Real Interest Rate Stationarity and Per Capita Consumption Growth Rate

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Abstract Many economic theories connecting the real interest rate and the per-capita consumption growth rate require that both rates evolve together over time. This paper investigates whether these rates present similar stationary behavior for the seven most industrialized countries over the 1957-2005 period. The analysis relies on the unit root tests developed by Elliott, Rothenberg and Stock (1996) and Lopez (2006) to look for stationary or regime-wise stationary behavior, respectively. Furthermore, the final break selection uses Bai and Perron's (2003) method. The results show for all the countries considered that both rates are either stationary or regime-wise stationary with a same number of breaks and, mostly, corresponding dates. The results hold whether the rates are calculated annually or quarterly.

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1 Introduction

Recent literature has provided a better understanding of the real interest rate's behavior since Walsh (1987)'s and Rose (1987)'s controversial results.[3] While Rapach and Weber (2004) still show that the real interest rate is non stationary for the post-1957 period, other studies demonstrate that it can be considered "stationary" around a changing mean. Whether these mean shifts are treated as structural changes when testing for the presence of a unit root, as proposed by Perron and Vogelsang (1992b) and Clemente et al. (1998), or as regime changes when testing only for the presence of break, as in Garcia and Perron (1996), Caporale and Grier (2000), Bai and Perron (2003), and Rapach and Wohar (2005), the conclusion remains the same: the real interest rate's process can be defined as regime-wise stationary.[4]

While this description of the real interest rate's behavior is quite useful, it does not reconcile empirical evidence with prominent economic theories such as the Consumption-based Capital Asset pricing model (C-CAPM) and the canonical economic growth theory. Indeed, these theories imply some restrictions on the behavior of the real interest rate and the per-capita consumption growth rate time-series.

The C-CAPM of Lucas (1978) or Hansen and Singleton (1982) suggests the following optimality condition (Euler equation): $E_t\left[\beta(1+r_t)U'(c_t)/U'(c_{t+1})\right]=1$, where r_t, β , and c denote the real interest rate, the discount factor, and the total per-capita consumption, respectively, while $U'(c)$ represents the marginal utility of consumption. Depending on the technique used to estimate the Euler equation, both series must be either stationary or have the same order of integration.[5] Yet, as it is rather unlikely that the per-capita consumption growth rate is I(1), both series must have the same type of stationarity.

Similarly, the Ramsey-Cass-Koopmans growth model with labor (L), capital (K), and a labor augmenting technological progress results in a similar optimality condition, which

[3] Rose (1988) concludes that there is no evidence of stationarity for the real interest rate of eighteen OECD countries. These results initiated a profound controversy in the literature due to the implications that a non-stationary real interest rate has for some major economic and financial theories. In essence every model that deals with intertemporal decisions (consumption, investment, savings) uses a constant (stationary) ex-ante real interest rate as the foundation for the theory and/or the results regarding optimal choices of individuals, firms, and policy makers.

[4] Regime-wise stationarity means that the series are overall non stationary because of the presence of time breaks, but it is not I(1).

[5] Ferson and Merrick (1987) and Rapach and Weber (2004) provide a deeper discussion regarding the reasons why these specific features should be observed in the data in order for the theory to hold.

establishes a unique relationship between the real interest rate and the per-capita consumption growth rate. This model predicts that the consumption per-capita (C/L) and the capital per-capita (K/L) grow at a constant rate, equal to the growth rate of technological progress, while the capital per unit of effective labor (K/AL) is constant. The latter implicitly determines the interest rate, therefore, the per-capita consumption growth rate and the real interest rate are related and stationary.

Both models suggest a clear and definite relationship between the real interest rate and the per-capita consumption growth rate, which requires that both series are either stationary or regime-wise stationary. In the latter case, the changes in the long run values of the per-capita consumption growth rate and the real interest rate are consistent with economic theories. For example, policy adjustments or exogenous shocks could result in structural changes that affect the productivity growth rate. This would lead to a different steady state equilibrium for the consumption and the capital stock growth rates while changing the long-run real interest rate. Similarly, in the case of the C-CAPM model, such events could affect expected returns on assets, due to the effects on economic activity, and end up causing long lived changes in the consumption growth rate and the real interest rate. Hence, a necessary but not sufficient condition for the data to support the empirical validity of the theory is for both series to be regime-wise stationary with the same number of breaks. A necessary and sufficient condition would be that the regime-wise series have related break dates. Of course, the stationarity of both series automatically fulfills all the theoretical requirements.

