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INTERNATIONAL EVIDENCE ON THE CO-MOVEMENTS BETWEEN BOND YIELDS AND STOCK RETURNS: 1984-1994

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Abstract

Forecasting stock returns and bond yields is an important goal of investment management. However, if a random walk process describes stock returns and bond yields, then much of the efforts devoted to forecasting stock returns and bond yields are of questionable value. Research by Fama and French (1996) and others support the hypothesis that stock returns do not follow a pure random walk process. Further support for returns not following a pure random walk is offered by Fleming and Remolona (1997), Clare and Thomas (1992), Campbell and Hamao (1989), and Keim and Stambaugh (1986). These researchers document the predictability of both stock returns and bond yields. Another objective of investment management is the asset allocation process which seeks to develop the mix of assets that provides the optimum risk-return combinations. Surprisingly, little research has been devoted to quantifying the co-movements of stock returns and bond yields, a process useful in the allocation process. The objectives of this research are twofold. First, we offer additional support for the view that stock and bond returns do not follow a pure random walk. Secondly, we quantify the relationship between stock returns and bond yields for nine industrial countries during the period 1984-1994.

INTRODUCTION

Two important goals of investment management include (1) forecasting stock returns and bond yields and (2) asset allocation. However, if a random walk process describes stock returns and bond yields, then much of the efforts devoted to forecasting stock returns and bond yields are of questionable value. Research by Fama and French (1996), as well as others, support the hypothesis that stock returns do not follow a pure random walk process and that forecasting does aid investment management.[1] Further support for returns not following a pure random walk is offered by Fleming and Remolona (1997), Clare and Thomas (1992), Campbell and Hamao (1989), and Keim and Stambaugh (1986), who document the predictability of both stock returns and bond yields. The second objective of investment management, the asset allocation process, seeks to develop the mix of assets that provides the optimum risk-return combinations. Surprisingly, little research has been devoted to quantifying the co-movements of stock returns and bond yields, a process useful in the allocation process.

The objectives of this research are twofold. First, we offer additional support for the view that stock and bond returns do not follow a pure random walk. Secondly, we quantify the relationship between stock returns and bond yields for eight industrial countries during the period 1984-1994. Section I contains a review of the studies that attempt to quantify the relation between stock returns and bond yields. Section II outlines the data and the methodology we use to assess the co-movement between stock returns and bond yields. The next section presents our empirical results. Finally, Section IV contains a summary and the implications of our findings.

LITERATURE REVIEW

Several studies assessing the co-movement between stock returns and bond yields include but are not limited to Solnik (1996), Wainscott (1990), Mills (1991), and Clare, Thomas, and Wickens (1994). Solnik (1996) regresses the monthly stock returns for the period 1973 to 1993 on the level of interest rates and changes in interest rates for the

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following countries: Canada, France, Germany, Japan, the Netherlands, Switzerland, the United Kingdom and the United States. Although Solnik was expecting a positive relationship as hypothesized within the Fisher framework, his results show consistently negative correlations between interest rate changes and equity returns. Wainscott (1990), using monthly returns for U.S. common stocks and U.S. long-government bonds, examined the correlation between these two major U.S. asset classes. He calculated the correlations between bond yields and stock returns using rolling regression for 1-, 3-, 5-, and 10-year horizons covering the period January 1925 through June 1988. His conclusion is that the correlations are unstable. Thus if correlations are used for asset allocations, the yield forecasts will be imprecise.

Mills (1991) and Clare, Thomas, and Wickens (1994) are more contemporary because they apply recent econometric methods in their investigation of the relation between stock prices, bond yields, and dividend yields. The objective of both sets of research is to empirically verify whether there is a stable ratio between bond yields and dividend yields which can be used by portfolio managers in determining the relative attractiveness of equities relative to investments in bonds. Mills (1991) tests for cointegration between equity prices, dividends, and gilt edged bonds. The variables are the logarithms of the end of month observations from January 1969 to May 1989 on the Financial Times Actuaries 500 equity index, the associated dividend index, and the Par yield on twenty-year British Government Stocks. Mills finds each series is integrated of order 1. Mills then estimates an Error Correction Model between stock prices, dividends, and bond yields. After satisfying the necessary diagnostic tests, Mills establishes the existence of a stable long run ratio between bond yields and dividend yields. Furthermore, Mills finds the ratio of bond yields to dividend yields to be stationary, implying that deviations from the average are mean reverting (i.e., deviation from the average can only be temporary).

