THE DEMAND DETERMINANTS OF LIFE INSURANCE:
THE BARBADOS CASE

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ABSTRACT

This paper examines the determinants of demand for life insurance in a small open economy within an integrated macroeconomic framework. Within this framework life insurance is looked at via its various financial and social components, as a savings and investment instrument and as an instrument to hedge against risk. The extent of the variations in the dollar value of life insurance premium income in Barbados is analysed with respect to movements in demand factors such as interest rates, prices, wages, tax relief and unemployment levels. An error correction model is utilized in order to desegregate the effects of these determinants into long-run and short-run effects.

Section 1: Introduction and Overview

It has long been recognized that the financial sector contributes significantly to economic growth. In developing countries, such as Barbados, the financial service industry (insurance services included) plays an integral role in the savings and investment process of many households. In spite of this however, there has been limited analysis of the insurance industry (life insurance in particular) in developing countries (see Outreville [1996]), where the bulk of research has focused on commercial banks. As it relates to the Caribbean, only Bourne and Bailey(1977), Craigwell and Haynes (1987), and to a lesser extent Odle (1972) and Ramsaran (1983) have discussed the insurance industry. Given this shortage in research, this paper seeks to reduce this void in the literature by looking at life insurance demand.

The previously mentioned empirical studies which focussed on estimating the demand for the life insurance function in the Caribbean were deficient on two counts:

a. They omitted issues of stationarity and cointegration.

b. They did not investigate the short-run dynamics of the function.

It is an empirical fact that most economic variables exhibit non-stationary means and variances. Such phenomena renders much of the classical inference procedures invalid. Cointegration allows estimation and inference to be possible when economic variables exhibit non-stationarity. If there exists a linear combination of non-stationary variables that is stationary, then these variables are said to be cointegrated, and an equation in the levels is valid. However, this equation in the levels ignores short-run dynamics in the data set. Error correction mechanisms [see Engle and Granger (1987)], permit the estimation of both the long run and short run effects of the regression. Its use avoids the potential spurious regression problem in running the function only in the levels. The theory and methodology of the ECM will be further discussed in Section 5.

This paper is divided into the following sections. Section 2 highlights the various motives and trends of the life insurance industry. Section 3 reviews previous work dealing with life insurance in a Caribbean context. Section 4 presents general insight into the specification of the model. Section 5 provides the tools and methodology which will be used in the empirical analysis. Section 6 gives the empirical results. There will also be some conclusions in the final section of the paper.

Section 2: Motives and Trends

Section 2.1

With changing developments in the financial sector, characterized by the increased levels of sophistication in both the markets and instruments available for savings and investment, it would seem timely to examine the drivers of life insurance. Life insurance as McGill (1975) described, is an investment object or "....[it is] a device for the reduction of the uncertainty of one party, the insured, through the transfer of particular risks to another party, the insurer, who offers a restoration, at least in part, of the economic losses suffered by the insured." Life insurance can be subdivided into four basic categories, all of which are offered within Barbados' industry, these are:

1. Term: This type provides life insurance protection for a limited period and is widely regarded as a temporary insurance contract.

2. Whole Life: As the name suggests the protection is in force for the duration of the insured's lifetime.

3. Endowment: Provides payment for a period during the insured's lifetime as well as at the end of the term.

4. Annuity: Provides for payment of a fixed amount periodically for a fixed period or during the duration of the life of the insured.

Though it is acknowledged that these various forms of life insurance exist, a numerical breakdown of type specific policies is not available in this paper due to a lack of information. This paper's focus however, is on the total life insurance product and it is possible that future work could be concentrated on the distribution of the different categories of life insurance policies.

Individuals purchase life insurance contracts primarily for one reason, the protection of income from the 'premature' death of the wage earner. This premature death destroys the potential earnings of the individual, and the economic loss falls upon those persons who had depended upon that particular life for support. This circumstance is not confined to a personal situation, since a business-either a sole proprietor or partnership, the death of a key individual may spell difficulties for the continuation of that entity. This key individual most likely procures capital for the firm, either from personal funds or accessing credit, and in ensuring the continuity of the firm, a contract may be necessary for this person. Where a person has invested in a pension fund or retirement fund, the benefits of a policy are not only enjoyed in the event of death. Benefits from these type of policies can be received at retirement age, where, again due to the loss of one's wage earning capacity, a regular flow of funds is still available. Policies can be used as collateral for purposes of securing credit for mortgages and business loans. Also, in some countries, by possessing an insurance contract, the holders are eligible to use the premium payments to reduce income tax liability, by using them as deductibles.