In this study, we investigate the stationary behavior of the real interest rate and the (private and total) per-capita consumption growth rate of the seven most industrialized countries over the post 1957 period. Specifically, we first focus on whether the series have the same type of stationarity using the unit root tests suggested by Elliott, Rothenberg and Stock (1996) and Lopez (2006), that is allowing up to two changes in the mean. Then, if the rates are regime-wise stationary, we focus on the time of the breaks by pre-selecting them with Bai and Perron's (2003) method before testing for the unit root. Clearly, we need to reject the unit root null hypothesis for both rates to conclude that they are regime-wise stationarity, independently from the break selection used.

Our findings show strong evidence of similar stationary behavior for both the real interest rate and the (private and total) per-capita consumption growth rate, for all the countries considered. Furthermore, most of them also satisfy the necessary and sufficient condition stated above by having the (private and/or total) per-capita consumption growth rate and the real interest rate being either stationary or regime-wise stationary with close break dates.

The rest of the paper is organized as follows. Section 2 discusses the data considered, while section 3 presents the estimation methods. Section 4 focuses on the empirical results, and section 5 summarizes our findings and presents concluding remarks.

2 Data

Real Interest Rate Analysis. Previous studies acknowledge the difficulties of dealing with the fact that theoretical results are based on assumptions regarding the *ex ante* real interest rate (an unobservable variable). Walsh (1987) infers the properties of the *ex ante* rate, r_t, from the readily available *ex post* real interest rate, exr_t, data using the following relations:

$$r_t = i_t - E_t\pi_{t+1} \tag{1}$$

$$exr_t = i_t - \pi_{t+1} \tag{2}$$

where π_{t+1} is the inflation rate. Plugging (2) into (1) and rearranging the terms results in the following expression for the *ex ante* real interest rate

$$r_t = exr_t + (\pi_{t+1} - E_t\pi_{t+1}) \tag{3}$$

Equation (3) implies that the difference between the *ex ante* and *ex post* real interest rates is determined by the difference between the realized and the expected inflation rates, i.e. the inflation forecast error. Under any reasonable expectation formation, the inflation forecast error should be stationary around a zero mean. Therefore, expression (3) determines that r_t can be assumed stationary, if and only if, exr_t is stationary. Based on this argument, our analysis focuses on the *ex post* real interest rate.

Description of the Data. We analyze the *ex post* real interest rate and the per capita consumption growth rate for the period 1957 to 2005, for the seven most industrialized countries: Canada, France, Germany, Italy, Japan, the United Kingdom and the United States. The data are obtained from the International Financial Statistics database of the International Monetary Fund.

We collect quarterly and annual data on consumption, population, and prices (CPI) for the calculations of real per-capita consumption and then use the resulting data to compute

the real private and total per-capita consumption quarterly and annual growth rates. The quarterly rates compare two consecutive quarters and the annual rates compare two periods four quarters apart. The expost real interest rates are calculated by using the representative nominal interest rate for a given period and the accumulated inflation rate over the following period.

We consider two different measures for consumption: private and total per-capita consumption. For the private consumption, we use the total household consumption expenditure series, while for the total consumption, we add government expenditures to the household consumption. Both definitions have been used in previous studies. King et al. (1991) used the household consumption for their stochastic trends analysis, while Neusser (1991) and Harvey et al. (2003) included government expenditures, in their study of the long-run implications of the neoclassical growth model, arguing that government spending can be viewed as a perfect substitute for private expenditures.

The resulting time series for the private and the total per-capita consumption growth rates and the real interest rate are presented in Figure 1. Visual inspection of the graphs presented in Figure 1 reveals the possible presence of structural changes in the series (i.e. changes in the long run mean). The real interest rate, for most of the countries considered, oscillates around a zero mean, or close to zero, in the sixties and seventies, as suggested by Fama (1975). In contrast, during the eighties and nineties, the mean appears to have increased, becoming positive. Similar patterns can be identified for the per-capita consumption growth rates: the sixties and seventies show higher levels and more volatility, in comparison to the eighties and nineties. The patterns for the quarterly and annual rates generally match; yet the quarterly data seems a little more volatile.

