaken prior to 1975, when both the rate of inflation and the rate of saving were relatively low and stable.[32]

Effects of Inflation in Hybrid Models

Several studies have combined two or more of the general frameworks previously outlined in an attempt to develop a more refined model of saving behavior. Also included in this section are several studies which have tested and compared more than one specific type of model.

Howard (1978) estimated a saving function based on a combination of the LCH and PIH frameworks for five major industrialized countries -- Canada, Germany, Japan, the United Kingdom and the United States -- to examine the inflation-saving link. He regressed the level of real per capita personal saving on variables for permanent and

transitory real personal disposable income (from the PIH), holdings of real liquid assets (from the LCH), the nominal interest rate, the actual and expected rate of inflation, the unemployment rate, and the first difference of the unemployment rate. The expected inflation variable was generated autoregressively as a function of time and past inflation rates. The unanticipated inflation effect was represented by the coefficient of the actual inflation rate, while the sum of the coefficients on actual and expected rates of inflation plus the nominal interest rate represented the impact of anticipated inflation on saving. A problem not addressed by Howard was the possibility of multicollinearity arising from the simultaneous inclusion of the nominal interest rate and inflation as explanatory variables.[33]

The coefficients of both income variables were found to be positive and significant for all of the countries examined over the sample period 1965 to 1976, with the MPS out of transitory income exceeding the MPS out of permanent income in each case. For all countries the liquid assets coefficient was found to be negative and significant, as expected, lending support to the existence of a real wealth effect in each of the countries examined. The coefficient for the interest rate was found to be statistically significant (and positive) only for the United Kingdom.

The coefficient of actual inflation, representing the effect of unanticipated inflation, was positive and statistically significant only for the U.S. and Japan. Expected inflation exerted a significant influence on saving only for Japan, displaying a negative coefficient. However, this coefficient was positive and almost significant for Canada and the U.S. (with t-ratios of 1.72 and 1.92 respectively). The effect of anticipated inflation was found to be positive and significant for the U.K. and the U.S., and almost so for Canada. The anticipated inflation effect was negative for both Japan and Germany, but statistically significant only for Japan.

At most, only one of the unemployment coefficients was significant in each country, and neither was significant in Japan. The coefficient for the level of unemployment was positive and significant for both Germany and the U.S., supporting the hypothesis that fear and uncertainty created by unemployment has a positive influence on personal saving. For Canada and the U.K. the effect of a change in unemployment was found to be positive and significant. All equations exhibited a great deal of explanatory power, with an adjusted R squared of 0.82 for the U.S. and between 0.94 and 0.99 for the remaining countries.[34]

In general, the results supported a positive relationship between inflation and personal saving through the direct

effect of uncertainty and indirectly through the real wealth effect. In addition, unemployment was also found to positively influence saving behavior through uncertainty effects for all countries except Japan.

Gylfason (1981) developed a model which combined characteristics of the LCH, the PIH and the H-T models. His model included a wealth variable similar to the LCH and PIH, and a lagged dependent variable, as in the H-T model. The primary purpose of his study was to examine the effect inflation as well as interest rates have had on aggregate consumption in the U.S. during the postwar period, and to test the sensitivity of the results to the choice of variables, data specification and sample period employed.

The ratio of real consumption to real personal disposable income was regressed on the nominal interest rate, the expected rate of inflation derived using adaptive expectations, the logarithm of the asset-income ratio, and the logarithm of the lagged average propensity to consume. The equation was estimated with OLS using U.S. quarterly data from 1952:3 through 1978:3. All of the coefficients displayed the correct signs. The coefficient for the interest rate was negative and significant, and the coefficients for the remaining independent variables were found to be positive and significant at the one percent level. The Durbin h-statistic was below

the critical level, indicating no serial correlation among the residuals.

Two additional explanatory variables were added to the basic equation to test the effect of general uncertainty about the future and uncertainty about the future rate of inflation. These two effects were proxied by the rate of change in the unemployment rate, and the standard deviation of the rate of inflation. Since both variables are hypothesized to positively influence the saving rate, they were expected to have a negative influence on the average propensity to consume.

Including both variables in the equation did not alter the significance of the original variables. The coefficient on the standard deviation of inflation was negative and statistically significant. This supported the hypothesis that increasing uncertainty about the future rate of inflation reduces the average propensity to consume, thereby increasing the saving rate. However, the unemployment variable displayed a statistically significant positive coefficient, contrary to expectations.

Replacing the expected rate of inflation with the actual rate adversely affected the results. The adjusted R squared dropped as did most of the t-ratios. Using a long-term as opposed to a short-term rate of interest did not alter the

original results. The sample was split in half to test for structural change and was found to be stable.

The results obtained in Gylfason's study supported the real wealth effect, as well as the uncertainty effect of future rates of inflation on saving as proxied by the standard deviation of the rate of inflation. However, no clearcut explanation exists for the positive coefficient found on the change in unemployment. This result contradicts those obtained in many other studies.

Burch and Werneke (1975) developed a model for the U.S. which combined characteristics of the PIH and the H-T stock-adjustment model. The objective of their study was to test for short-run phenomena such as money illusion and the role of wealth in short-run spending and saving decisions. Their model employed a stock-adjustment mechanism to take into account habits represented by established expenditure patterns, and a wealth adjustment process spread over several quarters.

Real personal NIA saving as a ratio of real personal NIA disposable income was regressed on lagged personal consumption expenditures, the quarterly change in disposable income [35], an Almon four-quarter distributed lag wealth variable represented by net financial assets from the FOF account, and the percentage change in prices from the previous year. All independent variables, with the exception of the

price variable, were expressed as ratios of lagged personal disposable income and were expressed in real terms.

The model was tested alternatively with the CPI and the Personal Consumption Expenditure (PCE) deflator as the price variable over the period 1956 to 1969. The coefficients displayed the correct signs and were all statistically significant at the 5 percent level for all of the final equations estimated. The equations deflated by the CPI performed slightly better than those deflated by the PCE deflator. Although the t-ratios of the expenditures, income and wealth coefficients were similar, the t-ratios of the price coefficients in the equations deflated by the CPI were higher as were the goodness-of-fit coefficients. In both sets of equations, using the PCE deflator as the price variable provided higher t-statistics and higher adjusted R squared values than did using the CPI. The equations which omitted the price variable had less explanatory power, although the remaining independent variables were all significant and displayed the correct signs.

The importance of distinguishing between unanticipated and anticipated inflation is well established. Burch and Werneke modified their basic model to include a price anticipation variable in addition to the actual inflation variable already in the equation. The price anticipation variable was represented by five measures obtained from the

Survey Research Center quarterly consumer survey questions regarding price expectations. The Beta coefficients [36] for anticipated and actual price variables in most of the equations indicated that actual prices explained much more of the variation in saving than did price expectations. The results therefore supported the hypothesis that anticipated inflation has had relatively little impact on the saving rate.

Burch and Werneke concluded that American consumers "increase their rate of saving in response to inflationary pressures which in the short-run they regard as moderate or of short duration."[37] The results also suggested that substitution of lower quality goods may be important and a means by which a portion of the extra saving is realized during times of inflation. This obviously refutes the existence of money illusion since downgrading purchases is inconsistent with feeling financially better off. Overall the results supported the real wealth effect of inflation on saving.

Deaton (1977) developed his own disequilibrium model of saving behavior containing characteristics of the PIH and H-T frameworks. From this model he derived an estimating equation to examine the effect of unanticipated inflation on involuntary saving.

Deaton's model contained three terms -- a lagged saving ratio derived from the equilibrium consumption function, unanticipated changes in income (deviations of actual from expected permanent income) and unanticipated changes in prices (deviations of the actual from the expected price level).[38] The first difference in the saving rate was regressed on these three variables.

The lagged saving rate coefficient was found to be negative as expected. The coefficient for transitory income, derived by subtracting a weighted average of actual income growth rates from the actual income growth rate, was found to be positive and significant. The unanticipated inflation variable was derived by subtracting anticipated inflation, calculated as a weighted average of the actual past rates and a base rate, from the actual rate of inflation. The coefficient for this variable was found to be positive as expected, and significant at the one percent level. Upon splitting the sample in half, inflation was found to positively affect saving in both periods. The results obtained by Deaton for the U.S. and Great Britain over the period 1954 to 1974 supported the hypothesis that unanticipated inflation positively influences the saving rate (although the equations for both countries had a very low R squared).

Another study incorporating characteristics of both the PIH and H-T models was undertaken, using United States data

for the period 1954 to 1978, by Fortune (1981). His approach was similar to that of Deaton (1977) with the exception that Fortune examined the relationship between "expected" inflation and personal "voluntary" saving. His study focussed on the effect of inflation on saving via the real wealth effect. He hypothesized that whether nominal wealth is rearranged or increased depends on whether inflation is anticipated for durables or for nondurables.

The model and resulting estimating equation employed in this study was identical to that developed by Deaton (1977).[39] The expected inflation rates were estimated using a distributed lag model. As expected, the coefficient for anticipated inflation of nondurables and services was found to be positive and significant, while the coefficient for anticipated inflation of durables was negative and significant. These results supported Fortune's hypothesis regarding the real wealth effect -- namely that the effect of anticipated inflation on the saving ratio is dependent upon the overall effect of anticipated inflation on durables and nondurables.

Koskela and Viren (1982) also tested Deaton's "money illusion" saving function and applied it to Finnish quarterly and annual data from 1959 to 1977. The equation was originally estimated by OLS with the Hildreth-Lu procedure for correcting for autocorrelation. The results were similar to those

obtained by Deaton. All of the coefficients displayed the correct signs and all were highly significant. They also obtained goodness-of-fit statistics which were slightly higher than those obtained by Deaton. Variables for the unemployment rate and size distribution of income were introduced, neither of which were found to be statistically significant. By splitting the sample period in half, the saving function was found to be stable over the entire period.

Testing this equation on data for ten OECD countries covering the period 1961 to 1978 provided further support for the positive relationship between unanticipated inflation and the saving rate.

Davidson and MacKinnon (1983) developed and compared several models based on Deaton's involuntary saving hypothesis and the overmeasurement hypothesis (i.e. that the observed relationship between inflation and the rate of saving is largely a statistical mirage). These were estimated using data for the United States and Canada, covering the period from 1954 to 1979.

Contrary to the results reported in the several preceding studies, they obtained little evidence supporting the hypothesis put forth by Deaton (only slight support was found using U.S. data, and none was found using Canadian data) and concluded that the results for both countries strongly support the overmeasurement hypothesis.

Another study which tested the inflation-saving hypothesis using a model based on both the PIH and H-T stock-adjustment frameworks was undertaken by Bisignano (1977) for the United States. He estimated separate equations for the rate of personal saving and the level of personal saving for the sample period 1955:1 to 1976:3.

The personal saving rate was regressed on the lagged saving rate, the ratio of transitory to current income, the rate of unemployment, the rate of anticipated inflation, and the rate of unanticipated inflation. Bisignano's approach differs from the previous studies by his derivation of the anticipated inflation variable. Rather than using adaptive expectations, he generated anticipated inflation (from the Fisherian interest rate equation) as the difference between the nominal and real interest rate. A rough estimate of unanticipated inflation was derived simply by subtracting anticipated inflation from the actual rate of inflation.

The results were as expected. The coefficients for the unemployment rate, the transitory/observed income ratio, and the unanticipated inflation variables were all positive and significant reflecting the uncertainty regarding employment, unanticipated income and inflation respectively. All three measures of uncertainty contributed to the increase in the saving rate. The coefficient for the anticipated

inflation variable was found to be statistically insignificant, as expected.

Bisignano then estimated an equation in which the level of personal saving was regressed on the same set of independent variables with permanent and transitory real income entering the equation as separate independent variables. The equation was estimated in this form in order to determine whether inflation had any effect on saving when income was held constant. Also added to the equation was real per capita money balances. The coefficient of this variable was negative and significant indicating support for the real wealth effect. The results indicated that unanticipated inflation affects the level of saving and the rate of saving in much the same way.

The study by Freebairn (1977) compared regressions employing Australian annual data for the period 1948/1949 to 1974/1975 based on several different types of models -- the Absolute Income model, the Habit-Persistence (Stock-Adjustment) model, the Normal Income (Permanent Income) model and the Desired Assets model. Each of these basic models was expanded to include the rate of inflation as a proxy for money illusion, real balance and uncertainty effects and the change in the rate of inflation as a proxy for money illusion and uncertainty.

The dependent variable for all regressions was the ratio of consumption expenditures to personal disposable income. The coefficient of the change in the rate of inflation was found to be negative and significant for most of the equations, implying a significant positive effect of this variable on the saving rate. This is what we would expect and provides support for the hypothesis that inflation, and especially a rising rate of inflation, generates uncertainty regarding future real income levels and this positively affects the saving rate. The coefficients for the interest rate, the unemployment rate and the change in the unemployment rate were generally found to be insignificant when added to the equations. Stability tests found most of the equations to be stable throughout the sample period. Generally, the results suggested that the real wealth and uncertainty effects outweighed the money illusion and intertemporal substitution effects as having the major influence on the saving rate.

Another study which tested and compared several models for Australia was undertaken by Ouliaris (1981) for the sample period 1961:3 to 1979:2. The major objective of his study was to examine the relationship between the post-tax real interest rate and the personal saving ratio.[40] The equations estimated by Ouliaris were based on three conventional models of the consumption-saving decision -- the PIH model, Zellner's (1957) liquid assets model and Patinkin's

(1965) non-human wealth model -- extended to allow for inflation and uncertainty effects on saving behavior.

The variable for price expectations was generated using adaptive expectations, regressing the inflation rate against Almon lag variables of past inflation rates. The unanticipated inflation variable was represented by the forecast errors resulting from the predictions used for the price expectations series.