In looking at the importance of the industry on a macro level, it should be noted that the life insurance industry is very important in developing countries, in terms of its contribution to savings, resource allocation, and government tax revenue. Reher (1966) highlighted two major characteristics of the industry which would enhance savings. The presence of a contractual obligation would constrain the future disposal of income over the long run, since, the contracts are long-term in nature. This would imply a savings habit is engendered and maintained by the mechanism of regular periodic payments of premiums. These effects may assist in ensuring the stability of household savings, and is further strengthened by the desire to avoid accumulated savings loss as a result of lapsed policies. Also, a general increase in savings throughout the economy, would activate an increase in the value of some financial assets, through an increase in demand for these assets.

Section 2.2

In 1972, the predominantly agency-type life insurance industry comprised 11 companies, with 81% foreign based and the remaining amount locally owned. By 1993, this figure rose to 14, of which 43% of this number was locally owned, an equal amount foreign-based and the remaining 14% originating from the CARICOM region (See Table 2). In light of rapid changes in the financial sector, the insurance industry continues to grow (see Table 1). Albeit, the growth trend, observed is at a reduced rate when compared to rapid increases registered during the late 1970's and the decade of the 1980's.

In observing the growth pattern it is clear that during the period beginning in the late 1960's to the late 1980's, the life insurance industry enjoyed rapid growth. The upward growth pattern is visible in the sum assured and the number of policies. Individual contracts are responsible for the bulk of the sum assured and the total number of policies, making up over 90% of both categories. The number of individual policies grew by 236% (or 56,212 policies) over 1972-1994 period and the sums assured of this grouping surged by more than $3 billion over the same period. This growth however, was not always continuous, for the number of individual policies at the end of 1992, actually declined by 12% over the 1990 figure. This decline in the number of policies could be attributable to the economic restructuring programme imposed on the Barbadian economy during 1991. However, this decline in the number of policies was not evident in the aggregate sums assured. The sums assured series, though displaying a growth trend demonstrates declining growth. Rapid growth was experienced in the 1970's and 1980's where the annual average growth between 1975-1985 stood at approximately 30%. This average annual growth path has however declined to approximately 3% during the 1992-1994 period. (See Table 3). In this paper premium income will be used as the dependent variable, since relative changes in premium income can be regarded as a good measure for assessing growth within the sector. The rapid growth experienced in the sums assured series in the 1970's and 1980's is mirrored by the trend in premium incomes. Premium income over the 1965-1975 period, grew by $7 million and further mushroomed to $31 million over the 1976-1986 period, with each period registering yearly averages of 20% or above. Figures recorded at the end of 1993 showed that total gross income grew by 17.5% more than 1992, however there was a 13% decline in income from premiums. Despite this slight decline in premium income, the average annual growth rate over the 1989-1993 period stood at 13.3% (See Table 1).

As a percentage of GDP, premium income was 9.2% in 1993, compared to 5%, 1.6% and 1% in 1985, 1975 and 1968 respectively. This would suggest that in more recent periods, the premium income/GDP ratio has been increasing, and further implies that a greater amount of income is being spent on insurance contracts. From the evidence provided, it seems the insurance industry, one of Barbados's largest private sector financial institutions, (second only to the commercial banks), continues to demonstrate a continuous growth pattern.

There have been some broad non-economic reasons proposed to be partly responsible for the growth trend exhibited. Bourne and Bailey (1977) in looking at the Jamaican industry listed three main factors, all of which can be applied to Barbados. First, with the use of highly mobile salesmen spread over a large area, come into more personal contact with potential and existing clients than any other financial institution. Secondly, premiums paid toward the contract are geared with the insured level of income taken into consideration. Finally, there is a seemingly greater level of individual sales effort by the members of the industry. This effort is manifested by personal communication, household visits and the salesmen's level of persuasive power, in extolling virtues on the advantages of insurance for the general advancement of the family. In the next section the economic factors will be examined by reviewing the previous literature originating from the Caribbean.