3 Methods of Estimation and Models

Unit root tests are commonly used to investigate stationarity issues. A rejection of the unit root null is generally interpreted as evidence of stationarity. Similarly, if the unit root hypothesis is rejected when one or two breaks in the mean are allowed in the alternative, then the process is considered regime-wise stationary.

We consider two unit root tests for our analysis: Elliott, Rothenberg and Stock's (ERS) (1996) test, Lopez's (2006) tests to look for the presence of a unit root when zero, one and two unknown changes in the mean are allowed, respectively. These tests are an improved version of the commonly used ADF test, Perron and Vogelsang's (1992a) and Clemente et

al.'s (1998) tests.[6]

The testing procedure can be described as follow. Let y_t and z_t be respectively the data series and the set of deterministic components such that

$$\begin{aligned} y_t &= \beta' z_t + u_t, \quad t = 0, ..., T, \\ u_t &= \alpha u_{t-1} + v_t \end{aligned}$$

where $\{v_t\}$ is an unobserved stationary mean-zero process, $u_0 = 0$. The set of deterministic components, z_t, is defined as

- $z_t = \{1\}$, for a process with no structural break
- $z_t = \{1, 1(t > TB_1)\}$, for a process with one structural break at an unknown date, TB_1
- $z_t = \{1, 1(t_1 > TB_1), 1(t_2 > TB_2)\}$, for a process with two structural breaks at unknown dates, TB_1 and TB_2

First, y_t is transformed such that $y_t^d = y_t - \tilde{\beta} z_t$, where $\tilde{\beta}$ is the least-squares estimate of the regression of $\tilde{z}_t$ on $\tilde{y}_t$. $\tilde{y}_t$ and $\tilde{z}_t$ are the quasi-differences of y_t and z_t, respectively; i.e., $\tilde{y}_t = (y_1, y_2 - a y_1, ..., y_T - a y_{T-1})'$ and $\tilde{z}_t = (z_1, z_2 - a z_1, ..., z_T - a z_{T-1})'$, where $a = 1 + \frac{\bar{c}}{T}$ represents the local alternative, with $\bar{c} = -7$.

Finally, the standard hypotheses, H_0 : unit root ($\alpha = 1$) versus H_1 : stationary process ($\alpha < 1$), are tested on the following regression:

$$\begin{aligned} \Delta y_t^d &= \alpha y_{t-1}^d + \sum_{i=1}^{k} c_i \Delta y_{t-i}^d + \varepsilon_t \qquad (4) \\ t &= k + 2, ..., T. \quad \varepsilon_t \tilde{} WN \end{aligned}$$

where k, the number of lagged first differences, is selected via Modified Akaike Information Criteria (MAIC).

The break dates, TB_1 and TB_2, are selected by minimizing the test statistic on α. Note that such break-date selection, while maximizing evidence against the null hypothesis, may lead to inconsistent break selection. As a result, the second part of the analysis use Bai

[6] Lopez (2006) compares the finite sample properties of these tests and of Saikkonen and Lutkepohl's (2002), and concludes that the tests used here have a higher finite sample power.

and Perron's (2003) method to preselect the break date as it provides consistent estimates and allows for multiple breaks. Our main focus being to analyze the type of stationarity observed by the series, we still need to test whether or not the processes have a unit root, when allowing for the preselected break(s).

4 Empirical Results and Analysis

The analysis focuses on two points: the behavior of the per-capita consumption growth rates and the real interest rate, and the robustness of such results to the rates' definition, that is annual versus quarterly.

We first analyze whether the series are stationary or regime-wise stationary with one or two breaks. Note that if a country's real interest rate and per-capita consumption growth rates are stationary, all the theoretical requirements (i.e. necessary and sufficient conditions) are fulfilled, hence there is no need to consider these series when testing for regime-wise stationarity.

No Break, Table 1: The analysis of all the series via ERS (1996) test leads to evidence of stationarity for 25 out of the 42 series considered. Yet, only the quarterly rates of Germany and the US and both quarterly and annual rates of Italy and the UK show evidence of stationarity for the real interest rate and both per-capita consumption growth rates.[7]. Additionally, Canada's annual and quarterly private per-capita consumption and real interest rates are stationary. In contrast, the annual and quarterly per-capita consumption growth rates, based on either private or total consumption, do not show any evidence of stationarity for France and Japan.