Clare, Thomas, and Wickens (1994) estimate a ratio of the irredeemable gilt yields to dividend yields, which they call Gilt-Equity Yield Ratio (GEYR). Buy-sell thresholds for equities are formulated on the assumption that the GEYR has a "normal" long-run level. When GEYR is "too high," bonds should be bought. Correspondingly, a "too low" GEYR implies that the bonds should be sold. The long-run average yield on bonds is estimated to be 2.5%. A value of GEYR less than 2 is taken to be a signal to buy equity, while a value greater than 2.4 is taken as a signal to sell equity. Although Clare, Thomas, and Wickens do not report the dividend yield within their paper, the average for the period was approximately 4.5%. Using the dividend discount model (i.e., the Gordon growth model), they regress the log of the rate of change of stock returns on a distributed lag function of the level and the first and second difference of the GEYR ratio. After satisfying the standard set of diagnostic tests, they conclude that their model can be nested within a forecasting model based on finance theory.

DATA AND METHODOLOGY

The first purpose in our paper is to provide evidence on the co-movement between stock returns and bond yields to support the view that stock and bond returns do not follow a pure random walk. In order to accomplish this task, we first estimate an autoregressive integrated moving average process (ARIMA) for both stock returns and bond yields. Then we add the residuals from each model to the other model to see if the residuals improve the explanatory power of the other model. Next, we estimate an error correction model using standard Granger causality between stock returns and bond yields (i.e., causality in the statistical sense), to test whether changes in one series precede changes in the other series. Finally to satisfy our second objective of quantifying the relationship between stock returns and bond yields for the eight industrial countries, we test whether there is a stable ratio between bond yields and dividend yields.

The eight countries we study include Canada, France, Germany, Japan, the Netherlands, Switzerland, the United Kingdom, and the United States. As proxies for stock returns, we use the Morgan Stanley Capital International (MSCI) Stock Indexes, which do not include dividends. We proxy dividend yields using the annualized dividend yields provided by MSCI. The dividend yield proxies become key inputs in the cointegration equations. As proxies for bond yields within each of our 8 sampled countries, we use the annualized Lombard Odier Government bond indexes.[2] All return and yield data are end of the month values and cover the period December 1983 to December 1994.

Our first step is to estimate an autoregressive integrated moving average process (ARIMA) for both stock returns and bond yields. Our ARIMA model is similar in spirit to that of Schwert (1989), Ou and Penman (1989), Cochrane (1988), Ali and Zarowin (1992), Campbell and Maniiw (1992), and Fama and French (1988). A complete discussion of a similar class of models can also be found in Hatanaka (1996). A basic assumption common to each of these models is that economic and financial data contain both permanent (represented by a random walk process) and transitory components (represented by a moving average process). The permanent component reflects the secular movements of a financial series. This component, which affects economic fundamentals, can cause a permanent effect on corporate performance. In contrast, the transitory, also called cyclical component, is viewed as stationary and is composed of a moving average sequence. Schwert (1987) suggests that many economic time series contain moving average components.