Of the equations estimated, the preferred equations of each model included only one term for inflation, that being the unanticipated inflation variable. For all models the coefficient for the unanticipated inflation variable was positive and significant. For the second and third models, the coefficient for the variable representing real asset balances was negative and significant at the one percent level. The unemployment rate was found to be statistically significant (positive) for the first model only (at the one percent level of significance), lending further support to the uncertainty hypothesis.

In all three models the coefficient for the interest rate variable was negative and significant. This implies that the income effect outweighed the intertemporal substitution effect. Ouliaris justified the negative coefficient obtained on the interest rate in all of the models as support for the real wealth effect. For example,

if the post-tax real interest rate falls, a greater amount of savings is required to maintain a desired level of real income out of savings.

The results suggested an alternative explanation for the rise in the saving ratio. Rather than uncertainty being the dominant influence on the saving rate, Ouliaris found the negative influence of the after-tax real rate of return to be more important. This result was obtained using different models and estimation periods. The results further imply that inflation influences saving via the uncertainty effect only if it is unanticipated.

Overall Assessment of the Literature

A summary of the studies surveyed is presented in Table 3.1. Of the twenty articles reviewed which specifically examined the inflation-saving link, seven supported the uncertainty effect, two supported the real wealth effect, five supported the combination of uncertainty and real wealth effects, and three supported money illusion. Only three studies (Houthakker and Taylor, Campbell and Lovati, and Davidson and MacKinnon) concluded that inflation had no

Table 3.1

Summary and Comparison of Empirical Studies of the Effect of
Inflation on Aggregate Consumption and Saving

Study	Country	Sample Period	Data[a]	Estimation Method[c]	Dependent Variable[f]	Inflation Variable[g]	Effect Supported[l]
LCH Framework							
Branson/Klevorick (1969)	U.S.	1955-1965	QTR[b]	OLS	C	ACT	MI
Jarrett (1981)	Canada	1965-1978	QTR	OLS	S/Y	EXP[h]/UNEXP	UNC
H-T Framework							
Houthakker/Taylor (1970)	U.S.	1929-1941, 1946-1966	QTR	OLS	S	ACT[k]	RW
		1953-1966	ANN	OLS	S	ACT[k]	RW
Taylor (1971)	U.S.	1953-1971	QTR[b]	OLS	S	----	----
Taylor (1974)	U.S.	1954-1970	QTR	OLS[d]	S	EXP[i]	UNC
Juster/Wachtel (1972a)	U.S.	1954-1971	QTR[b]	OLS	S	ACT/EXP[i]	UNC
Juster/Wachtel (1972b)	U.S.	1954-1972	QTR[b]	OLS[d]	S/Y	ACT/EXP[i]	UNC
Juster (1975)	U.S.	1949-1973	QTR	OLS	S/Y	ACT/EXP[i]	UNC
Juster/Taylor (1975)	U.S.	1953-1973	QTR	OLS	S	EXP[i,k]	UNC
Wachtel (1977)	U.S.	1955-1974	QTR[b]	OLS	S	ACT/EXP[i]/UNEXP	UNC
Campbell/Lovati (1979)	U.S.	1955-1974	QTR[b]	OLS	S	EXP[h,j,k]/UNEXP[k]	None
		1955-1978	QTR[b]	OLS	S		
Hybrid Models							
Howard (1978)	Canada, U.S.	1965-1976	QTR[b]	OLS[d]	S	ACT/EXP[h]	UNC, RW
	Japan, U.K.	1965-1976	QTR[b]	OLS[d]	S	ACT/EXP[h]	UNC, RW
	Germany	1965-1976	QTR[b]	OLS[d]	S	ACT/EXP[h]	UNC, RW
Gylfason (1981)	U.S.	1952-1978	QTR	OLS[d]	C/Y	ACT/EXP[h]	UNC, RW
Burch/Werneke (1975)	U.S.	1956-1969	QTR	OLS[d]	S/Y	ACT/EXP[i]	RW
Deaton (1977)	U.S., U.K.	1954-1974	QTR	OLS[d]	S/Y	EXP[h]/UNEXP	MI[m]
Fortune (1981)	U.S.	1954-1978	ANN	2SLS	S/Y	EXP[h]	RW
Koskela/Viren (1982)	Finland, 10 OECD countries	1959-1977 1961-1978	QTR, ANN	OLS[e]	S/Y	EXP[h]/UNEXP	MI[m]

Table 3.1 (Cont'd)

Study	Country	Sample Period	Data[a]	Estimation Method[c]	Dependent Variable[f]	Inflation Variable[g]	Effect Supported[l]
Davidson/MacKinnon (1983)	Canada	1954-1979	QTR	OLS	S/Y	EXP[h]/UNEXP	None
	U.S.	1954-1979	QTR	OLS	S/Y	EXP[h]/UNEXP	None
Bisignano (1977)	U.S.	1955-1976	QTR[b]	OLS	S/Y, S	EXP[j]/UNEXP	UNC, RW
Freebairn (1977)	Australia	1948-1975	ANN[b]	OLS[d]	C/Y	ACT/ACT[k]	UNC, RW
Ouliaris (1981)	Australia	1961-1979	QTR[b]	OLS	S/Y	ACT/EXP[h]/UNEXP	UNC, RW

[a] ANN=annual; QTR=quarterly

[b] equation also estimated in per capita form

[c] OLS=ordinary least squares; 2SLS=two-stage least squares

[d] corrected for autocorrelation with the Cochrane-Orcutt technique where necessary

[e] corrected for autocorrelation with the Hildreth-Lu technique where necessary

[f] C=level of consumption; C/Y=average propensity to consume; S=level of personal saving; S/Y=personal saving rate

[g] ACT=actual; EXP=expected; UNEXP=unexpected

[h] generated autoregressively

[i] obtained from Survey Research Center survey data

[j] generated using crude fisherian equation

[k] first difference was used

[l] UNC=uncertainty; RW=real wealth; MI=money illusion

[m] consistent with the uncertainty effect as described by previous studies

long-term effect on saving behavior in the U.S. and Canada. Five of the studies supporting the uncertainty effect also attributed the positive effect of uncertainty on saving to the unemployment rate in addition to the inflation variables. The studies conducted for the U.S. generally found stronger results for NIA saving as opposed to FOF saving.

The majority of these studies examined the direct effect of inflation on the saving decision, while four of them examined the relationship between inflation and the consumption decision. Fourteen of these studies were undertaken for the United States, two for Australia and only two employed Canadian data. Two of the studies examined data for several OECD countries. Of the Canadian studies conducted, Jarrett (1981) supported the uncertainty effect of inflation on saving. Also, it was the only study which found institutional factors to have a significant influence on the saving rate. The more recent study undertaken by Davidson and MacKinnon (1983) refuted the existence of a real effect of inflation on saving, suggesting that the observed positive correlation between the two variables was due mainly to inflation-induced overmeasurement of savings.

To incorporate the uncertainty hypothesis in empirical analysis, studies have typically separated inflation into anticipated and unanticipated components. Fourteen of the studies surveyed (i.e. Jarrett, Juster and Wachtel (1972a

and 1972b), Campbell and Lovati, Howard, Juster, Wachtel, Gylfason, Davidson and MacKinnon, Burch and Werneke, Deaton, Koskela and Viren, Bisignano, and Ouliaris) incorporated these two components into their analyses, while the remainder of the studies included only one inflation variable. Unanticipated inflation proxies for the uncertainty regarding the real purchasing power of future real income. This uncertainty generally becomes more variable as unanticipated inflation increases. Many of these studies also incorporated the unemployment rate as a proxy for the uncertainty arising from the increased variability of expected future real income.

While some studies employed only the actual rate of inflation, studies employing price expectations and measures for anticipated and unanticipated inflation have tended to generate price expectations by either an autoregressive mechanism, survey data, or other miscellaneous methods. The majority of these studies have employed price expectations which have been purely autoregressive in nature, generating price expectations variables by examining only past rates of inflation in some type of a lagged model. A number of studies have obtained inflationary expectations from observable expectations mechanisms based on consumer opinion survey data. The studies by Juster and Wachtel, Juster and Taylor, Wachtel, and Burch and Werneke obtained their data from the Survey Research Center, while Campbell and Lovati

obtained price expectations data from the Livingston survey. Campbell and Lovati, as well as Jarrett, also incorporated monetary data in their proxy for anticipated inflation. Only the study undertaken by Bisignano used price expectations data employing a different mechanism -- specifically, the Fisherian method. After obtaining data for anticipated inflation based on one of these mechanisms, unanticipated inflation was generated simply as the difference between actual inflation and anticipated inflation. Clearly there is no consensus with regard to the type of price expectations data to employ in generating anticipated and unanticipated inflation, variables.

Several econometric issues may not have been adequately addressed in the studies reviewed in the previous sections. These issues may be grouped into three general areas: multicollinearity, autocorrelation, and structural stability.

Multicollinearity appears to be one problem which has not been addressed in a number of studies. Of particular concern is the possible correlation of inflation with the other independent variables, specifically income and nominal interest rates. Problems associated with multicollinearity include large standard errors and confidence intervals, as well as difficulty in distinguishing the separate impacts of the correlated independent variables on the dependent

variable. Houthakker and Taylor, Juster and Wachtel, Howard, Gylfason, and Freebairn have all simultaneously included nominal interest rates and inflation as explanatory variables in their models. The majority of these studies obtained insignificant coefficients for the interest rate. Only Ouliaris included the real interest rate as an explanatory variable and found it to be statistically significant. A number of studies regressing the level of saving on the level of income and inflation among other independent variables may also suffer from multicollinearity. Those studies that did recognize the possibility of this problem tended to deal with it by estimating the saving function in rate form.[41]

Autocorrelation is another issue which has not received sufficient attention in many of the studies. This is a problem which often occurs in time-series analysis, and is particularly acute in the analyses employing a lagged dependent variable. In many of these cases testing for autocorrelation was done using the DW statistic (i.e. Houthakker and Taylor, Juster and Wachtel, Wachtel, Campbell and Lovati, Deaton, Fortune, Koskela and Viren, Bisignano, and Freebairn). Using the DW test in the presence of a model containing a lagged dependent variable results in a DW statistic which is strongly biased against finding autocorrelation.[42] Consequently, these studies all obtained DW statistics of close to 2.0 and concluded that autocorrelation was not present. If

autocorrelation was indeed present, by not correcting for it, the statistical significance of the coefficients as well as the goodness-of-fit coefficient were artificially improved.[43]

Only the study conducted by Gylfason (1981) correctly applied the Durbin h-statistic and found that autocorrelation was not present.[44] His results were generally consistent with the studies which incorrectly used the DW test although he did obtain a lower R squared. Since the majority of the studies containing a lagged dependent variable did not calculate the h-statistic, and several other studies did not report a DW or h-statistic, the extent to which autocorrelation exists is unknown.

Another issue which was not addressed by a number of studies is structural stability of the parameters over time. Although several studies did address this important issue (i.e. Juster, Wachtel, Gylfason, Deaton, Koskela and Viren, and Freebairn), the majority of the studies did not test for stability. Those studies which did test for it found the parameters of their models to be stable over the entire sample period tested.

A number of studies covered sample periods which did not go further than 1973/1974 when inflation began to accelerate. Since the major focus of this study is the effect of accelerating inflation on saving behavior,

especially after 1973/1974, the studies which are most relevant are those which examined sample periods through to the late 1970s (i.e. Jarrett, Campbell and Lovati, Howard, Gylfason, Fortune, Koskela and Viren, Davidson and MacKinnon, Bisignano, Freebairn, and Ouliaris). Although most of the other studies found a positive relationship between the price variable and the saving rate, the applicability of their results to recent saving behavior is questionable.

Summary

The effect of inflation on saving behavior appears to be statistically well-determined. The majority of the studies surveyed have tended to support the positive relationship between unanticipated inflation and saving behavior as a result of uncertainty generated by inflation. However it is important to note that because these models have included an expectations proxy, the reliability of the conclusions made will depend on the accuracy of this proxy. Various models were tested using several inflationary expectations mechanisms and numerous variables, with the majority of the studies generally arriving at the same conclusions.

The following chapter develops a model for an empirical analysis of the relationship between inflation and saving

in Canada.   This model is based on the general frameworks

examined in this chapter.

NOTES TO CHAPTER THREE

1. Keynes (1936), pp. 96-97.

2. Ferber (1973), p. 1305.

3. Friedman (1957), pp. 16-28.

4. Mayer (1972), p. 21.

5. Bhalla (1980), p. 724.

6. Ibid., p. 731.

7. Ibid., pp. 731-732.

8. Department of Finance (1980), pp. 28-29. Other demographic factors which could possibly affect the aggregate saving ratio positively are early retirement and increasing female labor force participation. When there are two workers in a household, the capacity to save is increased. Also by lowering the age of retirement, individuals have a shorter working life to save for a longer retirement, and thus must save more than if they retire at a later age.

9. Mayer (1972), p. 25.

10. Department of Finance (1980), p. 28.

11. Ando and Modigliani (1963), p. 56.

12. Mayer (1972), p. 28. Further assumptions made by Modigliani and Brumberg to simplify empirical work include: the individual plans to "evenly" consume his total resources over his lifespan; every age group has the same average income in any given year; every individual has the same total lifespan and earning span; and the interest rate is constant. (Ando and Modigliani (1963), p. 59.)