One Break, Tables 2, 4 and 6: Allowing for one change in the mean leads to a strengthening of the unit root rejection for both annual and quarterly (total and private) per-capita consumption growth rates for the remaining countries. Similarly, both annual and quarterly real interest rates demonstrate significantly stronger results than in Table 1 for France, Germany, and Japan. Only the results for the real interest rate of Canada differ depending on the rates considered: the annual rate is regime-wise stationary while the quarterly rate does not reject the unit root hypothesis.

Two Breaks, Tables 3, 5 and 7: Allowing for two changes in the mean leads to an overall strong rejection of the unit root for all the series considered.

Interestingly, our results corroborate Clemente et al. (1998)'s findings that the real

[7]It should be noted that our data for Germany includes the reunification period. Therefore, our results with respect to this country should be taken with caution.

interest rate for the U.S. is regime-wise stationary with two breaks. Yet, they also agree with Perron and Vogelsang (1992b)'s evidence of regime-wise stationarity for the U.S. real interest rate with only one break.

Our findings suggest that both the annual and quarterly (private and/or total) per-capita consumption growth rates and real interest rates of Italy and the UK are stationary while these rates are regime-wise stationary with one break for France and Japan. The annual and quarterly rates of Germany and the US demonstrate different type of stationarity: both countries' annual rates are regime-wise stationary with one break while the quarterly rates are stationary. Canada is the only country where the series require up to two breaks. Indeed, both per-capita consumption growth rates and the real interest rate are regime-wise stationary with two breaks for the quarterly rates and with one break for the annual rates.

For every country considered, the real interest rate and both per-capita consumption growth rates have similar type of stationarity. Countries such as Italy or the UK have only stationary rates and provide strong empirical support of all the theoretical requirements discussed in the introduction. However, the case of regime-wise stationary rates is more complicated as having a same type of stationarity is only a necessary condition. It must be supplemented by corresponding break dates to become a necessary and sufficient condition and insure the empirical validity of the theories discussed. As a result, we now focus on the break dates, if any, by preselecting them via Bai and Perron's (2003) methods, then we test for regime-wise stationarity of the series.

Table 8 summarizes the results by reporting only the cases where the unit root null hypothesis is rejected, without break and with the new break dates. The results corroborate the previous conclusions for all the countries except for the annual rates of France. In this case, the unit root null hypothesis cannot be rejected for the annual private per-capita consumption growth rate. Canada is the only country for which the type of stationarity remains unclear as both the real interest rate and the private per-capita consumption growth rate (annual and quarterly) are stationary, while the three series, the real interest rate and both per-capita consumption growth rates, are regime-wise stationary with one break for the annual rate and two breaks for the quarterly.

There is a clear connection between the breaks identified for the real interest rate and at least one of the per-capita consumption growth rates for France, Canada (annual rates) and Japan. Only the quarterly data of Canada show strong differences regarding the date of the breaks. Note that the discrepancy observed for Germany's annual rates is somehow expected due to the reunification in 1990.

Most of the break identified are around the two oil shocks, 1973 and 1979. The years lead-

ing to and following these shocks were characterized by periods of appreciation/depreciation of major currencies, financial and economic instability, and drastic changes in monetary and fiscal policies as central bankers all over the world dealt with inflation and battle ensuing recessions.

Both annual and quarterly (private and/or total) per-capita consumption growth rates and real interest rates of France, Italy, Japan and the UK follow stationary processes that are consistent with the most strict theoretical requirements, as the series show both similar type of stationarity and close break dates, if any. A similar outcome is shown by the quarterly rates of Germany and the US as they are stationary. However, the annual rates of both these countries satisfy the less restrictive condition of observing similar type of stationarity but the dates do not correspond that well: these results provide evidence for the weak empirical validity of the theory. Finally, Canada offers several alternatives. The private per-capita consumption growth rate and the real interest rate are both stationary whether we consider the annual or the quarterly rates. Yet, considering the three series, the annual rates show similar type of stationarity but the dates are a little off. The quarterly rates require two breaks for the three series to demonstrate similar stationarity type, however the dates of the breaks do not correspond.