Factors that may contribute to the presence of moving average (cyclical) movement of observed financial series are many. For example, since firms' performances are related to macroeconomic factors, and if most macroeconomic factors follow an ARIMA process, as documented by Schwert (1989, 1987), the observed financial series would possess moving average components because the firms' performances are expected to move along with these factors. Additionally, since monthly data are an aggregation of daily numbers, they may contain a moving average component. The fact that most financial data appears to contain an autoregressive component, as well as a relatively short moving average component, suggests that we use an ARIMA (2,1,2) model to estimate stock returns and bond yields.[3]

EMPERICAL RESULTS

Before implementing the ARIMA models for estimating stock returns and bond yields, we test for unit roots using the Phillips-Perron (PP) unit root test. Sequential tests are conducted to test for non-stationarity in both the levels and the first differences. The PP tests suggest non-stationarity for the levels, while the first differences of the series support stationarity. Table 1 reports the test results for the first differences. We conclude that the stock indexes, the associated dividend yield, and the bond indexes of all 8 countries are first difference stationarity. The tests are repeated using the augmented Dickey-Fuller which generate similar results.

We next estimate an ARIMA (2,1,2) for stock returns and bond yields for each of the 8 countries. Both the stationarity requirements of the AR coefficients (i.e., the sum of the coefficients have an absolute value less than 1) and the invertibility requirements on the MA coefficients are met. Next we add the residuals from the bond return models to the stock return models and the residuals from the stock return models to the bond return models.[4] The results of the models containing the residuals are presented in Table 2.

TABLE 1
Phillips-Perron Unit Root Tests

COUNTRY	STOCK RETURNS PP TEST STATISTIC	BOND YIELDS PP TEST STATISTIC
CANADA	-12.1109	-10.0066
FRANCE	-12.1109	-9.9186
GERMANY	-10.6240	-9.9384
JAPAN	-11.4201	-9.2614
NETHERLANDS	-10.7788	-9.1201
SWITZERLAND	-10.0328	-8.2653
UNITED KINGDOM	-11.8663	-9.2582
UNITED STATES	-11.8823	-9.7664

Note: Critical Values: (1%) -3.4811; (5%) -2.8835; (10%) -2.5783

A discussion of the results of the bond yields and stock returns of each country follows.

Canada. The evidence suggests that the Canadian model of bond yields follows a pure random walk process while the Canadian model of stock returns follows a mixed process. Within the bond yield model, both the AR coefficients and the MA coefficients are small and are statistically insignificant, but the coefficient of the residuals from stock returns is positive and statistically significant improving the explanatory power of the model. Within the stock return model both the second coefficients of the

TABLE 2a
ARIMA Models From Bond Yields

CANADA					
Constant	***Residual***	***AR(1)***	***AR(2)***	***MA(1)***	***MA(2)***
0.0099	0.0014	-0.1645	0.2056	0.2934	-0.1563
(0.3656)	(2.9309)	(-0.2999)	(0.5116)	(0.5277)	(-0.4069)
		Inverted AR	0.38	***Inverted MA***	0.27
		Roots	(-0.54)	***Roots***	(-0.57)
FRANCE					
Constant	***Residual***	***AR(1)***	***AR(2)***	***MA(1)***	***MA(2)***
0.0240	0.0014	-0.7853	n/a	0.9852	n/a
(1.2028)	(6.5464)	(-13.6139)		(82.2440)	
		Inverted AR	-0.79	***Inverted MA***	-0.99
		Roots		***Roots***	
GERMANY					
Constant	***Residual***	***AR(1)***	***AR(2)***	***MA(1)***	***MA(2)***
0.0046	0.0007	-0.4350	0.1319	0.6674	0.0619
(0.2570)	(3.7264)	(-0.6226)	(0.3273)	(0.9530)	(0.1702)
		Inverted AR	0.21	***Inverted MA***	-0.11
		Roots	(-0.64)	***Roots***	(-0.56)
JAPAN					
Constant	***Residual***	***AR(1)***	***AR(2)***	***MA(1)***	***MA(2)***
0.0129	0.0006	1.1603	-0.6519	-0.9578	0.4470
(0.6536)	(2.0656)	(6.4435)	(-3.4602)	(-4.7374)	(1.9377)
		Inverted AR	0.58 + 0.56i	***Inverted MA***	0.48 -0.47i
		Roots	(0.58 - 0.56i)	***Roots***	(0.48 + 0.47i)
NETHERLANDS					
Constant	***Residual***	***AR(1)***	***AR(2)***	***MA(1)***	***MA(2)***
0.0038	0.0005	-0.4506	0.4014	0.7569	-0.2022
(0.2152)	(2.3325)	(-1.4569)	(1.4958)	(2.2670)	(-0.6256)
		Inverted AR	0.45	***Inverted MA***	0.21
		Roots	(-0.90)	***Roots***	(-0.97)
SWITZERLAND					
Constant	***Residual***	***AR(1)***	***AR(2)***	***MA(1)***	***MA(2)***
-0.0088	0.0007	-0.0884	0.3127	0.4473	-0.1560
(-0.5842)	(4.9100)	(-0.2281)	(1.4518)	(1.1164)	(-0.6516)
		Inverted AR	0.52	***Inverted MA***	0.23
		Roots	(-0.61)	***Roots***	(-0.68)
UNITED KINGDOM					
Constant	***Residual***	***AR(1)***	***AR(2)***	***MA(1)***	***MA(2)***
-0.0017	0.0014	0.6226	-0.0728	-0.3491	-0.2365
(-0.0892)	(4.3444)	(1.7820)	(-0.2477)	(-0.0147)	(-0.7599)
		Inverted AR	0.47	***Inverted MA***	0.69
		Roots	(0.16)	***Roots***	(-0.34)
UNITED STATES					
Constant	***Residual***	***AR(1)***	***AR(2)***	***MA(1)***	***MA(2)***
0.0221	0.0016	0.5411	-0.0589	-0.3837	-0.7793
(0.9623)	(3.6013)	(0.8817)	(-0.1433)	(-0.6252)	(-0.1953)
		Inverted AR	0.39	***Inverted MA***	0.53
		Roots	(0.15)	***Roots***	(-0.15)