13. Jarrett (1981), pp. 91-93.

14. Mayer (1972), p. 351.

15. Examples given in Ferber (1973), pp. 1307-1308.

16. Houthakker and Taylor (1970), pp. 9-10.

17. Ibid., p. 10.

18. The derivation of this zero-depreciation equation can be found in Houthakker and Taylor (1970), pp. 287-288.

19. Taylor (1971), p. 386.

20. Branson and Klevorick (1969), p. 834.

21. Jarrett (1981), p. 86.

22. Houthakker and Taylor (1970), p. 293.

23. Ibid., p. 294.

24. Gujarati (1978), p. 238.

25. For an explanation of the F-test, see Pindyck and Rubinfeld (1981), pp. 123-124.

26. For details regarding the Survey Research Center survey data see Juster and Wachtel (1972a), pp. 112-114.

27. Howrey and Hymans (1978), p. 668.

28. The effect of anticipated inflation was calculated by adding together the coefficients of CPI and expected CPI. Unanticipated inflation was given by the coefficient on actual CPI. See Juster and Wachtel (1972b), p. 772.

29. Juster and Taylor (1975), p. 208.

30. Wachtel (1977a), p. 569.

31. The long-run effect of an explanatory variable on saving is given by the coefficient of the variable divided by one minus the coefficient of the lagged dependent variable. The derivation of the long-run income and uncertainty effects can be found in Wachtel (1977a), p. 567.

32. Bladen-Hovell and Richards (1983) estimated a consumption function for Australia based on the H-T model concluding that inflation positively influences saving behavior via the real wealth effect. Oksanen and Spencer (1972) conducted the only study for Canada based solely on the H-T model. Their study did not incorporate inflation into the analysis and has therefore not been included in the literature survey.

33. The nominal interest rate is expected to be highly correlated with the rate of inflation. The resulting multicollinearity could give rise to low t-statistics, thereby influencing conclusions made regarding the statistical significance of the individual explanatory variables. See Pindyck and Rubinfeld (1981), pp. 87-90.

34. The estimating equations for the various countries differed slightly, as some insignificant variables were omitted. Additional variables were also examined, with the results reported briefly in Howard (1978), p. 551, footnote 10.

35. The quarterly change in income was used rather than the actual level of income, since the "regression estimates of a level are dominated by the long-term trend," and Burch and Werneke were only testing short-run effects on saving. (Burch and Werneke, 1975, p. 142).

36. The Beta coefficient can be used to determine the relative importance of the explanatory variables in a multiple regression model. See Pindyck and Rubinfeld (1981), pp. 90-91.

37. Burch and Werneke (1975), p. 147.

38. For derivation and underlying assumptions of this disequilibrium model, see Deaton (1977), pp. 900-903.

39. For formulation of the model and derivation of the estimating equation, see Fortune (1981), pp. 135-140.

40. Boskin (1978) also examined the effect of the post-tax real interest rate on the saving rate. He found a positive and significant interest elasticity of saving for the U.S. based on an annual consumption function over the period 1929 to 1969.

41. For example, see Jarrett (1981), p. 86 and Freebairn (1977), p. 201. They both state that estimating the function in rate form helps to reduce some of the collinearity among the explanatory variables.

42. See Gujarati (1978), p. 238.

43. See Wonnacott and Wonnacott (1979), pp. 214-215.

44. For calculation of the h-statistic, see Gujarati (1978), pp. 269-270.

CHAPTER FOUR

SPECIFICATION OF THE MODEL

Introduction

This chapter presents a general model of Canadian saving behavior based on the results of the studies surveyed in the previous chapter. The first section discusses several basic issues concerning model design. The next section presents the general personal saving rate model based on a combination of the LCH and the H-T frameworks. Following this is a discussion of the explanatory variables that are included in this model and the justification for their inclusion.

Issues to be Considered in Developing the Model

A number of previous studies have chosen independent variables on what appears to be an ad hoc basis. Models which examine the influence of inflation on the saving rate should have a sound theoretical foundation; that is, only those variables theoretically considered to affect the saving rate should be included.

Previous studies have also been dominated by work concerning the United States and little attention has been given to the Canadian situation. The few studies which

have been carried out for Canada (Jarrett(1981) and Davidson and MacKinnon(1983)) have tested different models, which might explain why they reached different conclusions. Consequently, there may be a tendency to base explanations of Canadian saving rate behavior on American studies.

Until recently this issue was not one for great concern. Canada and the U.S. exhibited very similar trends in the behavior of saving ratios and rates of inflation up to the early 1980s - as shown in Table 4.1. Both countries had relatively stable post-war saving ratios until the early 1970s when their inflation and saving rates began to rise dramatically.

The situation changed again in the late 1970s. Whereas the Canadian saving rate has remained well above 10 percent since the mid-1970s, the U.S. saving rate began dropping in the early 1980s and has remained at low rates (approximately four percent) compared to Canada. At the same time, the direction of movement in the rate of inflation has been similar in both countries. The fact that both countries show similar patterns of inflation yet very different rates of saving suggests that other factors are involved in influencing saving behavior. To explain the unique pattern of saving behavior in Canada, a model which incorporates variables believed to be important to the Canadian situation is required.

Table 4.1

A Comparison of the Rates of Saving, Inflation and Unemployment
Between Canada and the United States

Year	S/Y [a]		π [b]		UR [c]	
	Canada	U.S.	Canada	U.S.	Canada	U.S.
1967	6.7	9.0	3.6	2.8	3.8	3.7
1968	5.7	7.9	4.0	4.2	4.4	3.4
1969	6.0	7.2	4.5	5.4	4.4	3.4
1970	6.1	9.8	3.4	5.9	5.6	4.8
1971	6.5	9.9	2.8	4.3	6.1	5.8
1972	7.7	8.4	4.8	3.3	6.2	5.5
1973	9.5	10.4	7.6	6.2	5.5	4.8
1974	10.8	10.3	10.9	11.0	5.3	5.5
1975	11.1	10.4	10.8	9.1	6.9	8.3
1976	9.5	8.8	7.5	5.8	7.1	7.6
1977	9.3	7.9	8.0	6.5	8.0	6.9
1978	11.2	7.9	8.9	7.7	8.3	6.0
1979	11.8	7.7	9.2	11.3	7.4	5.8
1980	12.9	8.0	10.2	13.5	7.4	7.0
1981	14.5	8.6	12.5	10.4	7.5	7.5
1982	15.5	8.2	10.8	6.1	10.9	9.5
1983	13.5	7.0	5.9	3.2	11.8	9.5
1984	13.6	6.3	4.3	4.3	11.2	7.4
1985	12.3	4.7	4.0	3.5	10.4	7.1

Source: OECD Economic Outlook - Historical Statistics, various volumes

[a] Net household saving as a percentage of disposable household income

[b] Percentage change in the CPI from the previous year

[c] Standardized unemployment rates

Note: This OECD publication uses internationally standardized data,
and thus the figures given in the above table for Canada differ
somewhat from those given in Table 1.1

A major difference between the model tested in this study and those previously undertaken for the U.S., is that it takes into account the role played by institutional factors. It is possible that one reason for the different rate of saving in Canada compared to the U.S. is the different institutional incentives to save. The RRSP, RHOSP and the $1000 interest income deduction which exist in Canada all provide Canadians with an incentive to save which doesn't exist (or which exists to a lesser extent) in the United States.[1] This would imply a positive impact on the saving ratio independent of the effects of the other (standard) explanatory variables. The role of these institutional factors is examined by the use of dummy variables in the general model, and is discussed further in the following chapter.

Another important issue to address when testing the model is the specific estimation period employed. It is not only important to test the effect of inflation on the dramatic change in saving behavior in the 1970's, but also to examine what role inflation may have played in keeping the saving rate at historically high levels so far in the 1980s. It is possible that due to the declining inflation rates experienced in Canada beginning in 1982, emphasis has shifted from inflation as being the source of the initial boost of the saving rate in the mid-1970s to some other

variable responsible for maintaining the saving rate above 10 percent. According to Table 4.1, the unemployment rate has been much higher and slower to decline in Canada as compared with the U.S., perhaps accounting to some extent for the much higher saving rate experienced in Canada during recent years. Studies prior to this one have generally employed sample periods which extend only to the 1970s. The most recent Canadian study (Davidson and MacKinnon(1983)) uses data which only goes up to 1979.

The model developed here is estimated using data up to the mid-1980s, thereby accounting for any new developments. Specifically, it tests whether a different type of uncertainty from that which predominated in the 1970s has become the major positive influence on the Canadian saving rate in the 1980s.

Also of concern in developing the model is the independent variables to include as proxies for the particular types of uncertainty which are hypothesized to influence the saving rate. The majority of the studies surveyed in the previous chapter have found uncertainty, in one form or another, to have been the primary force behind the increase in the saving ratio experienced in the U.S. during the 1970s. While most studies have favored uncertainty resulting from a high and variable rate of inflation, several other studies have found other types of uncertainty to influence saving behavior

as well. For example, Bisignano (1977) includes three types of uncertainty (regarding income, employment, and inflation) in his saving model, and concludes that the uncertainty arising from inflation has had the greatest impact on the saving ratio in the United States.

Since all three types of uncertainty can be theoretically justified to have a positive impact on the rate of saving, variables to capture these uncertainty effects are included in the general model developed in the following section. It is plausible that inflation-induced uncertainty was also a major factor contributing to the changing Canadian saving behavior of the 1970s, while another type of uncertainty (for example, regarding employment or income) has been a major influence responsible for maintaining a high rate of saving in the 1980s. The model developed in the next section attempts to shed some light on the importance of these various uncertainty effects.

Perhaps the most important issue in developing the model is the particular variable chosen to represent expected inflation, since the accuracy of any conclusions drawn depends crucially on the accuracy of the proxy for this variable. This is the one factor which varies most among studies. Various types of inflationary expectations mechanisms have been employed in previous studies. The majority use some type of autoregressive technique with expected inflation a

function of some type of distributed lag of past inflation rates. Considering the importance of this variable, the general saving model is estimated using several measures for expected inflation. This issue is further discussed in the section which examines each of the independent variables in detail.

General Model to be Tested

While the majority of the studies reviewed in the previous chapter involved the estimation of saving models in which the level of saving was the dependent variable, the approach taken here uses the rate of saving. As previously mentioned, multicollinearity is less likely to be a problem when estimating the model in rate form.

The model presented in this chapter is based on a combination of the general LCH and H-T frameworks and is tested over the 1968-1985 period using quarterly Canadian data. The general model (with the a priori signs of the explanatory variables shown in brackets) is:

$$(4.1) \quad S/Y = f((S/Y)_{-1}, \overset{(+)}{YT/Y}, \overset{(+,-)}{UR}, \overset{(+)}{DUR}, \overset{(-,0,+)}{\pi^e}, \overset{(+)}{\pi^u})$$

where:

S/Y = the ratio of real per capita personal saving to real per capita personal disposable income;

$(S/Y)_{-1}$ = the first quarter lag in the personal saving ratio;

YT/Y = the ratio of real per capita transitory disposable income to real per capita current

```
                    disposable income;
      UR     = the unemployment rate;
      DUR    = the difference in the unemployment rate from
               the same quarter a year ago;
      π^e    = expected inflation;
      π^u    = unexpected inflation.
```

The saving and income flows were deflated by the consumer price index and expressed in per capita terms. Expressing these variables in real terms rather than in nominal terms avoids problems arising from money illusion. Also, using a per capita denomination instead of an aggregate prevents the effect that a variation in income has on saving behavior from merely reflecting population growth.[2]

The lagged dependent variable is included as the stock-adjustment variable to quantify the partial adjustment in any period of the actual saving rate to the desired rate. This variable is expected to have a positive effect on the current rate of saving. The remaining explanatory variables are included as proxies for various uncertainty effects on saving behavior. The rate of transitory to current income is included to capture the income uncertainty effect. The rate of unemployment and change in the rate of unemployment variables capture uncertainty regarding future employment and future nominal income. The expected and unexpected inflation variables capture inflation-induced uncertainty and pessimism regarding future real income and future economic

conditions in general. The three general groups of explanatory variables will now be discussed in turn.

Explanatory Variables

Income

Since transitory income is derived as the residual between current and permanent income, the first problem to be addressed is the formulation of a proxy for permanent income. It is usually generated autoregressively using past values of current income. In its simplest form, permanent income may be generated by regressing current income on lagged income. This general form can be written as:

(4.2) $YP(t) = a0Y(t) + a1Y(t-1) + a2Y(t-2) + ... + e(t)$

where:

$YP(t)$ = permanent income in period t; and
$Y(t)$ = current income in period t.