Section 3: Caribbean Literature Review

There have been a number of studies which dealt with the specification of the demand for life insurance function and the rationale for holding such an instrument[1]. In the Caribbean, Bourne and Bailey(1977), Craigwell and Haynes (1987), Odle (1972) and Ramsaran (1983) are the appropriate references. Odle (1972) looked at the operations and importance of non-bank operations in Guyana and Trinidad and gave some insight into this sector, however, he did not provide a quantitative analysis of the demand for life insurance. Ramsaran (1983) also provided some thoughts on the operation of the financial system in the Bahamas, but he too did not provide a comprehensive study of the insurance sector. The work of Bourne and Bailey (1977) and Craigwell and Haynes (1987) dealt with the insurance sector, but more

[1] See Cargill and Troxel (1980), Babbel (1981,1985), Browne and Kim (1996), Yaari (1965) and Fortune (1973) among others.

specifically, with the demand for life insurance in Jamaica and Barbados respectively.

The study performed by Bourne and Bailey, can be considered as the forerunner in providing a model for insurance demand in the Caribbean. The paper initially highlighted the important role of the life insurance industry in terms of mobilizing and allocating domestic resources, and then specified a model and performed the various tests. The authors recognized the multipurpose nature of a life insurance contract, and as such analyzed some socioeconomic factors which could influence its demand. The theoretical model was presented as:

$$LI = f(Y, REG, A, EDUC, DEP, TAX, R)$$

Where LI is the life insurance variable, Y is income, REG is a measure of income instability, EDUC is the level of education, DEP is the number of dependents, TAX is the rate of income taxation and R is the interest rate on alternative financial assets.

However, due to data limitations the specified theoretical model was reduced to life insurance demand being a function of income, rate of income taxation and the rates on alternative financial assets. Based on hypotheses by Fortune (1973) and Neumann (1969), the rate of inflation was included into the reduced form of the theoretical model. From this, three forms of the dependent variable were used in the model specification: life insurance premium income, the sum assured, and the number of policies in force. Regressions were then run on the three models over the period 1959-1972, using the Ordinary Least Squares technique. In the results from the first two models with the dependent variable being premium incomes and the number of policies in force, the only statistically significant variable (tested at the 5% level), was the income variable. Being positively correlated and significant, suggested that premium incomes move in the same direction to changes in income. In the model where the sum assured is the dependent variable, income and the rate of inflation were both significant at the 5% level. From these results, the authors concluded that the level of income is the major determinant in the demand for insurance and on occasion, the rate of inflation can exert a small degree of influence. However, due to the restraints of nonexistent and fragmentary information, the authors refrained from making a generalized statement about the empirical determinants for life insurance demand in Jamaica. The model proposed by Craigwell and Haynes (which focused on demand for life insurance in Barbados) also included a series of socioeconomic factors. The theoretical model which was put forward can be formally represented as:

$$PR = \beta_0 + \beta_1 y + \beta_2 r + \beta_3 p^e + \beta_4 t + \beta_5 w + \beta_6 n + u$$

Where PR represents the demand for life insurance, y is the disposable income variable, r is the bank deposit interest rate, p^e is the expected price level, t is the tax incentive to purchase insurance, w is non-human wealth, n is household formation, and u is a portmanteau variable which captures all other factors that may affect the demand for life insurance, e.g., the level of social security benefits.

Utilizing OLS techniques, with data ranging from 1964-1984, the authors found that all specified variables except household formation and non-human wealth were significant at the 5% level. The explanatory power of the specified equation was high and judging from the Durbin-Watson statistic there was no evidence of serial correlation. It was also noted that in specifying two alternative models, one excluding both insignificant variables and the other with only household formation excluded, the explanatory power of the model was not affected. There was however, some evidence of mispecification, which can be seen by observing the relevant Durbin-Watson statistics.

Generally it was recognized that consumer confidence has an inverse relationship with expected inflation. The explanation put forward stems from the observation that, large unanticipated increases in inflation will most likely increase, through erosion of real income the consumer's ability to purchase life insurance. In explaining the insignificance of household formation, the authors attributed this to its cyclical nature, since labour force participation, marriages and divorces are postponed during recessionary periods.

Using these papers as a base, the next section proposes the components of a model for the demand for life insurance in Barbados.