TABLE 2b
ARIMA Models From Stock Returns

CANADA

Constant	*Residual*	*AR(1)*	*AR(2)*	*MA(1)*	*MA(2)*
5.3509 (4.1445)	57.1039 (3.3084)	0.1109 (0.6654)	0.7113 (4.3729)	-0.1069 (-0.7694)	-0.8741 (-6.2347)
		Inverted Roots ***AR***	0.90 (-0.79)	***Inverted Roots*** ***MA***	0.99 (-0.88)

FRANCE

Constant	*Residual*	*AR(1)*	*AR(2)*	*MA(1)*	*MA(2)*
13.3176 (2.2270)	139.8403 (5.1703)	-0.9373 (-3.3417)	-0.1649 (-0.6730)	0.9978 (3.6918)	0.07233 (0.2725)
		Inverted Roots ***AR***	-0.23 (0.70)	***Inverted Roots*** ***MA***	-0.08 (-0.92)

GERMANY

Constant	*Residual*	*AR(1)*	*AR(2)*	*MA(1)*	*MA(2)*
11.2247 (1.4613)	132.3247 (3.0654)	0.6569 (0.2077)	0.2716 (0.0455)	-0.50236 (-0.1590)	-0.1372 (0.1637)
		Inverted Roots ***AR***	0.70 (-0.04)	***Inverted Roots*** ***MA***	0.70 (-0.20)

JAPAN

Constant	*Residual*	*AR(1)*	*AR(2)*	*MA(1)*	*MA(2)*
8.3999 (1.3937)	88.1378 (3.0178)	0.6628 (3.5351)	-0.6506 (-2.5000)	-0.7171 (-3.6399)	0.6363 (2.6369)
		Inverted Roots ***AR***	0.33 + 0.74i (0.33 - 0.74i)	***Inverted Roots*** ***MA***	0.36 -0.71i (0.36 + 0.71i)

NETHERLANDS

Constant	*Residual*	*AR(1)*	*AR(2)*	*MA(1)*	*MA(2)*
0.0219 (2.4535)	90.5900 (3.0455)	0.06634 (0.56554	0.6513 (5.7838)	-0.0823 (-1.3016)	-0.8983 (-14.0276)
		Inverted Roots ***AR***	0.84 (-0.77)	***Inverted Roots*** ***MA***	0.99 (-0.91)