The lag structure can either be geometrically declining (i.e. Koyck lag structure) or take the form of a polynomial distributed lag (i.e. Almon lag structure) which does not make this restriction.[3]

The Koyck lag assumes that the coefficients in (4.2) decrease exponentially over time, such that:

(4.3) $aj = a0 \lambda^j$

Upon substituting (4.3) into (4.2) and making further substitutions and rearrangements, the following simplified Koyck expression results:

(4.4) $YP(t) = a0Y(t) + \lambda YP(t-1) + e^*(t)$

where:

(4.5) $e^*(t) = e(t) - \lambda e(t-1)$

From the general equation (4.2), the Almon assumption is that the lag structure is a polynomial of degree n, with n+1 parameters. Each term in (4.2) stands for a distributed lag of the form:

(4.6) $a(i) = b(0) + b(1)i + b(2)i^2 + \ldots + b(n)i^n$

Although the Almon lag structure is less restrictive than the Koyck, choosing an incorrect lag structure may lead to a problem of misspecification.[4]

A more theoretically correct approach to the formulation of permanent income involves the use of an error-learning or adaptive expectations model, as employed by Friedman.[5] Friedman assumes a partial adjustment mechanism whereby this period's addition to permanent income is proportional to the difference between this period's measured and permanent income. This difference is defined as transitory income. Assuming the function is multiplicative we have the following:

(4.7) $YP(t)/YP(t-1) = (Y(t-1)/YP(t-1))^\beta$

where:

$$YP(t) = \text{permanent income in period } t;$$
$$Y(t-1) = \text{measured income in period } t-1; \text{ and}$$
$$\beta = \text{the adjustment coefficient}$$

Expressing equation (4.7) in log-linear form yields:

(4.8) $LYP(t) - LYP(t-1) = \beta(LY(t-1) - LYP(t-1))$

where:

$$LYP(t) = \text{the logarithm of permanent income in period } t;$$
$$LY(t-1) = \text{the logarithm of measured income in period } t-1; \text{ and}$$
$$\beta = \text{the adjustment coefficient}$$

After rearranging terms, equation (4.8) can be rewritten as:

(4.9) $LYP(t) = \beta LY(t-1) + (1-\beta)LYP(t-1)$

Assuming a Koyck lag structure, this equation is identical to equation (4.4). However, in its present form (4.9) presents a problem since LYP(t-1) is unobservable. In order to make permanent income a function of observable terms, the following assumption is made:

(4.10) $LYP(t-1) = LY(t-2)$

Substituting (4.10) into (4.9) gives:

(4.11) $LYP(t) = \beta LY(t-1) + (1-\beta)LY(t-2)$

Permanent income is calculated as an infinite geometric lag on past values of current income by making continuous substitutions for LYP:

(4.12) $\quad LYP(t) = \sum_{i=0}^{\infty} \beta(1-\beta)^i LY_{t-1-i}$

Allowing for a secular growth rate in income of (g), equation (4.12) can be reformulated as:

(4.13) $\quad LYP(t) = \sum_{i=0}^{\infty} \beta(1-\beta)^i (1+g)^i LY_{t-1-i}$

or in Koyck form as:

(4.14) $\quad LYP(t) = \beta LY(t-1) + (1-\beta)(1+g)LY(t-2)$

In his work Friedman assumed an adjustment coefficient of 0.4 and a secular growth rate of 0.02 (i.e. 2 percent per annum).[6]

The permanent income variable used in equation (4.1) was estimated using several methods. Estimates were generated based on the polynomial distributed lag given in (4.2) and (4.6), the adaptive expectations model given in (4.13), and the Koyck transformation given in (4.14). For the polynomial distributed lag model, lags of up to twenty quarters were tried on second and third degree polynomials. The best results were obtained for the third degree polynomial of the logarithm of income lagged twelve quarters with no endpoint restrictions.[7]

Various estimates for permanent income were also generated based on the adaptive expectations model of (4.13) and the simplified Koyck version of (4.14) using alternative values for ß from the set {0.1, 0.2,...,1.0}. The model was estimated with a secular growth rate of 0.02 as well as for zero growth.

Transitory income was generated by subtracting permanent income from current income. Transitory income was then divided by current income to represent income uncertainty. This variable is expected to have a significant positive influence on the saving rate. According to the PIH, consumption is a function of permanent income. Therefore any excess of current income above permanent income will be saved. Without exception, every study reviewed in chapter three which employed some form of transitory income found the coefficient of this variable to be positive and significant.[8]

Unemployment

The sign on the coefficient of the unemployment rate is theoretically indeterminate since it could be argued that an increase in the rate of unemployment would tend to lower aggregate saving, but it could also pick up some uncertainty effects thereby positively influencing precautionary saving.[9] The rationale behind a negative coefficient is that a high unemployment rate indicates that a relatively

large proportion of the population is receiving substantially less income than normal. As a result, the aggregate rate of personal saving is expected to decline, given the stickiness of consumption patterns.[10] However, this effect only holds true if unemployment is concentrated in the high income groups which typically do most of the saving. If unemployment is concentrated in low income groups which generally save little, the rate of unemployment is not expected to influence the saving rate.

On the other hand, the unemployment rate may capture the uncertainty effect (i.e. uncertainty regarding employment) beyond that captured by the inflation variables, thereby positively influencing the rate of saving. Consumers may become uncertain about their own job security and thus their future income the higher the unemployment rate is. As a result, they may increase their rate of saving to hedge against the possibility of becoming unemployed in the future.[11] Because of the changing pattern of unemployment rates over the sample period, it is possible that the unemployment rate has affected the rate of saving differently over the various subperiods. This hypothesis will be tested using dummy variables in the stability analysis.

The change in the rate of unemployment was measured by the four-quarter difference in the unemployment rate (i.e. the

difference between the unemployment rate in the current quarter and in the same quarter a year ago). A one-quarter difference in the unemployment rate as well as the one and four-quarter rate of change in the unemployment rate were tried, with the four-quarter difference being the preferred estimate. As well as performing slightly better in the saving equation than the other estimates, the four-quarter difference variable seems more appealing on a priori grounds, as it is the figure which the public is most often exposed to.[12]

The change in the unemployment rate variable is a proxy for expected unemployment and, as such, quantifies the degree of uncertainty that consumers perceive about future income. A positive coefficient is expected for this variable, since an increasing rate of unemployment is hypothesized to increase uncertainty regarding future income and job security, which in turn positively influences saving.[13]

Inflation

Because the focus of this study is on inflation-induced uncertainty, a great deal of attention is given to the particular inflation variables employed. Although several studies have included actual inflation as an explanatory variable (refer to Table 3.1), the arguments presented in chapters two and three have shown that the inclusion of separate variables for expected and unexpected inflation

more accurately explains saving behavior. Due to the importance of the expected inflation variable, the various mechanisms by which this variable may be generated will be discussed here at some length.

Previous studies have derived expected inflation variables either indirectly using proxy measures or directly using survey data. The majority of the studies deriving expected inflation indirectly did so employing some type of autoregressive mechanism, constructed by weighting a series of past price changes. Since there are no Canadian data available on expectations of inflation similar to the Livingston or SRC data, proxies must be used. These proxies for expected inflation can be determined within an autoregressive expectations paradigm, or by assuming rational expectations.[14]

According to the autoregressive approach, the primary determinant of an individual's inflationary expectations is the past history of actual inflation rates. In general form this is as follows:

(4.15) $\quad \pi^e(t) = f(\pi(t-1), \pi(t-2), \ldots, \pi(t-n))$

where f is some functional form which is determined empirically.

Since many different autoregressive mechanisms have been used, from the very simple to the more sophisticated, no

specific one stands out as being the "correct" one to employ.
However, within the broad category of autoregressive models
there are several specific hypotheses. These include adaptive
expectations, extrapolative/regressive expectations, and
weighted (distributed lag) expectations.

Adaptive Expectations

The adaptive expectations or error-learning model assumes
that inflationary expectations adjust in proportion to the
last recorded forecast error. That is:

(4.16) $\pi^e(t) - \pi^e(t-1) = \lambda(\pi(t-1) - \pi^e(t-1))$

where:

$\pi^e(t)$ = the expected rate of inflation in period t;
$\pi^e(t-1)$ = the expected rate of inflation in period t-1;
$\pi(t-1)$ = the actual rate of inflation in period t-1; and
λ = the adjustment coefficient.

Rearranging (4.16) has the following result:

(4.17) $\pi^e(t) = \lambda\pi(t-1) + (1-\lambda)\pi^e(t-1)$

Thus expected inflation in this period is based on a weighted
average of last period's actual rate of inflation and some
proportion $(1-\lambda)$ of last period's expected rate of inflation.
By successively lagging (4.17) and making substitutions for
the unobservable expected inflation variable, the adaptive

expectations model becomes a geometrically declining lag of past price level changes:

$$(4.18) \qquad \pi^e(t) = \sum_{i=0}^{\infty} \lambda(1-\lambda)^i \pi_{t-1-i}$$

The geometrically declining weights indicate that individuals base their forecasts relatively more on the most recent rates of inflation. An obvious problem with adaptive expectations is that it consistently underpredicts inflation when it is increasing. The adaptive expectations model implies that expected rates of inflation are a weighted average of current and past rates of inflation, which will always be less than the current rate when the rate of inflation is increasing.

Extrapolative/Regressive Expectations

The extrapolative/regressive expectations model assumes that individuals extrapolate past inflation rates into the future or conversely that they expect inflation to revert to its long-run average level. This model may be expressed as: [15]

$$(4.19) \qquad \pi^e(t) = \pi(t-1) + \beta(\pi(t-1) - \pi(t-2))$$

Expectations are said to be extrapolative if β is positive and regressive if β is negative.

Weighted Expectations

Both the adaptive and extrapolative hypotheses are special cases of distributed lags. The general weighted expectations model assumes that expected inflation is a distributed lag of past rates of inflation, imposing the restriction that the weights add to unity. This model may be expressed as: [16]

$$(4.20) \quad \pi^e(t) = \sum_{i=0}^{\infty} w(i) \, \pi(t-1-i)$$

Since it is unknown which mechanism "truly" generates price expectations, the only basis for choice would be their relative abilities in explaining saving behavior according to plausible a priori hypotheses. To this end, equation (4.1) was estimated using four general models of expected inflation. The first two models were based on the general weighted expectations of (4.20). Previous studies have found the lag length to be relatively short (i.e. between four and eight quarters) with the largest weights attached to the most recent rates of inflation and declining sharply thereafter.[17] The models of expected inflation are as follows:

Model I

The first expected inflation model, referred to as the naive model, assumes that all of the weight is attached to last period's rate of inflation:

(4.21) $\quad \pi^e(t) = \pi(t-1)$

where the actual rate of inflation is measured as the four-quarter percentage change in the consumer price index.[18]

Model II

The second model uses arbitrary weighting schemes to generate an expected inflation rate from four quarter lagged values of actual inflation:

(4.22) $\quad \pi^e(t) = \sum_{i=0}^{3} w(i)\pi(t-1-i)$

As well as choosing weights a priori, this model was also estimated using the Almon technique for various lag lengths and degrees. The preferred Almon equation was a second degree polynomial lagged four quarters with a far-endpoint restriction imposed.

The remaining models are based on adaptive expectations as given in (4.18). The adaptive expectations model was chosen over the extrapolative model based on its more widespread use.[19]

Model III

The third model is based on first-order error- learning and is slightly more sophisticated than the naive and weighted distributed lag models. It is based on (4.17) with the assumption that:

(4.23) $\pi^e(t-1) = \pi(t-2)$

so that expected inflation is now solely a function of observable terms:

(4.24) $\pi^e(t) = \lambda\pi(t-1) + (1-\lambda)\pi(t-2)$

This also happens to be in the form of a Koyck lag structure.

Model IV

A more sophisticated version of adaptive expectations is the second-order error-learning hypothesis, in which individuals adapt to the size of the previous two forecast errors:

(4.25) $\pi^e(t) - \pi^e(t-1) = \lambda_0(\pi_{t-1} - \pi^e_{t-1}) + \lambda_1(\pi_{t-2} - \pi^e_{t-2})$

This can be reformulated as:

(4.26) $\pi^e(t) = \lambda_0\pi(t-1) + (1-\lambda_0)\pi^e_{t-1} + \lambda_1(\pi_{t-2} - \pi^e_{t-2})$

Assuming, for simplicity,

(4.27) $\pi^e(t-1) = \pi(t-2)$; and

(4.28) $\pi^e(t-2) = \pi(t-3)$

equation (4.26) may be rewritten in observable terms as:

(4.29) $\pi^e(t) = \lambda_0\pi(t-1) + (1-\lambda_0)\pi(t-2) + \lambda_1(\pi(t-2) - \pi(t-3))$

In forming expectations regarding inflation, individuals take into account both the recent rate of inflation and its rate of change.[20] This study also estimates a slightly modified version of (4.29) which can be written as:

(4.30) $\pi^e(t) = \lambda_0\pi(t-1) + \lambda_1(\pi(t-1) - \pi(t-2)) + \lambda_2(\pi(t-2) - \pi(t-3))$

with various values of $\lambda_0, \lambda_1, \lambda_2$ set a priori and adding to unity. It would seem plausible that in forming expectations for the current period, consumers attach the most weight to last period's rate of inflation as well as some weight to the difference between last period's actual and expected rate and the difference of the actual and expected rate from two periods ago.

In generating various types of inflationary expectation mechanisms, Carlson and Parkin (1975) concluded that in the presence of high rates of inflation, expected rates of inflation tend to be generated by a second-order error-learning process, while for modest rates of inflation, expectations seem to be purely autoregressive in nature.[21] This point illustrates the difficulty in choosing a particular estimate for expected inflation to be used throughout a sample period which is characterized by periods of both modest and rising rates of inflation.

The sign of the expected inflation variable is indeterminate a priori, depending on which inflation effect is assumed to have the dominant influence on the saving behavior of individuals. According to the conventional theory discussed in chapter two, all prices and nominal rates of interest should adjust for anticipated inflation. Therefore, expected inflation should not affect consumption/saving decisions since relative prices are unaffected by changes in anticipated inflation. The coefficient of this variable is expected to turn up statistically insignificant in estimates of equation (4.1).[22]

The other effects of anticipated inflation on saving which have been previously discussed in chapter two will be mentioned here briefly. The coefficient for anticipated inflation is expected to be negative according to the "buy in advance" and "flight from currency" arguments. In both cases consumer goods become more attractive while nominal assets become less attractive, resulting in less saving. A positive coefficient for anticipated inflation is expected according to search theory. Consumers increase their rate of saving as they postpone purchases until a search of the market verifies that nominal prices for all goods have increased, and that the goods they wish to buy are not relatively more expensive than other goods. Another positive effect could be due to the progressive income tax structure.

As inflation pushes incomes into higher tax brackets, saving increases with income (in proportion), whereas disposable income will not increase as fast.[23]

The unanticipated inflation variable is included in (4.1) as a measure for inflation-induced uncertainty effects on saving behavior. This variable was calculated as the difference between the actual and the expected inflation rate.[24] The coefficient of this variable is expected to be positive, based on the various uncertainty arguments presented in chapter two. Pessimism regarding the future in general is expected to encourage precautionary saving as is uncertainty regarding future real income.