5 Conclusion

Theories such as the C-CAPM and the canonical economic growth theory require that the real interest rate and the per-capita consumption growth rate have the same type of stationarity. Yet, most of the recent studies focus only on the real interest rate's behavior, concluding that it is best described as regime-wise stationary. Hence, such description is useful only if the consumption growth rate shows similar pattern.

In this paper, we investigate whether the real interest rate and both the (private and total) per-capita consumption growth rate present a common behavior. Using quarterly data, we compute both annual and quarterly rates for the seven most industrialized countries for the 1957-2005. The analysis relies on a set of unit root tests that allows up to two breaks, and on the Bai and Perron's (2003) break selection. The results show similar type of stationarity for both the real interest rate and the per-capita consumption growth rate for every country. We show that the annual and quarterly real interest rates and (total and/or private) per-capita consumption growth rates are regime-wise stationary for France, and Japan and stationary for Canada, Italy and the UK. The annual rates of Germany and the US are regime-wise stationary with one break while, for both countries, the quarterly

rates are stationary. Hence, we find strong statistical support for the theoretical arguments suggesting that the per-capita consumption growth rate and the real interest rate exhibit a common behavior. Note that quarterly rates support the most restrictive theoretical requirement for all the countries while the annual rates do not for two countries, Germany and the US, as the breaks selected do not correspond.

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Table 1: Private and Total Consumption Growth Rate and Reat Interest Rate, Unit Root Test

		annual		quarterly	
	Period	t-stat	Rej.	t-stat	Rej.
Canada					
Private Consumption Growth Rate	1958:1-2005:4	-2.06	**	-1.88	*
Total Consumption Growth Rate	"	-1.30	-	-1.56	-
Real Interest Rate	1957:2-2005:4	-2.00	**	-1.82	*
France					
Private Consumption Growth Rate	1966:1-2005:4	-0.56	-	-0.89	
Total Consumption Growth Rate	"	-0.45	-	-0.89	-
Real Interest Rate	1957:2-1999:2	-0.36		-0.42	-
TB	1970:1-2005:4	-1.42	-	-1.17	-
Germany					
Private Consumption Growth Rate	1961:1-2005:4	-1.52	-	-3.40	***
Total Consumption Growth Rate	"	-1.52	-	-3.86	***
Real Interest Rate	1957:2-2005:4	-2.29	**	-2.95	***
Italy					
Private Consumption Growth Rate	1971:1-2005:4	-1.68	*	-2.23	**
Total Consumption Growth Rate	"	-1.76	*	-2.67	***
Real Interest Rate	1957:2-2005:4	-2.12	**	-1.85	*
Japan					
Private Consumption Growth Rate	1958:1-2005:4	-1.25	-	-0.98	-
Total Consumption Growth Rate	"	-0.85	-	0.75	-
Real Interest Rate	1957:2-2005:4	-0.93	-	-2.57	**
UK					
Private Consumption Growth Rate	1958:1-2005:4	-3.66	***	-3.51	***
Total Consumption Growth Rate	"	-3.41	***	-2.97	***
Real Interest Rate	1957:2-2005:4	-2.06	**	-1.89	*
US					
Private Consumption Growth Rate	1958:1-2005:4	-1.21	-	-2.61	***
Total Consumption Growth Rate	"	-1.51	-	-2.27	**
Real Interest Rate	1957:2-2005:4	-2.72	***	-2.29	**

*, **, *** represent the rejection H_0 at 10%, 5% and 1%

Table 2: Real Interest Rate TB, Unit Root Test with 1 Time Break

	annual			quarterly		
	T_{b1}	t-stat	Rej.	T_{b1}	t-stat	Rej.
Canada	1983:1	-2.57	**	1979:2	-2.11	
France	1982:2	-2.95	**	1982:2	-2.40	*
Germany	1980:2	-3.93	***			
Japan	1974:2	-2.78	**	1978:2	-3.33	***
US	1979:3	-2.75	**			

*, **, *** represent the rejection H_0 at 10%, 5% and 1%

Table 3: Real Interest Rate TB, Unit Root Test with 2 Time Breaks

	annual				quarterly			
	T_{b1}	T_{b2}	t-stat	Rej.	T_{b1}	T_{b2}	t-stat	Rej.
Canada	1981:3	1994:4	-3.00	**	1981:3	1999:1	-3.05	**
France	1980:2	1982:2	-3.42	**	1981:3	1983:3	-5.91	***
Germany	1980:3	1996:4	-4.29	***				
Japan	1968:3	1974:4	-2.93	**	1972:4	1976:2	-4.38	***
US	1982:4	1990:2	-3.42	***				