SWITZERLAND

Constant	*Residual*	*AR(1)*	*AR(2)*	*MA(1)*	*MA(2)*
11.7302 (2.0069)	195.1924 (4.0581)	0.0474 (0.0683)	n/a	0.0702 (0.1010)	n/a
		Inverted Roots ***AR***	0.50	***Inverted Roots*** ***MA***	0.07

UNITED KINGDOM

Constant	*Residual*	*AR(1)*	*AR(2)*	*MA(1)*	*MA(2)*
12.2059 (2.5818)	103.9663 (4.7932)	0.1922 (0.4386)	-0.3939 (-0.9747)	-0.1841 (-0.3975)	0.2627 (0.6151)
		Inverted Roots ***AR***	0.10 + 0.62i (0.10 - 062i)	***Inverted Roots*** ***MA***	0.09 - 0.50i (0.09 + 0.50i)

UNITED STATES

Constant	*Residual*	*AR(1)*	*AR(2)*	*MA(1)*	*MA(2)*
11.3161 (10.8831)	79.8538 (5.0227)	-0.0833 (-0.2895)	-0.6711 (5.1875)	-0.0748 (-0.7352)	-0.8916 (-8.4050)
		Inverted Roots ***AR***	0.80 (-0.84)	***Inverted Roots*** ***MA***	0.98 (-0.91)

AR and MA terms are statistically significant. In addition, the coefficient of the residuals from the bond yields is positive and statistically significant. Again improving the explanatory power of the model.

France. The French model of bond yields was re-estimated because both the MA terms were positive and greater than one. The re-estimated model, ARIMA (1,1,1), passes both the stationarity and invertibility requirements since both AR(1) and MA(1) terms are statistically significant. Similar to the Canadian model, the addition of the residuals from stock returns produced a positive and statistically significant coefficient adding explanatory power to the model. The stock returns model is a mixed process. The addition of the residuals from the bond yields model produce a positive and statistically significant coefficient, again added to the explanatory power of the base model.

Germany. The German model of bond yields shows results similar to the Canadian case, that is the evidence suggests that German bond yields follow a pure random walk process. Both the AR and MA terms are statistically insignificant. The addition of residuals from stock returns model produced a positive and statistically significant coefficient. Unlike the two prior cases, the German stock returns model provides evidence that stock returns follow a pure random walk. The results show insignificant AR and MA terms but a positive and significant coefficient of the residuals from the bond yields.

Japan. The Japanese model for both bond yields and stock returns follow an AR and MA process. Both AR and MA terms are statistically significant. The addition of the residuals from the stock returns and bond returns respectively are positive and statistically significant.

Netherlands. The Netherlands model of bond yields offers weak support for the random walk. The coefficients of the AR terms and the second MA are statistically insignificant, while the first term of the MA term is positive and statistically significant. The coefficient of the residuals from the stock returns is positive and statistically significant. The model of stock returns is a mixed process in which the second terms of both the AR and MA are statistically significant. Again the coefficient of the residuals from the bond returns is positive and statistically significant.

Switzerland. The Swiss model of bond yields follows a pure random walk process because the coefficients of the AR as well as MA terms were statistically insignificant. The coefficient of the residuals from stock returns was positive and statistically significant. The Swiss model of stock returns is re-estimated because both the MA terms were positive and greater than one. The ARIMA (1,1,1) failed to pass both the stationarity and invertibility requirements since both the AR(1) and MA(1) terms are insignificant. The coefficient of the residuals from the bond model is positive and statistically significant.

United Kingdom. In the U.K., both models of bond yields and stock returns produced statistically insignificant coefficients, which offers support for the random walk. The addition of the residuals from each model to the other model produced positive and statistically significant coefficients.