The unexpected inflation variable is thought to be especially important in periods of high and variable rates of inflation. High and variable inflation rates increase the difficulty in predicting inflation which in turn increases the uncertainty of money income keeping pace with expected inflation. Thus, unexpected inflation can increase the perceived variability of real income resulting in an increase in the saving rate. According to the real wealth effect, unexpected inflation tends to increase the saving rate to guard against declining real income. Another argument for the positive influence of unanticipated inflation on the saving rate is that unanticipated inflation tends to create

the impression that relative prices have changed, thereby generating decisions to change spending patterns in favor of saving more.[25] With the exception of Campbell and Lovati (1979), all of the studies previously surveyed which have included an unexpected inflation variable have generally found the coefficient of this variable to be positive and significant, and hence in support of the uncertainty hypothesis.

Other Explanatory Variables

Several modifications could be made to the basic model given in (4.1) by incorporating additional explanatory variables which have been included in previous studies. These include an interest rate variable, demographic variables, a wealth variable, and variables representing taxes and transfer payments.

As previously discussed in chapter two, changes in the rate of interest which affect the relative cost of present and future consumption will affect saving. However, offsetting income and substitution effects render the a priori effect on saving indeterminate. The nominal interest rate is intended to pick up the opportunity costs of future consumption. As the interest rate rises, the cost of present consumption relative to future consumption increases thereby increasing saving. However, the income effect may be negative,

as an increasing rate of interest allows a reduction in saving to maintain a given level of future income.

In the previous studies which have included a nominal interest rate variable in their empirical work, the results have been mixed. While Juster and Taylor (1975) and Gylfason (1981) found a positive coefficient for the interest rate, Houthakker and Taylor (1970) found the coefficient to be negative and significant; and Juster and Wachtel (1972b), Bisignano (1977), Freebairn (1977), and Howard (1978) found the coefficient to be statistically insignificant in explaining saving behavior. As nominal interest rates generally adjust for inflation, the probability of finding a relationship between the nominal interest rate and the inflation variables is high, making its inclusion in the general models questionable. Only two studies (i.e. Wachtel (1977a) and Ouliaris (1981)) have included the real interest rate, finding a negative coefficient for this variable. As it would seem more plausible for the real, rather than the nominal, rate of interest to affect (real) saving behavior, model (4.1) will be modified to include the real rate of interest.

Several demographic variables which are hypothesized to influence saving behavior according to the LCH have also been included in previous models of saving behavior. One such variable is the proportion of the population which is

in the 15-34 age bracket. As this is the age group most likely to be net borrowers or low savers, due to relatively low income and relatively high consumption patterns, an increase in this population group would be expected to affect saving negatively. The female labor force participation rate has also been included with the expectation of a positive coefficient. As more and more women enter the labor force, simultaneously occurring social trends such as smaller family size and higher family income should increase the household's capacity and ability to save. Jarrett (1981) found this variable to display a positive and significant coefficient as expected, but found the coefficient on the 15-34 age group to be positive contrary to expectations. Since changes in the proportion of the population which is in this age group are expected to be very slow moving over time, especially with respect to quarterly data, this variable will not be included in the estimation of (4.1).

Several studies have included a wealth variable to proxy for the wealth effect. The justification for the inclusion of this variable is that the households' wealth will have an effect on consumption and saving decisions above and beyond the wealth effects already captured by the income variables. The wealth variable has generally been proxied in the literature by some measure of personal liquid assets. This coefficient is expected to display a negative sign as

saving is expected to adjust to achieve the desired liquid asset level.

The studies which have incorporated a wealth variable in one form or another into the saving model include those by Burch and Werneke (1975), Bisignano (1977), Howard (1978), Jarrett (1981) and Ouliaris (1981). With the exception of Jarrett's analysis, which showed an insignificant coefficient for personal financial wealth, the remaining studies found the coefficient for this variable to be positive and significant. The expectation of a high degree of correlation between the permanent income and wealth variables would render the inclusion of a variable of this sort questionable, and therefore (4.1) will not be modified to include a wealth variable.

Juster, Wachtel and Taylor in their various studies have included various components of disaggregated income, namely the ratio of taxes paid to personal income and the ratio of transfer payments to personal income, as additional explanatory variables in their models of saving behavior. The rationale for including the tax variable is that changes in income taxes should affect saving more than consumption because of the stickiness of consumption patterns.[26] An increase in personal income taxes reduces disposable income relative to personal income, thereby reducing saving. Since the reduction in saving would generally be larger than the

reduction in disposable income, the ratio of taxes paid to personal income is expected to have a negative coefficient in explaining the rate of saving. This is precisely what was found by Taylor (1971 and 1974), Juster and Wachtel (1972b), and Juster and Taylor (1975). Juster (1975), however, found this variable to be statistically insignificant. When adding this variable to equation (4.1) the dependent variable becomes the ratio of personal saving to personal income, rather than personal disposable income.

The studies which have incorporated the ratio of transfer payments to personal income into their models have invariably found the coefficient for this variable to be positive and significant (i.e. Taylor (1971 and 1974), Juster and Wachtel (1972b), Juster (1975) and Juster and Taylor (1975)). The above studies also agree that this result is quite puzzling since the majority of recipients of transfer payments are lower-income individuals with a low marginal propensity to save. Therefore, the coefficient of this variable is expected to be negative. Again, when incorporating this variable into the model, the dependent variable in (4.1) becomes the ratio of personal saving to personal income. However, since the dependent variable in (4.1) is the ratio of real per capita personal saving to real per capita disposable income, the effect of taxes and transfer payments would already be reflected in the disposable income variable, therefore making

it inappropriate to include this additional explanatory variable.

Summary

The general model of the saving rate developed in this chapter was based on a combination of the LCH and H-T frameworks. Several issues regarding the development of the model were presented, stressing the importance of a model for Canada based on sound theoretical foundations. The specific explanatory variables chosen to capture the various types of uncertainty, and the justification for their inclusion were discussed. Proxies for expected inflation and permanent income were generated using various types of autoregressive mechanisms, varying in their degree of sophistication.

The following chapter reports the results obtained for the estimation of the basic model given in (4.1). Results are also reported for various modifications to the general model, including tests for structural stability.

NOTES TO CHAPTER FOUR

1. Jarrett (1981), p. xi.

2. Ackley (1978), p. 164.

3. See Wonnacott and Wonnacott (1979), pp. 224-229.

4. See Schmidt and Waud (1973), particularly pp. 11-13. It is crucial that the degree of the polynomial and especially the length of the lag be chosen correctly. Understating the lag length leads to biased and inconsistent estimates and invalid t-tests. Overstating the lag length also leads to specification error.

5. Friedman (1957), pp. 143-147.

6. Ibid., pp. 146-147. Studies which have estimated permanent income based on the general adaptive expectations model in equation (4.13) have generally assumed a stable growth rate of 2 percent as Friedman had, and attempting to determine the appropriate adjustment factor by trial and error. For example see Clark (1973).

7. The criterion used in choosing the "best" lag structure was minimum standard error. According to Schmidt and Waud (1973), p. 13, it is incorrect to choose among alternative lag lengths on the basis of t-tests, since they are invalid when the lag length is incorrectly specified.

8. Of the studies reviewed in chapter three, only Bisignano (1977) incorporated the transitory/current income ratio variable in his saving rate equation, finding the coefficient to be positive. When estimating the equation with the level of saving as the dependent variable, he included the level of transitory income, finding its coefficient also to display a positive sign.

9. Howard (1978), p. 549.

10. Juster and Wachtel (1972b) and Juster (1975) attributed this argument to their finding of a negative influence of the unemployment rate on the rate of saving.

11. Juster and Taylor (1975), Bisignano (1977), Howard (1978), and Ouliaris (1981) found the unemployment rate to positively affect the level and rate of saving based on this uncertainty argument. Freebairn (1977), Gylfason (1981), and Koskela and Viren (1982) found the

unemployment rate to be insignificant in explaining saving
behavior.

12. Juster and Wachtel (1972b), Juster (1975), and
Ouliaris (1981) employed the four-quarter difference in the
unemployment rate in their studies, while Howard (1978) and
Gylfason (1981) employed the one-quarter difference.

13. Juster and Wachtel (1972b), Juster (1975) and
Howard (1978) found the coefficient on the change in the
rate of unemployment to be positive and significant.
Juster and Taylor (1975), Freebairn (1977) and Ouliaris
(1981) found it to be statistically insignificant.

14. The rational expectations model requires that
individual forecasts of inflation be essentially the same
as economic theory would predict and as such is much more
complicated than a model which only employs information on
past actual rates of inflation. Although adaptive
expectations has been criticized for its simplicity,
rational expectations has been criticized for being too
complex in assuming that consumers possess all the relevant
information that economists do about the precise levels of
economic variables. See Gylfason (1981), p. 237, footnote
9; and Springer (1977), pp. 300-301, footnote 7 on this
point. Several objections to the rational expectations
approach which have been raised are summarized in Begg
(1982), pp. 62-69. Since the purpose of finding a proxy
for expected inflation is to develop a simple mechanism for
generating an unobserved economic variable, the discussion
will be limited to the various models which are classified
as being autoregressive in nature. Carlson and Parkin
(1975) found that an autoregressive scheme closely
approximated actual expectations obtained using United
Kingdom survey data; as did Defris and Williams (1979)
using Australian survey data; and Tanzi (1980) using
Livingston data for the United States.

15. Turnovsky (1970), p. 1442.

16. Ibid., p. 1443.

17. In their attempt to explain price expectations
for Australian survey data, Defris and Williams (1979),
p. 141, restricted the longest lag of the general
distributed lag model to seven quarters. With subsequent
estimation using Almon and unrestricted lags, they found
the lags to be much shorter than this. As a result they
estimated both a naive model (with a one-quarter lag in the
actual inflation rate as the only independent variable) and

a Koyck-type equation, obtaining satisfactory results as those obtained for an adaptive expectations model.

18. Both the one-quarter and four-quarter change in the CPI have been employed in the literature as a measure of actual inflation. The four-quarter measure is employed in this study as it would seem to be the relevant measure of inflation which consumers are most exposed to.

19. For example, see Valentine (1977), p. 403.

20. Carlson and Parkin (1975), p. 132.

21. Ibid., pp. 124-125.

22. Previous studies which obtained a statistically insignificant coefficient for expected inflation in a saving model include Burch and Werneke (1975), Bisignano (1977), Howard (1978), Campbell and Lovati (1979), Fortune (1981) and Ouliaris (1981).

23. None of the studies surveyed obtained a negative coefficient for expected inflation, with the exception of Juster and Wachtel (1972b). Taylor (1974), Juster (1975), Juster and Taylor (1975), Wachtel (1977a) and Jarrett (1981) found expected inflation to positively affect saving behavior.

24. Several studies take the coefficient on actual inflation as being the effect of unanticipated inflation on saving. For example, see Juster and Wachtel (1972a) and Howard (1978). However, the method of obtaining unexpected inflation as the difference between the actual and expected values was chosen for this study.

25. Bisignano (1977), p. 7.

26. Juster (1975), p. 6.

CHAPTER FIVE

RESULTS

Introduction

This chapter outlines the regression results for the models presented in chapter four. It begins with a discussion of the data and the estimation methodology employed. Next is a discussion of the derivation of the proxies for the expectations variables; permanent income and expected inflation. Following this is the presentation of the results obtained using the basic model and modified models as well as the results from tests for structural stability.

Data and Methodology

The general saving model specified in chapter four was estimated using quarterly Canadian data for the sample period beginning with the first quarter of 1968 and ending with the fourth quarter of 1985. The data used in this study were all taken from the Statistics Canada CANSIM University data base.[1] All flows are seasonally adjusted at annual rates in millions of current dollars, and are converted into real, per capita form.

Since the purpose of this study is to analyze the saving behavior of households, the personal saving measure was chosen

over private or gross saving. The income measure chosen was personal disposable income rather than personal income. The unemployment rate was the 15 years and over rate, seasonally adjusted. The monthly rates were converted to quarterly by taking a simple average over each quarter. The inflation rate was represented by the four quarter rate of change in the CPI for all items (for 1981 = 100). This data was also reported monthly, and was converted to quarterly by averaging over each quarter. Inflation rates were then derived as the four quarter rate of change in the quarterly CPI figures.

The availability of the data dictated the particular sample period chosen. As the unemployment rate data is not reported prior to 1966, and allowing for several lags, the sample period begins with the first quarter of 1968.

All of the regressions were run initially using ordinary least squares (OLS). When the durbin h-statistic revealed evidence of first-order autocorrelation, the data was transformed using an autoregressive coefficient (ρ), which was estimated using a maximum likelihood iterative procedure.[2] However, very few regressions were found to exhibit autocorrelation. Although autocorrelation frequently plagues regressions which employ time-series data, it is not surprising that the regressions run here generally did not have this problem since they were estimated in rate form.

The introduction of proxy variables for expected inflation and permanent income introduces an errors-in-variables problem. Under these conditions, OLS yields both biased and inconsistent coefficient estimates.[3] The most common solution to the problem is to apply the instrumental variables technique.[4] However, studies testing actual versus proxied expectations have usually found the errors-in-variables problem to be a minor one. As a result, the instrumental variables approach will not be used here. Before reporting the regression results, it is necessary to examine which proxies were chosen to represent the permanent income and expected inflation variables.