Section 4: Model Specification

Insurance is a multi-faceted phenomenon and this implies that no single generalized theory is applicable. Therefore as a result, the specification of the model draws on some papers done by DePamphilis (1977), Browne and Kim (1996) and from the literature discussed in the previous section. The type of model which is specified in the paper was compiled taking an eccletic approach, where it was put forward that the demand function must include prices, interest rates, real income and some socioeconomic factors such as household formation. Given this, the formal specification of the model which will be discussed is:

$$PREMIUM = f(SPOP, LIFE, I, CPI, TBR, UNEMP, WAGE, GDPR, DUMMY) \qquad (1)$$

where PREMIUM is the annual premium income variable, LIFE is an individual's life expectancy, SPOP is the population which is used as a proxy for household formation, I is the interest rate, CPI is the average retail price index, TBR is the rate of interest on Treasury Bills and is included as an alternative investment, UNEMP is the unemployment level, WAGE is the wage index and functions as the income variable, DUMMY is a dummy variable to represent changes in tax policy with regards to policy holders and GDPR is the real gross domestic product figure (used in this paper as a proxy for inheritable wealth).

The use of the life expectancy variable is included in the model specification, since the widely accepted motive for acquiring a life insurance contract, is due to the uncertainty of an individual's life span. Bourne and Bailey (1977), presented the variable as a utility function, where an individual derives utility from wealth being transferred to his family after his death, and from his personal satisfaction derived from consumption over his lifetime. The utility function could be represented as;

$$U = \int_0^T a(t)U[C(t)] + b(t)V[B(t)]dt$$

s.t

$$\sum_{i=0}^{T-1} \frac{y_i}{(1+r)^i}$$

where T is the individual's lifespan, t is time, a the rate of discount, c is the level of consumption, B(t) is the level of bequests and b is the weighting coefficient which measures the subjective value of bequests at time t.

As a result of the uncertainty of one's lifetime, the insurance contract will be used as a precautionary instrument to hedge against the risk of an 'early' death. The policy holder by investing in the insurance contract, has effectively enhanced the physical and psychological well-being of his family in the event of such an occurrence. Given that the level of bequests is being accommodated by the insurance contract, the individual's utility function, which he will seek to maximize, subject to his lifetime income (which acts as a constraint), can be rewritten as;

$$U=\int_0^T a(t)U[C(t)]+b(t)V[P(t)]dt$$

s.t $$\sum_{t=0}^{T-1} \frac{y_t}{(1+r)^t}$$

where P(t) is the insurance policy at time t.

It should be noted that the life expectancy of an individual will be actuarially included into the price of the contract, and the expectation of a long lifespan would see the price of insurance decline. This would make a life insurance contract more attractive and affordable to a greater number of persons. Also, with the expectation of a long life there should also be greater incentives for human capital accumulation. As indicated by Beenstock et al (1986), a longer expected life should have a positive effect on the demand for life insurance. This positive effect is exhibited in Table 1, where the longer life span is mirrored by the growth in premium incomes.

Price levels are also included since they can have an effect on the demand for life insurance through a number of avenues. Cargill and Troxel (1980) highlighted two main paths, initially through intra period financial disintermediation[2], where past rates of inflation serve as bases for anticipated future price increases. These anticipated changes are then incorporated in the determination of nominal interest rates into the financial markets. DePamphilis (1977) maintained that higher inflation can have two opposing effects on the demand for life insurance. There is a positive effect where the policy holder will seek to increase his insurance premium relative to income in order to maintain the ratio of insurance protection relative to income. The second, is a negative impact where given higher prices an individual's ability and willingness to purchase insurance is eroded. Also, in inflationary conditions there may be an indirect negative impact, where individuals may be able to receive better returns on alternative investment instruments such as fixed assets. Due to the opposing effects the overall effect on the demand for insurance is ambiguous, and would be dependent on the relative magnitude of the opposing effects. The data in Table 1 demonstrates a positive relationship between the level of inflation and the growth in incomes. This would initially suggest that in light of rising inflation there is increased demand for insurance protection.

The dummy variable which is included in the specification is intended to factor in the relationship with respect to the demand for insurance in light of tax policy changes. Tax exemptions on life insurance premiums would tend to minimize the tax liability of policy holders. The expected relationship therefore, is positive and there should be an added incentive to purchase insurance contracts and in doing so increase life insurance demand.