United States. The bond model of the U.S. produced insignificant coefficients for both the AR and the MA terms, supporting the random walk. The addition of the residuals from the stock returns model produced positive and statistically significant coefficient. The stock returns model is a mixed process. The second terms of both the AR and MA are statistically significant. The addition of the residuals from the bond model produced positive and statistically significant coefficient.

Error Correction Models and Granger Causality

The existence of nonstationarity in a financial series suggests that a test of cointegration between variables is necessary for correct modeling. According to Engle and Granger (1987), if a set of variables is cointegrated, there always exists an error correction model between the variables. We therefore test for cointegration between stock returns and bond yields using the methodology found in Johansen (1991). The tests indicate that stock returns and bond yields as well as dividend yields are cointegrated. With this knowledge, we estimate an error correction model for stock returns and bond yields. The results, presented in Table 3, indicate that each country's model is significant at least at the 5% level of significance.

Since the Phillips-Perron unit root tests establish that stock returns and bond yields are stationary in first difference, we estimate the following error correction models for bond yields (eq. 1) and stock returns (eq. 2).

Equation 1

$$\Delta B_t = \alpha_1(\Delta S_t) - \alpha_2(B_{t-1} - \lambda S_{t-1}) + \mu_{1t}$$

Equation 2

$$\Delta S_t = \beta_1(\Delta\beta_t) - \beta_2(B_{t-1} - \lambda S_{t-1}) + \mu_{2t}$$

where λ is the cointegrating parameter, μ_{1t} and μ_{2t} joint white noise, and ΔB and ΔS are changes in stock returns and bond yields from $t-1$ to t, and $| \alpha_1 | + | \beta_1 | \neq 0$. If stock returns and bond yields are cointegrated, then there must be Granger causality at least in one direction, as one variable can help forecast the other. Table 4 presents the estimates of the cointegrating parameters from regressions of bond yield and stock returns.

TABLE 3
Johansen Cointegration Tests Of Bond Yields, Stock Dividends, And Stock Returns

	EIGEN VALUE	LIKELIHOOD RATIO	NUMBER OF CEs
CANADA	0.2036	47.0978	1 @ 5%
FRANCE	0.2187	44.8489	1 @ 5%
GERMAY	0.2244	40.8412	1 @ 5%
JAPAN	0.3532	71.2537	1 @ 5%
NETHERLANDS	0.2433	42.2628	1 @ 5%
SWITZERLAND	0.0293	42.5023	1 @ 5%
UNITED KINGDOM	0.2477	47.5449	1 @ 5%
UNITED STATES	0.2337	64.7495	2 @ 5%

Note: Critical Values: (1%) 41.07; (5%) 34.91

Not surprisingly, all the cointegrating parameters are statistically significant, but many of the coefficients from standard Granger causality are not statistically significant. That is, Granger causuality, which contains only lag values of all the variables in the model, does not produce the same results obtained from the error correction model. If two variables are cointegrated (i.e., they share a common trend), there will be causality in at least one direction which is not the case when standard Granger causality is used.

Canada. For example, Canadian stock returns changes (CANSRD) precede changes in bond yields when changes in bond yields are on the left side of the equation. The reverse is true when changes in stock returns are on the left-hand side of the equation (i.e., changes in bond yields (CANBYD) precede changes in stock returns).

France. For France, both prior changes in stock returns (FRANSRD) and bond yields (FRANBYD) are statistically significant when changes in bond yields are on the left hand side of the equation. Neither prior changes in bond yields nor stock returns are statistically significant when changes in stock returns are on the left-hand side of the equation.

Germany. For Germany, prior changes in bond yields (GERMBYD) are not statistically significant. But prior changes in stock returns (GERMSRD) are statistically significant when changes in bond yields are on the left-hand side. Neither changes in bond yields nor stock returns are statistically significant when changes in stock returns are on the left-hand side.

Japan. For Japan, neither prior change in bond yields (JAPBYD) nor stock returns (JAPSRD) are statistically significant when changes in bond yields are on the left-hand side. Prior changes in bond yields are statistically significant but prior changes in stock returns are not when changes in stock returns are on the left-hand side.