Expectation Variables

Permanent. Income

As discussed in chapter four, the permanent income variable used in the calculation of transitory income in model (4.1) was estimated using several methods. Various Almon lag structures and adaptive expectations estimates for alternative values of the adjustment coefficient were employed in the estimation of the following saving rate model (hereafter referred to as the basic model):

(5.1) $S/Y = a0 + a1(S/Y)_{-1} + a2(YT/Y) + a3UR + a4DUR + a5\pi$

where, as previously defined:

S/Y = the ratio of real per capita personal saving to real per capita personal disposable income;

$(S/Y)_{-1}$ = the first quarter lag in the personal saving ratio;

YT/Y = the ratio of real per capita transitory disposable income to real per capita current disposable income;

UR = the unemployment rate;

DUR = the difference in the unemployment rate from the same quarter a year ago;

π = the actual rate of inflation.

Actual inflation was employed as an explanatory variable rather than expected and unexpected inflation, since an estimate for the permanent income variable must first be chosen in order to subsequently test the saving rate model (4.1) for alternative estimates of expected and unexpected inflation. After this initial stage, the best Almon lag structure and the best Koyck lag structure were chosen as the basis for further testing.

The preferred proxies for permanent income resulting from the estimation of (5.1) over the period 1968:1 to 1985:4 using ordinary least squares, and a maximum likelihood iterative procedure to correct for first-order autocorrelation when present, are reported in Table 5.1. Only those lags which could be reasonably expected were

Table 5.1

Regression Results using Alternate Permanent Income Estimates

YP Proxy Used	Constant	Explanatory Variables					SE	$\bar{R}^2$	h	ρ
		$(S/Y)_{-1}$	YT/Y	UR	DUR	π^a				
Almon Lag Structure 3rd degree, 12Q lag	-0.745 (-1.843)†	0.6347 (7.552)**	0.5857 (7.831)**	0.3404 (3.368)**	-0.072 (-0.817)	0.259 (4.893)**	0.7589	0.9436	1.51	
Adaptive Expectations equation (5.2)	-1.957 (-4.772)**	0.6776 (8.098)**	0.597 (8.228)**	0.388 (4.009)**	-0.068 (-0.789)	0.254 (4.899)**	0.7407	0.9463	1.57	
equation (5.3)	-1.687 (-1.824)†	0.2436 (2.728)**	0.6016 (9.348)**	0.848 (6.42)**	-0.292 (-2.04)*	0.499 (6.443)**	0.7068	0.7513	-1.05	0.6614

NOTE: t-statistics in parentheses: † indicates significance at the 10% level; * indicates significance at the 5% level; ** indicates significance at the 1% level

The dependent variable is the personal saving rate. YP = permanent income; $(S/Y)_{-1}$ = the dependent variable lagged one quarter; YT/Y = the ratio of transitory to current income; UR = the unemployment rate; DUR = the four-quarter change in the unemployment rate; π^a = the actual inflation rate which is the four-quarter rate of change in the CPI; and SE = the standard error of the regression.

employed in estimating (5.1). Of the various Almon lag estimates tried, the third degree polynomial of personal disposable income lagged twelve quarters with no endpoint restrictions provided the best results according to the minimum standard error criterion. The lagged dependent variable, the ratio of transitory to current income, the unemployment rate, and the actual inflation rate all displayed statistically significant positive coefficients. Only the coefficient on the change in the unemployment rate showed up as statistically insignificant.

Alternate estimates of permanent income were also constructed according to the adaptive expectations model given in (4.11) and (4.13), for various values of β ranging from $\{0.1, 0.2, \ldots, 0.8\}$. Equation (5.1) was then estimated with the ratios of transitory to current income corresponding to the antilogs of these permanent income proxies. According to (4.11) and (4.13), permanent income must be calculated in log form. To calculate transitory income, the antilog of these permanent income proxies is subtracted from the current level of personal disposable income. Transitory income is then converted into rate form by dividing it through by current disposable income. As reported in Table 5.1, for the simple Koyck lag structure of adaptive expectations given in (4.11), the best results occurred when an adjustment coefficient of 0.8 was employed. That is, using:

(5.2) $LYP(t) = 0.8LY(t-1) + 0.2LY(t-2)$

For all values of β tested, the standard error of the regression ranged from 0.7407 to 0.9254 and the adjusted R squared from 0.9161 to 0.9463. The coefficients for the lagged saving ratio, the transitory income ratio, the unemployment rate, and actual inflation were positive and significant at the one percent level for all values of β tested. Once again the only insignificant coefficient was obtained for the change in the unemployment rate.

For the adaptive expectations model given in (4.13), alternative values of β were chosen from the set {0.15, 0.20, 0.30, 0.40, 0.45, 0.50, 0.60} for no growth as well as for a growth rate of 2 percent. In all cases, the coefficients for the lagged saving rate, the transitory income ratio, the unemployment rate, and the rate of inflation were positive and significant at the one percent level. In most cases the coefficient for the change in the unemployment rate showed up negative and significant at the five percent level. For all values of β tested, the standard error of the regression ranged from 0.7068 to 0.710 and the adjusted R squared from 0.6699 to 0.7513. Autocorrelation was found in the regressions using this particular type of permanent income proxy and therefore the regressions were run again using the maximum likelhood iterative procedure. This

explains why the adjusted R squared values are much lower than for the preceding regressions which did not need to be corrected for autocorrelation. The preferred permanent income estimate occurred for $\beta = 0.60$ and $g = 0.02$, lagged five quarters as follows:

$$(5.3) \qquad LYP(t) = \sum_{i=0}^{5} 0.6(1-0.6)^i (1+0.02)^i LY_{t-1-i}$$

The results obtained for the basic saving rate model (5.1) were generally insensitive to the particular estimate of permanent income chosen. According to Table 5.1, the standard error ranged from 0.7068 to 0.7589. The adjusted R squared values showed slightly more variation, ranging from 0.7513 to 0.9463. The coefficients for the various transitory income ratios were always positive and significant at the one percent level. In most regressions, the only coefficient which was found to be statistically insignificant was the coefficient attached to the change in the unemployment rate. The best estimates of the two general types of permanent income models shown in Table 5.1 (i.e. the Almon estimate of personal disposable income and the Koyck lag structure of adaptive expectations) were subsequently employed in the saving model given in (4.1) to determine the preferred expected inflation proxy.

Expected Inflation

Because of the importance of this variable, alternative estimates of the four general types of models, i.e. the naive, weighted distributed lag, and the first and second-order error-learning models, were employed in estimating the general model given in (4.1). The preferred estimate for each type of expectation model was chosen on the basis of minimum standard error of the regression. Before reporting the results of the general saving model in the following section, the preferred estimates of the expected inflation models when using the Almon and Koyck permanent income proxies will first be reported.

Almon Permanent Income Proxy

Model I

The naive model of expected inflation was the simplest of the models developed, with expected inflation in the current period exactly equal to the actual inflation rate of the previous period:

$$(5.4) \quad \pi^e(t) = \pi(t-1)$$

Model II

The weighted distributed lag model given in (4.22) was estimated for various a priori weighting schemes over four quarters. Although the standard errors and adjusted R squared

values varied only slightly between the various weighting schemes, the preferred estimate was the following:

$$(5.5) \qquad \pi^e(t) = 0.25\,\pi(t-1) + 0.25\,\pi(t-2) + 0.25\,\pi(t-3) + 0.25\,\pi(t-4)$$

This weighted distributed lag model was also estimated using the Almon lag structure of inflation, letting the data determine the weights. Second and third degree polynomials were tried for various lag lengths, with the preferred estimate being a second degree polynomial lagged four quarters with a far-endpoint restriction imposed.

Model III

The preferred estimate of the first-order error-learning model is for an adjustment coefficient of 0.7, lagged six quarters:

$$(5.6) \qquad \pi^e(t) = \sum_{i=0}^{5} 0.7(1-0.7)^i \pi_{t-1-i}$$

Using the simplified Koyck transformation as given in (4.24), the preferred estimate has an adjustment coefficient of 0.5, as follows:

$$(5.7) \qquad \pi^e(t) = 0.5\pi(t-1) + 0.5\,\pi(t-2)$$

Model IV

For the second-order error-learning model given in (4.29), the best results were found for an adjustment

coefficient of 0.6, yielding the following expected inflation proxy:

(5.8) $\pi^e(t) = 0.6\pi(t-1) + 0.3\pi(t-2) + 0.1(\pi(t-2)-\pi(t-3))$

The preferred estimate of the modified version of this model was found to be:

(5.9) $\pi^e(t)=0.7\pi(t-1)+0.2(\pi(t-1)-\pi(t-2))+0.1(\pi(t-2)-\pi(t-3))$

Koyck Permanent Income Proxy

Model I

Again, expected inflation based on the naive model is simply equal to the previous period's actual rate of inflation as given in (5.4).

Model II

For the various a priori weighting schemes tried, the preferred estimate of expected inflation was the following:

(5.10) $\pi^e(t) = 0.5\pi(t-1)+0.3\pi(t-2)+0.15\pi(t-3)+0.05\pi(t-4)$

The preferred estimate using the Almon lag structure of inflation was a second degree polynomial lagged four quarters with a far-endpoint restriction imposed. This is the same result as that found when using the Almon proxy for permanent income.

Model III

The preferred estimate of expected inflation using the first-order error-learning model was found with an adjustment coefficient of 0.9 lagged three quarters:

$$(5.11) \qquad \pi^e(t) = \sum_{i=0}^{2} 0.9(1-0.9)^i \pi_{t-1-i}$$

Using the simplified Koyck transformation as given in (4.24), the preferred estimate is also for an adjustment coefficient of 0.9 as follows:

$$(5.12) \qquad \pi^e(t) = 0.9\,\pi(t-1) + 0.1\pi(t-2)$$

Model IV

The best results for the second-order error-learning model occurred for an adjustment coefficient of 0.8:

$$(5.13) \qquad \pi^e(t) = 0.8\pi(t-1)+0.15\pi(t-2)+0.05(\pi(t-2)-\pi(t-3))$$

The preferred estimate of the modified version of this model was found to be identical to that found when employing the Almon permanent income proxy. Namely:

$$(5.14)\ \pi^e(t)=0.7\pi(t-1)+0.2(\pi(t-1)-\pi(t-2))+0.1(\pi(t-2)-\pi(t-3))$$

In each of the models of expected inflation, the above preferred estimates were chosen on the basis of minimum standard error, although the general results

(i.e. significance of the coefficients, standard error, adjusted R squared, and the durbin h statistic) were very similar for each of the alternative estimates within each model. The results obtained using these expected inflation and corresponding unexpected inflation proxies for the general model given in (4.1) will now be discussed.

Results for the General Saving Rate Model

The results of estimating (4.1) employing the best expected inflation proxy for each of the general models of expected inflation are reported in Table 5.2 for the Almon lag of personal disposable income as the permanent income proxy, and Table 5.3 for the Koyck transformation of adaptive expectations as the proxy. All equations were estimated over the sample period 1968:1 to 1985:4 using ordinary least squares.

Almon Permanent Income Proxy

The results were consistent among the regressions run using alternate expected and unexpected inflation proxies for the third degree, twelve quarter Almon lag permanent income proxy. As can be seen from Table 5.2, the standard

Table 5.2

Regression Results for Almon Permanent Income Proxy

	Explanatory Variables										
	Constant	$(S/Y)_{-1}$	YT/Y	UR	DUR	π^a	π^e	π^u	SE	$\bar{R}^2$	h
Basic Model	-0.745 (-1.843)†	0.635 (7.552)**	0.586 (7.831)**	0.340 (3.368)**	-0.072 (-0.817)	0.259 (4.893)**			0.7589	0.9436	1.51
With the following Expected Inflation Model:											
Naive (equation (5.4))	-0.765 (-1.880)†	0.653 (7.433)**	0.594 (7.825)**	0.332 (3.248)**	-0.037 (-0.368)		0.245 (4.294)**	0.352 (2.579)*	0.7616	0.9432	1.41
Weighted Distributed Lag: a priori weights (equation (5.5))	-0.796 (-1.949)*	0.653 (7.560)**	0.593 (7.877)**	0.344 (3.401)**	-0.030 (-0.300)		0.236 (3.989)**	0.316 (3.906)**	0.7598	0.9434	1.24
pdl[a]	-0.722 (-1.752)†	0.641 (7.422)**	0.589 (7.774)**	0.334 (3.243)**	-0.061 (-0.657)		0.253 (4.519)**	0.310 (2.094)*	0.7640	0.9428	1.56
First-Order Error-Learning (equation (5.7))	-0.774 (-1.904)†	0.656 (7.470)**	0.595 (7.860)**	0.333 (3.279)**	-0.027 (-0.266)		0.239 (4.098)**	0.342 (3.132)**	0.7604	0.9434	1.30
Second-Order Error-Learning (equation (5.8))	-0.767 (-1.888)†	0.656 (7.444)**	0.594 (7.849)**	0.331 (3.246)**	-0.031 (-0.300)		0.229 (3.544)**	0.349 (2.871)**	0.7608	0.9433	1.35

NOTE: t-statistics in parentheses: † indicates significance at the 10% level; * indicates significance at the 5% level; ** indicates significance at the 1% level

The dependent variable is the personal saving rate. $(S/Y)_{-1}$ = the dependent variable lagged one quarter; YT/Y = the ratio of transitory to current income; UR = the unemployment rate; DUR = the four-quarter change in the unemployment rate; π^a = the actual inflation rate; π^e = the expected inflation rate; π^u = the unexpected inflation rate; and SE = the standard error of the regression.

[a] pdl is the 2nd degree, 4Q lagged polynomial of actual inflation with far-endpoint restriction imposed

error of the regression varied only slightly from a low of 0.7589 obtained in the basic model, to a high of 0.764 for the regression employing the second degree, four quarter Almon lag of actual inflation. Similarly, the adjusted R squared ranged from 0.9428 to 0.9436. None of the regressions exhibited autocorrelation according to the durbin h-test. In all cases the calculated h statistics were below the critical h of 1.645 at the five percent level of significance.