The levels of income uncertainty and unemployment theoretically can have an impact on the demand for life insurance. However, in dealing with unemployment there are opposing effects. There may be a negative impact as a result of increased unemployment, where an investment channeled into a long-term contract or savings instrument may exceed the

[2] Financial disintermediation effectively alters consumption patterns.

capacity of some individuals, and they will be unable to hedge against an 'early' death due to lack of income. Counteracting this impact, is that with increasing levels of unemployment an individual may, in an attempt to ensure his family's security purchase an insurance contract. Therefore, theoretically the impact of unemployment is ambiguous. Also, in looking at the data presented in Table 1, there does not seem to be a clear relationship between unemployment and demand for the insurance product.

Included in previous studies[3] as a demand determinant is the level of household formation, however due to unavailability of this data, population is employed as a proxy. In recent times, with the increasing levels of participation by women within the employed labour force, there would be an increased combined household income when compared to previous periods. Given this, families would be involved in more vigorous financial planning and would tend to look at insurances as a prime investment (which could be used as collateral in mortgage transactions), and as an instrument for hedging against death. Also, an increase in household formations should have a positive effect since, the bequest motive is affected. An individual given the additional responsibility of an extension to his family would attempt to ensure their protection in the event of his death. This positive effect could be slightly offset by the additions to the family which may reduce the levels of funds available for investment, since the young are predominantly consumers, as opposed to contributors of income. Trends registered in the data in Table 1 shows a positive correlation between the household formation variable and insurance demand. One can infer that with increases in marriages and household formation, the level of purchases of life insurance is increased.

Interest rate movements are of special interest in relation to insurance demand, because of its implication to the role of the insurance industry in monetary transmission policy. Interest rate increases tend to depress premium incomes, since, the attractiveness of cash values of insurance as a savings tool would be reduced. Also, a large increase would see policy holders make requests for loans on their policies (as a result of the fixed rate of interest attached to loans taken out on policies). This, according to DePamphilis (1977) would result in a drain on premium income as policies with loans tend to have higher termination rates than those without. Movement in interest rates, according to the data in Table 1 does not provide evidence of any set correlation between insurance demand and interest rates.

Some studies (Bourne and Bailey [1977], Outreville[1996] and Cargill and Troxel [1980]) have included the rates on alternative investments within their models' specification. In terms of the savings and investment motive, insurance contracts face competition from other assets. Given his knowledge of portfolio theory, an individual with a set of yields of assets available, will attempt to maximize the aggregate rate of return in accordance with his risk preference. The extent of this competition, however, is generally dependent on the level of sophistication of the community and their liquidity preference. An increase in the level of sophistication and a greater liquidity preference, *ceteris paribus*, will weaken insurance demand. This may be the case since, insurance portfolios by their long term contractual nature are less liquid and could be further compounded with the surrender penalty on redemption. The expected result then, is a negative relationship with the demand for insurance. This does not however compare favourably with the evidence provided in Table 1, where the relationship between the Treasury Bill rate and insurance premium income seem to be ambiguous.

Fortune (1973) proposed that life insurance demand is a decreasing function of wealth, since

[3] See Craigwell and Haynes (1987) and DePamphilis (1977)

risk aversion is a declining function of wealth (non-human capital), and an increasing function of income. This relationship may tend to be ambiguous due to the directions of the various effects. The income variable acts as a constraint to the individual's goal of maximizing utility and effectively determines his capacity to acquire insurance coverage. An increase in income may also tend to lower the level of risk aversion. On the other hand, this increase may also increase the individual's level awareness to protect this wealth. Seeing this, risk averse individuals would raise their level of protection through insurance coverage. Given the above effects the overall relationship of wealth with insurance demand is dependent on the interplay of effects in relation to each other. The level of wealth and income exhibited in Table 1 provides a definite positive relationship between the level of wealth and the demand for insurance. This would lead to a general conclusion that with rising levels of wealth, there is also increased demand for the purchase of insurance contracts.

There have been a number of papers where premium rates and the number of insurance policies were included within the model's specification (see Babbel [1985] and Bourne and Bailey [1977]), however due to informational deficiencies, these variables could not be analysed in this paper. These papers also suffered due to data availability and the impact of these variables are doubtful.