Netherlands. For the Netherlands, prior changes in bond yields (NETHBYD) are marginally significant but prior changes in stock returns (NETHSRD) are not when changes in bond yields are on

TABLE 4
Error Correction Models For Bond Yields And Stock Returns

VARIABLE	Coef	t-Stat	VARIABLE	Coef	t-Stat
CANADA: BOND YIELDS			**CANADA: STOCK RETURNS**		
CONSTANT	0.0021	0.08425	CONSTANT	0.55343	0.12720
CANBYD(-1)	0.0139	0.14308	CANSRD(-1)	0.06492	0.69910
CANSRD(-1)	-0.0011	-3.03866	CANBYD(-1)	-33.68660	-2.36994
CANRES(-1)	-0.7971	-6.17888	CANRES(-1)	-1.26657	-8.81107
FRANCE: BOND YIELDS			**FRANCE: STOCK RETURNS**		
CONSTANT	-0.0009	-0.0399	CONSTANT	-0.1981	-0.0302
FRANBYD(-1)	0.2382	2.3109	FRANSRD(-1)	-0.0014	-0.0146
FRANSRD(-1)	-0.0009	-3.7671	FRANBYD(-1)	-5.3343	-0.1991
FRANRES(-1)	-0.9991	-7.2357	FRANRES(-1)	-1.0237	-7.4325
GERMANY: BOND YIELDS			**GERMANY: STOCK RETURNS**		
CONSTANT	-0.0015	-0.0995	CONSTANT	0.2835	0.0422
GERMBYD(-1)	-0.0309	-0.3144	GERMSRD(-1)	0.0221	0.2297
GERMSRD(-1)	-0.0003	-2.0963	GERMBYD(-1)	-59.4460	-1.5783
GERMRES(-1)	-0.7136	-5.8063	GERMRES(-1)	-0.9370	-7.5729
JAPAN: BOND YIELDS			**JAPAN: STOCK RETURNS**		
CONSTANT	0.0016	0.0749	CONSTANT	-0.3629	-0.0550
JAPBYD(-1)	0.0410	0.4335	JAPSRD(-1)	0.0437	0.4862
JAPSRD(-1)	-0.0002	1.0777	JAPBYD(-1)	-54.5680	-2.2468
JAPRES(-1)	-0.8062	-6.6884	JAPRES(-1)	-1.1230	-8.6201
NETHERLANDS: BOND YIELDS			**NETHERLANDS: STOCK RETURNS**		
CONSTANT	-0.0003	-0.0251	CONSTANT	-0.5981	-0.1200
NETHBYD(-1)	0.0176	0.1887	NETHSRD(-1)	0.0586	0.6746
NETHSRD(-1)	0.0003	-1.9649	NETHBYD(-1)	-43.7630	-1.4003
NETHRES(-1)	-0.7168	-6.2737	NETHRES(-1)	-0.9944	-8.2251
SWITZERLAND: BOND YIELDS			**SWITZERLAND STOCK RETURNS**		
CONSTANT	0.0004	0.0365	CONSTANT	0.5559	0.1014
SWISBYD(-1)	0.0640	0.6239	SWISSRD(-1)	-0.0981	-1.0032
SWISSRD(-1)	-0.0005	-3.5599	SWISBYD(-1)/	15.0863	0.3042
SWISRES(-1)	-0.5698	-4.8673	SWISRES(-1)	-0.8890	-6.8575
UNITED KINGDOM: BOND YIELDS			**UNITED KINGDOM: STOCK RETURNS**		
CONSTANT	0.0003	0.0134	CONSTANT	-0.2439	-0.0408
UKBYD(-1)	0.2175	2.1524	UKSRD(-1)	0.1436	1.4339
UKSRD(-1)	-0.0008	-2.8424	UKBYD(-1)	-55.7721	-2.5396
UKRES(-1)	-0.9330	-7.4081	UKRES(-1)	-1.1544	-8.1711
UNITED STATES: BOND YIELDS			**UNITED STATES: STOCK RETURNS**		
CONSTANT	0.0010	0.0416	CONSTANT	0.7807	0.1705
USBYD(-1)	0.0698	0.7067	USSRD(-1)	0.1045	1.1134
USSRD(-1)	-0.0009	-2.5070	USBYD(-1)	-45.3271	-2.9176
USRES(-1)	-0.8567	-6.6312	USRES(-1)	-1.1728	-8.7904

the left-hand side. Neither prior changes in bond yields nor stock returns are statistically significant when changes in stock returns are on the left-hand side.