*, **, *** represent the rejection H_0 at 10%, 5% and 1%

Table 4: Total Consumption Growth Rate, Unit Root Test with 1 Time Break

	annual			quarterly		
	T_{b1}	t-stat	Rej.	T_{b1}	t-stat	Rej.
Canada	1976:2	-3.09	**	1975:3	-3.31	***
France	1968:2	-3.14	**	1979:1	-12.85	***
Germany	1992:1	-4.67	***			
Japan	1975:1	-2.81	**	1971:4	-4.94	***
US	1971:1	-3.65	***			

*, **, *** represent the rejection H_0 at 10%, 5% and 1%

Table 5: Total Consumption Growth Rate, Unit Root Test with 2 Time Breaks

	annual				quarterly			
	T_{b1}	T_{b2}	t-stat	Rej.	T_{b1}	T_{b2}	t-stat	Rej.
Canada	1961:4	1974:3	-3.00	**	1978:4	1981:2	-4.00	***
France	1979:2	1990:2	-5.87	***	1977:2	1978:2	-13.14	***
Germany	1972:3	1992:1	-4.79	***				
Japan	1973:1	1994:3	-3.95	***	1972:4	1996:1	-19.65	***
US	1974:3	1978:1	-3.64	***				

*, **, *** represent the rejection H_0 at 10%, 5% and 1%

Table 6: Private Consumption Growth Rate, Unit Root Test with 1 Time Break

	annual			quarterly		
	T_{b1}	t-stat	Rej.	T_{b1}	t-stat	Rej.
Canada	1961:4	-3.76	***	1979:3	-3.91	***
France	1974:3	-5.21	**	1973:1	-13.24	***
Germany	1973:2	-3.81	***			
Japan	1962:3	-2.84	**	1963:1	-2.71	**
US	1970:3	-3.30	***			

*, **, *** represent the rejection H_0 at 10%, 5% and 1%

Table 7: Private Consumption Growth Rate, Unit Root Test with 2 Time Breaks

	annual				quarterly			
	T_{b1}	T_{b2}	t-stat	Rej.	T_{b1}	T_{b2}	t-stat	Rej.
Canada	1961:4	1975:4	-4.39	***	1977:4	1981:3	-5.46	***
France	1973:2	1990:2	-5.79	***	1973:1	1976:3	-13.34	***
Germany	1988:4	1991:2	-4.85	***				
Japan	1973:1	1994:3	-3.95	***	1971:4	1996:1	-6.18	***
US	1974:3	1978:1	-3.45	***				

*, **, *** represent the rejection H_0 at 10%, 5% and 1%

Table 8: Summary

	Annual		Quarterly	
Canada[8]				
Private Consumption Growth Rate	No break	1975 : 4	No break	1972 : 2/1975 : 3
Total Consumption Growth Rate	-	1976 : 2	–	1961 : 4/1977 : 4
Real Interest Rate	No break	1981 : 3	No break	1981 : 1/1996 : 3
France				
Private Consumption Growth Rate	–		1975 : 4	
Total Consumption Growth Rate	1980 : 1		1979 : 2	
Real Interest Rate	1982 : 2		1982 : 2	
Germany				
Private Consumption Growth Rate	1991 : 3		No break	
Total Consumption Growth Rate	1992 : 1		No break	
Real Interest Rate	1980 : 2		No break	
Italy				
Private Consumption Growth Rate	No break		No break	
Total Consumption Growth Rate	No break		No break	
Real Interest Rate	No break		No break	
Japan				
Private Consumption Growth Rate	1973 : 1		1972 : 4	
Total Consumption Growth Rate	1973 : 1		1974 : 4	
Real Interest Rate	1977 : 2		1978 : 2	
UK				
Private Consumption Growth Rate	No break		No break	
Total Consumption Growth Rate	No break		No break	
Real Interest Rate	No break		No break	
US				
Private Consumption Growth Rate	1974 : 2		No break	
Total Consumption Growth Rate	1973 : 2		No break	
Real Interest Rate	1982 : 4		No break	

"-" stands for no rejection of the unit root null hypothesis

Figure 1: Data