Section 5: Econometric Methodology

In most time series of economic interest, trends exist, and are therefore non-stationary. However, traditional foundations and classical inference assume that the data is covariance stationary. Therefore, the results from traditional econometric methodology on these non-stationary variables renders inference invalid. Performing regressions on these non-stationary series, may lead to t statistics diverging as the sample size increases, and due to spurious correlation the DW statistic may tend to zero. This problem of performing regressions on non-stationary data could conceivably be lessened by differencing the data series until stationarity is achieved. This method however, would not be ideal, since this would lead to a loss of long-run properties (reason being the model in differences does not have a long-run solution). However, recent econometric techniques (see Engle and Granger) demonstrate that valid estimation and inference is possible, if there exists a linear combination of integrated variables that is stationary. This linear combination of non-stationary variables which may, over time, converge to equilibrium are known as cointegrated variables[4].

Cointegration analysis allows for the evaluation of a model which combines both short and long run properties, and at the same time maintaining stationarity in all of the variables. The fact that the variables are cointegrated, implies that there is some adjustment process which prevents the errors in the long run relationship from becoming increasingly large. Generally, a set of variables Y in a k-dimensional process are cointegrated of order (d, b), CI(d, b) if (i) all components are I(d), and (ii) there exists a linear combination $h \neq 0$, (which is I [d - b]), such that $e_t = hY_t \sim I(d,b)$, $b>0$. For example if all components of [c] are I(1) and h is stationary[I(0)], then $Y \sim CI(1,1)$.

The methodology in this paper utilizes the Granger Representation Theorem, which states that if a set of variables cointegrate, then there exist corresponding ECM of these variables. Error correction models have been widely mentioned in econometric literature, other than

[4] These cointegrated variables describe a fixed, long run relationship.

Engle and Granger.(1987), there have been Davidson, Hendry, Srba and Yeo (1978), Hendry, et al (1981) and Salmon (1982).

Formally, for *r* linearly cointegrating variables and *d=b=1* there exists an error correction representation of *r* stationary variables, such that

$$A^*(L)(1-L)Z_t = be_{t-1} + g(L)U_t \quad (1)$$

where $A^*(0) = I_n$, N is the dimensionality of Z_t, and g(L) is a lag polynomial. The Granger Representation Theorem provides a theoretical basis for ECM when the levels cointegrate. If the data generating process is an equation like (1) then Z_t must be a set of cointegrating variables.

Engle and Granger show that if the OLS is used to estimate the cointegrating vector, then the other parameters of the ECM may be consistently estimated provided the first stage estimates of the cointegrating vector are imposed on the second stage ECM. This is achieved by including the lagged error terms from the cointegrating regression in a general ECM. This procedure is known as the Granger two-step method. It gives the second stage OLS standard errors that are estimates of the true standard errors. The procedure uses convergence properties of the first stage estimates and permits testing whether the vector of variables properly cointegrates or not. The ECM is therefore not a spurious regression.
This two-step procedure is as follows;

The first step involves determining the order of integration of the variables, and then estimating the parameters of the long run equilibrium equation. Estimation is done by running a static regression in the level of the variables using the OLS technique.

- Testing is then carried out on the residuals for evidence of stationarity, and the existence of a cointegrating vector.
- The error correction model is then estimated.
- One finally carry out various tests on resulting equation in order to determine its level of suitability.

All steps only require OLS and the results are shown to be consistent for all parameters. The results of these procedures will be discussed in the following section.

Section 6: Data and Empirical Results

The multivariate model specified in equation (1) is now reduced (due to data limitations experienced with some of the series) and represented in semi-log form. The equation can now be represented as:

LPREMIUM = *f*(LSPOP, LI, LCPI, LTBR, LUNEMP, LGDPR, WAGE, DUMMY) (2)

Where L preceding the variables signifies, the variable's logarithmic form.

The model is generated using the statistical package EVIEWS 2.0 with annual observations for the period 1960-1994. The variables specified in equation (2) are then tested for their order of integration by using the Phillips-Perron and Augmented Dickey-Fuller tests for unit roots (see Appendix - Table 4). From the table mentioned it could be seen that all of the explanatory variables were I(1). They were then included into the model which was estimated using the Ordinary Least Squares (OLS) technique. This process generated the long run equilibrium form of the demand for life insurance.