With the exception of the change in the unemployment rate, all of the coefficients were statistically significant and had the anticipated signs. The coefficients of the lagged saving rate, the transitory income ratio, the unemployment rate, the expected inflation proxy and the unexpected inflation proxy were positive and significant at the one percent level for most of the regressions. In every case the coefficient attached to the change in the unemployment rate variable was statistically insignificant. This result is not surprising. Although it was mentioned in chapter four that the coefficient of this variable is expected to be positive, it is plausible that the actual rate of unemployment, rather than its change, is picking up the majority of the unemployment uncertainty effect. Indeed, in every regression the coefficient of the unemployment rate is positive and significant at the one percent level,

suggesting that high rates of unemployment promote uncertainty regarding job security which in turn encourages saving.

Koyck Permanent Income Proxy

The results obtained when the Koyck form of adaptive expectations was employed as the proxy for permanent income were almost identical to those obtained using the Almon proxy. Although the particular expected and unexpected inflation proxies employed in estimating (4.1) differed slightly between the regressions using the two permanent income proxies, the results were consistent with those just reported.

The coefficients of the lagged saving ratio, the transitory income ratio, the unemployment rate and the expected rate of inflation were all positive and significant at the one percent level for all of the regressions run. The unexpected inflation coefficient was positive and significant at the five percent level, while the coefficient representing the change in the unemployment rate was statistically insignificant in every case. The standard errors were all in the 0.745 range as compared to 0.76 for the regressions employing the Almon permanent income proxy. The adjusted R squared values were approximately 0.946 as compared to 0.943. None of the regressions exhibited signs of

Table 5.3

Regression Results for Koyck Permanent Income Proxy

	Explanatory Variables										
	Constant	$(S/Y)_{-1}$	YT/Y	UR	DUR	π^a	π^e	π^u	SE	$\bar{R}^2$	h
Basic Model	-1.957 (-4.772)**	0.678 (8.098)**	0.597 (8.228)**	0.388 (4.009)**	-0.068 (-0.789)	0.254 (4.899)**			0.7407	0.9463	1.57
With the following Expected Inflation Model:											
Naive (equation (5.4))	-1.978 (-4.768)**	0.689 (7.887)**	0.601 (8.179)**	0.383 (3.918)**	-0.046 (-0.473)		0.245 (4.401)**	0.313 (2.345)*	0.7450	0.9456	1.58
Weighted Distributed Lag: a priori weights (equation (5.10))	-1.979 (-4.752)**	0.686 (7.896)**	0.599 (8.181)**	0.388 (3.977)**	-0.049 (-0.497)		0.245 (4.271)**	0.288 (2.864)**	0.7454	0.9456	1.54
pdl^a	-1.935 (-4.664)**	0.686 (7.977)**	0.601 (8.180)**	0.380 (3.856)**	-0.054 (-0.592)		0.246 (4.486)**	0.320 (2.210)*	0.7450	0.9456	1.64
First-Order Error-Learning (equation (5.12))	-1.978 (-4.767)**	0.689 (7.879)**	0.601 (8.181)**	0.384 (3.926)**	-0.046 (-0.466)		0.244 (4.364)**	0.310 (2.402)*	0.7451	0.9456	1.57
Second-Order Error-Learning (equation (5.13))	-1.977 (-4.767)**	0.689 (7.873)**	0.601 (8.183)**	0.384 (3.921)**	-0.046 (-0.464)		0.241 (4.084)**	0.309 (2.420)*	0.7451	0.9456	1.57

NOTE: t-statistics in parentheses; * indicates significance at the 5% level; ** indicates significance at the 1% level

The dependent variable is the personal saving rate. $(S/Y)_{-1}$ = the dependent variable lagged one quarter; YT/Y = the ratio of transitory to current income; UR = the unemployment rate; DUR = the four-quarter change in the unemployment rate; π^a = the actual inflation rate; π^e = the expected inflation rate; π^u = the unexpected inflation rate; and SE = the standard error of the regression.

^{a} pdl is the 2nd degree, 4Q lagged polynomial of actual inflation with far-endpoint restriction imposed

autocorrelation as all of the calculated h statistics were below the critical h value at the five percent level of significance.

Overall, the results obtained for the general model are very encouraging. For both permanent income proxies employed, the results seem highly supportive of the uncertainty hypothesis. When comparing the results between the two measures of permanent income, it is apparent that they are quite similar.

Tables 5.1, 5.2 and 5.3 show that the overall results are insensitive to the particular permanent income proxy and the particular expected and unexpected inflation proxies employed. In every case, all of the coefficients with the exception of the coefficient for the change in the unemployment rate, were highly significant displaying positive signs as anticipated. Increasing the degree of sophistication with respect to both the income and inflation proxies only had a marginal impact on the results. This suggests that when picking the particular equation for each permanent income proxy to be used for further testing, it is desirable to choose a relatively simplistic inflation proxy over a more sophisticated one. The following two sections report the results of these further tests.

Structural Stability

Although the reported results indicate that all but one of the explanatory variables have had a significant influence on the saving rate, there is no guarantee that the functional relationship has been stable over the entire sample period examined. It is therefore desirable to test the structural stability of this relationship. This was done using the dummy variable method.[5] Although the few studies surveyed in chapter three which tested for stability did so simply by splitting the sample period in half, this is not an accurate method if there is no plausible reason to believe that the relationship changed at that particular time. Structural stability was tested in this study with respect to several intuitively reasonable "breakpoints" over the 1968-1985 sample period. The hypothesis that the individuals' saving behavior, as reflected by the rate of saving, shifted in response to changes in the institutional, the unemployment, and the inflationary environments were all tested using dummy variables.

As mentioned in chapter four, the institutional incentives to save which exist in Canada are hypothesized to positively influence the saving ratio independently of the other explanatory variables. The effect of the institutional factors on the rate of saving were tested using intercept dummies. The structural breakpoints examined

were for 1972, 1974 and 1976. While the RRSP's have been available since 1957, their attractiveness increased as a result of the tax reforms of 1972 which increased the maximum deductible contribution to an RRSP from $2500 to $4000 to a limit of 20 percent of earned income. In 1976 the limit was raised further to $5500.[6] Therefore, intercept dummies representing the increased RRSP contribution limits for 1972 and 1976 were incorporated into the model. An intercept dummy was also included for the RHOSP and $1000 interest income deduction, both of which were implemented in 1974.[7]

The intercept dummies representing the increased contribution allowed to the RRSP are expected to have a positive impact on saving behavior as a result of the increasing popularity of RRSP's over the 1970s as both a tax reduction and saving mechanism.[8] Although the availability of RRSP's is theoretically expected to have a significant positive influence on saving behavior, no convincing studies exist to indicate what, if any, effect RRSP's have had on personal saving.[9] The effect that the interest income deduction program has had on saving behavior is also uncertain. Not all individuals can take advantage of this program since the incentive to save is only marginal for those persons with lower incomes.[10]

The only study which formally incorporated institutional variables was undertaken for Canada by Jarrett(1981). The

RRSP and RHOSP participation rates were included in separate regressions of the saving rate. Due to limited availability of data on these programs, the sample period was restricted from 1965 to 1978. Jarrett found that the coefficients of both of these variables were positive and significant over the sample period tested.

The equations chosen from Table 5.2 for further testing are those employing weighted distributed lags for the inflation proxies, with the weighting scheme given in (5.5) and the inflation proxies based on first-order error-learning given in (5.7). The equations chosen from Table 5.3 are those which employ the second degree, four quarter Almon lag of inflation and the second-order error-learning process given in (5.13). Including the three intercept dummies in the above equations yielded the following results. The intercept dummies representing 1974 and 1976 were statistically insignificant in all of the above regressions tested. The results of these regressions were identical to the general results reported in the previous section, with respect to significance of the coefficients, standard error of the regression and adjusted R squared.

The dummy intercept for 1972 was found to be statistically significant at the five percent level for the regressions employing the Almon permanent income proxy, and significant at the one percent level for the regressions employing the

Koyck proxy. However, in all cases the sign of this variable
was negative, contrary to expectations. This result would
suggest that the saving function shifted downward in response
to the changing institutional environment of 1972. However,
it is possible that some factor other than the change to
RRSP contributions was responsible for negatively influencing
the saving rate in 1972. Again in these regressions, all
coefficients on the other explanatory variables were positive
and significant, however the standard error was slightly
lower and the adjusted R squared slightly higher than for
the regressions in the previous section.

Aside from structural breakpoints occurring over the
sample period from changes to institutional incentives to
save, the rate of saving may also have shifted in response
to changes in the inflationary environment as well as changes
in response to the unemployment rate. The existence of
these breakpoints was tested with the use of slope dummies
for anticipated inflation, unanticipated inflation and the
unemployment rate.

As can be seen from Table 4.1, the unemployment rate
increased significantly beginning in 1977 and has stayed at
high levels ever since. It would seem reasonable to suspect
that individuals have responded more strongly to this marked
change in the unemployment rate by increasing their saving

in response to the greater uncertainty regarding job security which is reflected in the high rates of unemployment.

Upon examination of the results, this would appear to be the case. The coefficient representing the slope dummy of the unemployment rate was found to be positive and significant at the five percent level for the regressions employing the Almon permanent income proxy, and positive and significant at the one percent level for the regressions employing the Koyck permanent income proxy. This result indicates the possibility that saving behavior responded more strongly to the higher unemployment rates since 1977 than those prior to 1977. However, this shift in saving behavior could be due to other factors unaccounted for in the model, rather than solely due to a change in the rate of unemployment.

In each case the coefficients of the lagged saving rate, the transitory income ratio and expected inflation remained positive and significant at the one percent level. The unexpected inflation coefficient was positive and significant at the five percent level for the regression employing the Almon income proxy, when the weighted distributed lag model of (5.5) and the first-order error-learning model of (5.7) were used in determining the inflation proxies. The coefficient of unexpected inflation was statistically insignificant for all inflation proxies attempted in the

regressions employing the Koyck permanent income measure. For all regressions the unemployment rate coefficient became statistically insignificant. This is to be expected as the impact of the unemployment rate on saving behavior is being picked up by the unemployment slope dummy. All of the regressions employing the unemployment slope dummy reported lower standard errors and higher adjusted R squared values than the corresponding regressions of the general model.

The various slope dummies representing the changing inflationary environment over the sample period were generally found to be statistically insignificant. The only exception was a positive and significant coefficient found. for the slope dummy of anticipated inflation, when the dummy was set to zero for the subperiod 1968 to 1976 and set to one for the 1977 to 1985 subperiod. This result is interesting as it suggests that anticipated inflation had a stronger positive impact on saving behavior in the period since 1977 which is characterized by higher rates of anticipated inflation than the earlier subperiod.

Modifications to the General Model

There are virtually endless combinations of variables that could be added to and dropped from the general model. Therefore only those modifications which have theoretical justification will be attempted. These modifications are

again made to the "best" equations found in Tables 5.2 and 5.3. The explanatory variables which will be added to the general model are the short-term real rate of interest and the female participation rate.[11] The only variable which could conceivably be dropped from the general model would be the change in the unemployment rate as it was generally found to be statistically insignificant in estimations of the general model.

The interest rate coefficient showed up positive and significant at the one percent level in all of the regressions estimated. Adding the rate of interest to the general model did not alter the statistical significance of the explanatory variables. In fact, doing so improved the statistical fit of the regression in all cases. The standard error dropped markedly from the 0.76 range to 0.65 for the regresions employing the Almon permanent income proxy, and from the 0.74 range to 0.61 for the regressions employing the Koyck income proxy. The adjusted R squared values, which were similar for both permanent income proxies, increased slightly from 0.94 to approximately 0.96. However, when the interest rate was incorporated, none of the slope dummies turned up statistically significant. With respect to the intercept dummies representing the institutional factors, only the dummy intercept for 1976 was found to be negative and

significant at the five percent level for the Almon income proxy, and insignificant in all other cases.

The next modification was the addition of the female participation rate to the general model. For the regressions employing the Koyck income proxy, the coefficient of this variable was positive and significant at the one percent level for each of the inflation proxies included. However, both the unemployment rate and the unexpected inflation coefficients became statistically insignificant in the majority of the cases. The standard error dropped from approximately 0.74 in the general model to approximately 0.70 in this modified version of the model.

Although autocorrelation was not found to be a problem in the regressions employing the Koyck income proxy, this was not the case with respect to the Almon income proxy. Correcting for autocorrelation using the maximum likelihood iterative procedure resulted in lower standard errors (dropping from 0.76 in the general model to 0.70) as well as a lower adjusted R squared (0.85 as compared to 0.94 in the general model which did not exhibit autocorrelation). The female participation rate coefficient was positive and significant at the five percent level, and the significance of the unexpected inflation coefficient dropped slightly from the one percent level of significance to the five percent level. The other explanatory variables remained significant

at the one percent level. Multicollinearity is also likely to be somewhat of a problem in the modified model since the female participation rate was found to be highly correlated (with a partial correlation coefficient of approximately 0.86) with the unemployment rate. This could likely explain why in each regression the female participation coefficient was positive and significant while the unemployment rate coefficient was insignificant.

Dropping the change in the unemployment rate variable did not significantly alter the results. The standard error and adjusted R squared for each of the regressions were approximately the same as those found for the general model. The t-ratios of each of the coefficients increased in significance over those found in the general model, with all coefficients displaying a positive sign at the one percent level of significance.