Following this procedure, the residuals of this model, LONGRESID, were then tested for stationarity and for the existence of a cointegrating set formed by the independent variables. On performing the ADF test on the LONGRESID variable the null hypothesis of the existence of a unit root was rejected at the 5% level. A value of -5.068 was displayed compared to critical value of -2.9850. From the results of this test (where LONGRESID was found to be I[0], and thus stationary), it was noted that there was evidence of cointegrated equations.

These residuals lagged one period were then incorporated into a model of changes to form an error correction model. A model of lag order one was assumed, and then the insignificant variables were then eliminated, producing a reduced (more parsimonious)error correction model (See Appendix).

An overview of the long run model shows that the alternative investment instrument LTBR, the dummy variable representing the changes in tax policy, DUMMY, interest rates LI, and the level of prices LCPI are all insignificant at the traditional levels. The accepted long run model (see Appendix) includes the LSPOP (0.0033)[5] variable which is highly significant at the 5% level and also positive, thus indicating that with an increasing number of households, (and subsequently the number of insurable members) the demand for life insurance premiums would also increase. The same analogy can be applied to other specified variables WAGE (0.000) and LGDPR (0.0011), representing wage levels and wealth respectively. The unemployment variable LUNEMP (0.0224) is significant, however, results show a negative relationship with insurance demand, and this implies that with increasing levels of unemployment and job uncertainty, the demand for insurance declines. The model generated displays no evidence of correlation and a Durbin-Watson statistic of 1.99 would support this. Also, the explanatory power of the model is high with the R^2 term being 0.99.

In the ECM, unlike the long run model, the level of wages (WAGE) proved insignificant in the short run, but the level of unemployment, household formation and wealth all proved significant. Interestingly, the change in tax policy (DUMMY[-1]) from the previous period was also significant (0.0027). This relationship is a positive one and this implies that given an incentive in the previous year, individuals would be inclined to purchase insurance contracts. The error correction term, (RES[-1]) was also significant (0.00) and this supports the previous analysis of the evidence of cointegrating equations. The R^2 term of 0.83 and, the error term coefficient of 0.938 (which suggests a speedy long run adjustment) depicted a fairly encouraging short-run model. Other tests were also performed on the error correction model, namely residual tests, such as Jacque-Bera test, White Heteroskedascity tests, the ARCH test and the Breusch-Godfrey Serial Correlation tests. There were also tests carried out for stability (Chow tests, CUSUM tests and Ramsey's RESET tests), all of which passed these diagnostic tests.

Conclusion

This paper utilizes cointegration and error correction mechanisms to analyze life insurance services in a developing economy of Barbados. The model suggested that in the long run, the growth of life insurance is positively affected by movements in wages, the amount of

[5] Represent the significance probabilities of the variables in brackets. (See Appendix)

nonhuman capital and the level of household formations[6]. However, with the worsening of employment possibilities, which is characterized by high unemployment there will be a decline in the level of insurance demanded.

In looking at the short run dynamics, all of the variables in the long run except wages, do not provide any significant impact on insurance demand. Also, this model does suggest that relative prior period changes in tax policy are taken into consideration by individuals when making their decisions in purchasing insurance.

Unlike Fortune's (1973) analysis, the level of prices and the interest rate movements do not significantly affect the demand for insurance in Barbados's economy. This implies that in Barbados, insurance demand is generally unaffected by monetary policy and that expectations about the level of prices do not discourage individuals from entering into an insurance contract. This may be plausible in Barbados where over the long term there are relatively stable rates of interest and inflation. Another factor which can be taken into consideration is the lack of or the underdevelopment of the financial markets. Despite this slow pace of development in financial markets, the insurance industry exhibits an appreciable growth pattern and is very important to the flow of funds in the financial sector. This importance is illustrated through its involvement in credit to individuals and the purchasing of government securities.

In closing, the model does contribute to the understanding of life insurance demand determinants in Barbados, however due to some data unavailability, the model could not be fully analysed as specified. Therefore, with more complete information there is the possibility that a better specified model and results could be generated.

[6] These assertions are in agreement with Fortune (1973) and DePamphilis in observing the US and U.K economies.