Summary

This chapter has presented the empirical results from the estimation of the general model developed in chapter four, as well as for several modifications made to this model. The overall results indicate that the theoretical model performs well in explaining the rate of saving in Canada. The signs of the coefficients of the lagged saving rate, the transitory income ratio and unanticipated inflation

were as theory would predict. Although the a priori signs of the coefficients for the unemployment rate and expected inflation are theoretically indeterminate, the positive coefficients found for these variables are consistent with the uncertainty hypothesis. Only the sign of the change in unemployment rate coefficient was found to be contrary to theory. The results are generally insensitive to the particular permanent income and expected inflation proxies chosen.

To summarize, the regressions for the rate of saving indicate the following:

(1) For the third degree, twelve quarter Almon lag proxy of permanent income, the coefficients of the lagged saving ratio, the transitory income ratio, the unemployment rate, and all proxies of expected and unexpected inflation were found to be positive and significant at the one percent level in the majority of the cases. Only the coefficient for the change in the rate of unemployment was statistically insignificant. The standard errors were in the 0.76 range with the adjusted R squared values in the 0.94 range.

(2) For the Koyck proxy of permanent income with an adjustment coefficient of 0.8, the results were almost identical. All coefficients, with the exception of the change in the unemployment rate, were found to be positive and

significant at the one percent level, although the unexpected inflation coefficient was significant at the five percent level in the majority of the regressions. The standard errors were in the 0.74 range and the adjusted R squared values were in the 0.94 range.

(3) Testing for structural stability using intercept dummies representing institutional factors indicated that the only significant institutional dummy was found for 1972. However, in all cases this coefficient was negative, suggesting a downward shift in the saving rate since 1972 due to factors unaccounted for in the general model.

(4) Testing for structural stability using slope dummies indicated that the saving rate responded more strongly to the unemployment rate in the 1977 to 1985 subperiod than in the previous period.

(5) Modifying the general model by adding the short-term real interest rate improved the results for both permanent income measures employed, as did the addition of the female participation rate. However the presence of multicollinearity when this variable was incorporated into the general model reduces the reliability of the results somewhat. Dropping the change in the unemployment rate variable did not alter the results significantly.

The following chapter summarizes the major findings of this study along with policy implications and suggestions for further research.

NOTES TO CHAPTER FIVE

1. "CANSIM" is an official mark of Statistics Canada. The following is a list of the specific data sources used: personal saving, CANSIM identifier (C.I.) 001015.1.8; personal disposable income, C.I. 001015.2; unemployment rates 15 years and over, C.I. 002075.133.11.9; and the consumer price index for all items, C.I. 001922.1.

2. When correcting for first-order autocorrelation, the TSP econometrics package invokes the maximum likelihood (ML) iterative procedure, unless the Cochrane-Orcutt procedure is specifically requested. Although TSP prefers to use the ML procedure, the Cochrane-Orcutt procedure is asymptotically equivalent to ML, differing only with small samples. See Beach and MacKinnon (1978).

3. Gujarati (1978), pp. 323-324.

4. For example, see Liviatan (1963).

5. See Gujarati (1978), pp. 295-298.

6. Jarrett (1981), p. 61.

7. Ibid., p. 60.

8. The proportion of tax returns which included deductions for contributions to RRSP's increased from 2.7 percent in 1970 to 11 percent in 1978. See Jarrett (1981), p. 62.

9. Boadway and Kitchen (1984), pp. 330-331.

10. Ibid., p. 84.

11. Both of these variables were obtained from CANSIM. The short-term rate of interest used is the Government of Canada 91-day Treasury Bill rate, C.I. 002560.1; the female participation rate is the participation rate of women 15 years and over, seasonally adjusted, C.I. 002075.333.11.8. Both variables are reported monthly and were converted into quarterly data by averaging over each quarter. The real rate of interest was calculated by subtracting the rate of inflation from the nominal interest rate.

CHAPTER SIX

SUMMARY AND CONCLUSIONS

Summary

The objective of this study was to examine both the theoretical and empirical linkages between inflation and saving behavior in Canada. It focussed on the role played by inflation in the drastic jump in the saving rate in the mid-1970s and the persistence of high rates of saving into the 1980s. The significance of saving behavior to short-run variations in economic activity as well as to long-run economic growth makes it important to understand the factors which influence it.

Although many studies have examined saving behavior in the United States, the recent divergence in the patterns of the rate of personal saving between Canada and the U.S. makes it inappropriate to apply the results and conclusions obtained from U.S. data to the Canadian situation. In addition, it is desirable to undertake a study of Canadian saving behavior because of the lack of empirical studies for Canada.

It was found in this study that no single factor can be held responsible for the increase in the personal saving rate in Canada. Saving behavior is complex and determined by institutional and psychological, as well as economic factors. The empirical model developed in this study attempted to incorporate these various factors. The economic factors represented in the general model included the unemployment rate, inflation (both anticipated and unanticipated) and income. The psychological factors focussed on various types of uncertainty regarding these economic factors. More specifically, uncertainty regarding income (represented by the ratio of transitory to current disposable income), uncertainty regarding employment (represented by the unemployment rate) and uncertainty regarding inflation and the future in general (represented by the unanticipated rate of inflation) were examined in the model.

There are various ways in which this study differed from previous studies of saving behavior. One difference is that it incorporated institutional factors into the model using dummy variables for the RRSP, RHOSP and $1000 interest income deduction. A second difference is that it examined structural breaks in the response of the saving rate to economic factors, such as the unemployment rate and inflation. Another difference is in the particular variable employed to capture income uncertainty. In this study, the ratio of

transitory to current income was incorporated to capture this uncertainty effect. Only one previous study has used this variable. The majority of these studies include either the level of transitory income or both the levels of permanent and transitory income, a practise which is inappropriate when examining changes in the "rate" of saving.

The complexity of saving behavior has resulted in the failure of standard economic theories to adequately explain the changing saving behavior of the 1970s. The standard versions of the permanent income and life-cycle hypotheses as well as the Houthakker-Taylor stock-adjustment model do not formally incorporate inflation, nor do they take into account institutional factors.

The model developed in this study was based on a combination of the life-cycle hypothesis and the stock-adjustment model. It recognized that the saving decision should be examined within a multi-period framework, with importance placed on past behavior in influencing current saving decisions. The rate of personal saving was chosen as the dependent variable. The specific explanatory variables included in the model were the lagged rate of saving, the ratio of transitory to current income, the unemployment rate, the four quarter change in the unemployment rate, anticipated inflation and unanticipated inflation. All saving and income flows were expressed in real per capita terms. Modifications

to this general model included the addition of the short-term real rate of interest and the female participation rate, and the exclusion of the change in the unemployment rate.

A major issue in the development of the model was the generation of proxies for expected inflation and permanent income. Both were calculated using an autoregressive expectations mechanism as opposed to the more sophisticated rational expectations. Various estimation methods for generating permanent income were employed, with the preferred estimates chosen on the basis of the performance of the corresponding ratio of transitory to current income variable in the general saving rate model. The preferred estimates were for a Koyck lag structure based on adaptive expectations with an adjustment coefficient of 0.8, and for a third degree, twelve quarter Almon lag with no endpoint restrictions imposed.

Various expected and corresponding unexpected inflation proxies were employed in two versions of the general saving rate model; one in which permanent income was proxied by the above Koyck lag structure, and the other model which incorporated the Almon lag proxy. The best proxy for each type of autoregressive expectations mechanism -- the naive, the weighted distributed lag, the first-order error-learning, and the second-order error-learning -- was chosen according to the minimum standard error criterion and reported in

chapter five. The results were found to be insensitive to the proxies chosen for expected inflation and permanent income.

For the saving rate model employing the Almon permanent income variable, the standard error of the regression was approximately 0.76 with an adjusted R squared of approximately 0.943 for all expected inflation proxies. In all cases the coefficients for the explanatory variables were statistically significant at the one percent level, with the exception of the coefficient for the change in the rate of unemployment, which was always insignificant. The results using the Koyck permanent income proxy were almost identical. In all cases, the standard error was in the 0.745 range with an adjusted R squared of approximately 0.946. The coefficient for the change in the unemployment rate was again insignificant. The coefficient representing the unexpected rate of inflation was positive and significant at the five percent level, while the remaining coefficients were positive and significant at the one percent level. Autocorrelation was generally not found to be a problem in the models tested. Of the various direct (i.e. money illusion, intertemporal substitution, uncertainty) and indirect (i.e. real wealth, interest rate effect) transmission mechanisms put forth in chapter two to explain the relationship between inflation and the rate of saving, the results generally support the

uncertainty hypothesis as the primary mechanism by which inflation influences saving behavior.

Modifying the general model only affected the results slightly. The adjusted R squared and standard error improved somewhat by the addition of the short-term real rate of interest. The inclusion of the female participation rate resulted in the coefficients for the unemployment rate and unexpected inflation becoming statistically insignificant. However a high degree of correlation between the female participation and unemployment rate variables may have reduced the reliability of the results. No change in the results were found when the change in the unemployment rate variable was dropped from the model.

The only intercept dummy variable representing institutional factors which entered significantly into the model was that representing a break in 1972. In this year there was an increase in the limit for RRSP contributions. However this coefficient was negative and significant, contrary to expectations. Of the various dummies employed to reflect several breakpoints over the 1968-1985 sample period with respect to changes in the unemployment and the inflationary environment, only the slope dummy representing a change in the pattern of the unemployment rate in 1977 was found to be positive and significant for all regressions.

The results obtained are indicative but not conclusive. Overall, the results are supportive of the inflation - uncertainty hypothesis. The positive coefficient of the unemployment slope dummy suggests that the unemployment rate (reflecting uncertainty regarding job security) has become a major positive influence on the saving rate in recent years. The results suggest that uncertainty in general has been a major force in increasing and maintaining a high rate of personal saving in Canada. Uncertainty regarding inflation is likely responsible for the initial jump in the 1970s, with uncertainty regarding employment responsible for the persistence of high rates of saving in the presence of much lower rates of inflation.

Policy Implications

Having determined the factors responsible for influencing the rate of saving it is useful to briefly examine several economic and policy implications of its recent behavior. If a high saving ratio is seen as desirable, and if , indeed, the presence of inflation positively influences the rate of saving, inflation may not be as undesirable as generally believed. Inflation is generally thought of in a negative way, with the desire to eliminate or reduce inflation because of its high "welfare costs." If the presence of inflation has a positive influence on the rate of saving, which is

deemed a desirable goal in terms of its positive effect on long-run economic growth, then the welfare costs of inflation may not be as high as perceived. This would conceivably alter the costs and benefits of various economic policies designed to reduce inflation.

However, the link between the saving ratio and growth depends on the type of assets held. Although high rates of inflation positively influence the rate of saving, they also influence the manner in which savings are held and hence overall economic growth. For example, with high inflation rates there would generally be a tendency to hold savings in the form of real assets whose values will keep pace with inflation, rather than assets which are important in terms of financing additions to real productive capacity. The presence of these "diversion" effects becomes more important as inflation becomes more severe.

Another point to consider is the direction of linkage between rates of inflation and rates of real economic growth. Although inflation may positively influence growth through an increase in productive assets held, a reverse relationship is possible. Increasing economic growth can lead to greater aggregate demand, which in turn creates inflation. Therefore, the extent to which "welfare costs" of inflation are reduced depends on whether inflation causes growth or vice versa.

If the former is true, a reduction in welfare costs further depends on the manner in which increased savings are held.

Another issue is the importance placed on short-run versus long-run economic goals. In the short-run a lower saving rate would be desirable to increase aggregate demand. Therefore policies designed to increase consumption should be undertaken. However, if long-run economic growth is seen as a more important goal, then policies designed to increase saving should be implemented.

A major policy implication regarding saving behavior which is related to the above issue is whether income or consumption should be used as the base for taxation. The income tax has often been criticized for distorting the decision to save in the sense that it leads to a double taxation of savings. According to this argument, savings are made out of income which is net of tax and the return to savings is then taxed further.[1] Proponents of the consumption tax believe that this tax distortion can be removed by replacing the income tax system with a progressive consumption tax. In this way, capital income would be exempted from the tax base. As a result, saving would be encouraged thereby increasing capital accumulation.[2] However, a major problem with the implementation of a consumption tax is that it is seen as politically undesirable, since the tax

breaks would be disproportionately given to the rich who do most of the saving.[3]

Shortcomings and Future Research

The decision of how much to consume or save out of one's income is not solely an economic decision. The saving decision is a complex human behavior which is influenced by psychological as well as economic factors. It is difficult for the empirical model developed in this study to adequately capture the psychological aspect of the decision to save. For instance, it remains unknown to what extent the variables representing the various types of "uncertainty" hypothesized to influence saving behavior do in fact capture uncertainty.

Another shortcoming of the model developed is the difficulty in incorporating institutional and demographic factors which also influence saving behavior. Although these factors were included in the form of dummy variables, it is possible that several important institutional and demographic factors have been excluded. Improvements to a model of saving behavior would be made by a closer examination of the interaction among the psychological, demographic and institutional factors. Unfortunately, the problem of incorporating these factors into an empirical model has no easy solution, and it is a problem which is likely to remain.

Another possible problem with the model developed in this study is that the reliability of the results obtained highly depends on the accuracy of the expected inflation and permanent income proxies. If either of these proxies are not sufficiently accurate measures the reliability of the results is greatly reduced. However since no actual expectations data exist it leaves no alternative but to use some proxy. The high degree of similarity between the results using the various proxies would suggest that perhaps this is not a very serious problem.

NOTES TO CHAPTER SIX

1.   St.-Hilaire and Whalley (1985), p. 217.

2.   Boadway and Bruce (1985), p. 145.   For a more detailed discussion of the consumption - income tax issue and its implications see Boadway and Kitchen (1984), pp. 27-49.

3.   St.-Hilaire and Whalley (1985), p. 221.

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