Table 1

TIME SERIES	1965	1970	1975	1980	1985	1990	1993
Premium Income *	3110	6565	10127	21259	38947	63713	73428
Unemployment	11.8	11.4	22.5	14.5	21.2	21.1	24.3
Wages	19.1	30.6	53.1	100	148.9	182.8	184.0
Population *	235.2	239.2	245.6	249.1	253.4	257	n.a
Life Expectancy	67.4	69.3	70.7	73.2	74.1	75.8	n.a
Treasury Bill Rate	n.a	7.1	4.0	5.78	5.48	7.28	5.63
Real GDP #	n.a	605.5	626.5	802.3	786.8	879.1	801.0
CPI	100.0	128.7	302.3	543.5	739.7	860.0	996.9
Interest Rates[7]	4.0	6.75	5.5	5.62	4.87	6.5	5.37

Source: Annual Statistical Digest: The Central Bank of Barbados

NB: * - For premium income and population figures recorded in thousands ('000).
- Real GDP figures recorded in millions.

Table 2

TIME SERIES	1972	1993
Total Number of Firms	11	14
Number of Foreign Firms	9	6
Number of Local Firms	2	6
Number of Firms - CARICOM	-	2

Source: The Office of the Supervisor of Insurance.

Table 3

TIME SERIES	1975	1980	1985	1990	1992	1994
Number of Policies-I	23867	41249	63443	84293	74495	80079
Number of Policies-G	127	150	174	297	354	401
Number of Policies-A	254	623	1377	2355	2738	3753
Aggregate Sum Assured	431.2	1084.6	2764.0	3822.4	4135.0	4437.4

Source: Annual Statistical Digest: The Central Bank of Barbados and The Office of the Supervisor of Insurance.
NB. : I - Represents individual policies G - Group policies A - Annuity Contracts
Aggregate sum assured denoted in BDS$ millions.

Table 4

Unit Root Test

Variables	Augmented Dickey-Fuller (Critical Values - 5% level)	Phillips-Perron (Critical Values - 5% level)
ΔWAGE	-3.61 (-3.57)	-3.35 (-2.95)
ΔLCPI	-3.68 (-3.58)	-3.09 (-2.98)
ΔLGDPR	-3.85 (-3.59)	-2.76 (-1.95)
ΔLLIFE	-6.24 (-3.57)	-4.04 (-1.95)
ΔDUMMY	-4.35 (-2.96)	-8.53 (-2.95)
ΔLTBR	-4.28 (-2.99)	-4.79 (-2.97)
ΔLUNEMP	-3.36 (-2.96)	-5.98 (-2.95)
ΔLPREMIUM	-3.78 (-3.59)	-5.03 (-2.97)
ΔLI	-4.49 (-3.58)	-5.37 (-3.56)
ΔLSPOP	-4.26 (-3.57)	-7.32 (-2.95)

Δ: Represents a change in the lag of the variable.

[7] Used in this paper as the average of the maximum and minimum values of the six (6) month timed deposit rate.

LONG-RUN DEMAND EQUATION

$$LPREMIUM = -80.51 + 15.485\ LSPOP - 0.198\ LUNEMP + 0.733\ LGDPR + 0.007\ WAGE$$

(-4.898) (4.853) (-2.456) (3.745) (7.098)

$R^2 = 0.996$ s.e = 0.05 D.W = 1.99

NB: t-values in brackets ( ).

(ERROR CORRECTION MODEL)

$$\Delta\ LPREMIUM = 0.068 + 0.742\ \Delta LGDPR_t - 0.156\ \Delta LUNEMP_t + 0.046\ \Delta DUMMY_{t-1}$$

(4.850) (4.457) (-3.85) (3.423)

$$+ 9.76\ \Delta LSPOP_t - 0.938\ RES_{t-1}$$

(3.342) (-6.448)

$R^2 = 0.83$ s.e = 0.031 D.W = 2.11 $NORM[\chi^2(2)] = 0.748$ $ARCH = [F(1,25)] = 1.26$

$WHITE^1[F(1,26)] = 0.458$ $WHITE^2[F(1,26)] = 1.205$ $RESET = [F(3,26)] = 0.19$

$RESET[F(4,26)] = 0.777$ $CHOW\ 90[F(6,20)] = 1.326$

NB: $WHITE^1$ = Test with no cross terms.

$WHITE^2$ = Test with cross terms.

RES = ECM

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