Switzerland. For Switzerland, prior changes in stock returns (SWISSRD) are statistically significant, but prior changes in bond yields (SWISBYD) are not when bond yields are on the left-hand side. Prior changes in both bond yields and stock returns are not statistically significant when changes in stock returns are on the left-hand side.

United Kingdom. For the U.K., prior changes in both stock returns (UKSRD) and bond yields (UKBYD) are statistically significant when changes in bond yields are on the left-hand side. Prior changes in bond yields are statistically significant but prior changes in stock returns are not when changes in stock returns are on the left-hand side.

United States. And for the U.S., prior changes in stock returns (USSRD) are statistically significant, but prior changes in bond yields (USBYD) are not when changes in bond yields are on the left-hand side. Similarly, prior changes in bond yields are statistically significant but prior changes in stock returns are not when changes in stock returns are on the left-hand side.

It is of some interest that the results derived from the error correction model are different from results derived from standard Granger causality tests. But the results from the error correction model are consistent with Granger theory, which states that cointegrated variables must have an error correction model and if two variables have an error correction model, they must be cointegrated. See Table 5 for a summary of the results.

The test results are of standard Granger causality and based on one-month lag. Longer lags proved to be statistically insignificant. The results for Canada and Switzerland indicate a circular relationship between stock returns and bond yields. That is, changes in stock returns precede changes in bond yields but there is also feedback from bond yields to stock returns. For France and Japan, changes in bond yields preceded changes in stock returns without feedback from stock returns to bond yields. Both the German and Netherlands results are the opposite of those from France and Japan. Germany and the Netherlands data show that changes in stock returns precede changes of bond yields without feedback from bond yields to stock returns. Finally, the U.K. and U.S. markets are similar and both are characterized by independence of the bond yields and stock returns, because neither changes in bond yields or changes in stock returns precede changes in the other market.

TABLE 5
Standard Granger Causality Tests
Sample 1983:12 1994:12
131 Observations

NULL HYPOTHESIS	BOND YIELDS F-STATISTIC (Significance Level)	STOCK YIELDS F-STATISTIC (Significance Level)
Canada	4.6509 (0.0329)	2.8523 (0.0937)
France	1.2882 (0.2585)	7.4868 (0.0072)
German	10.0461 (0.0019)	0.0022 (0.9625)
Japan	0.6253 (0.4305)	3.1718 (0.0773)
Netherlands	4.7951 (0.0304)	1.2683 (0.2622)
Switzerland	7.0571 (0.0089)	5.7884 (0.0176)
United Kingdom	0.7201 (0.3977)	0.3058 (0.5813)
United States	1.4112 (0.2371)	1.4266 (0.2345)

The *Country's* Stock Returns (Bond Yields) Do Not Granger Cause *Country's* Bond Yields (Stock Returns)

The Bond Yield-Dividend Yield Ratio

Financial analysts use many stock market indicators for individual stocks as well as proxies for the market as measured by indexes such as the S&P 500. Among the popular indicators are the dividend yield, the market-to-book ratio, and the price-earning ratio. Conventional wisdom suggests that when dividend yields are low relative to their historical average (which is about 4.56%), and market-to-book and price-earnings ratios are high relative to their historical averages (which are about 2 and 15), equities tend to perform poorly (see Helwege, Laster and Cole [1996]). In the academic literature, the co-movement between stocks and bond prices are frequently studied using the present-value model as a framework. According to the present-value model, the current prices of stocks and bonds should be equal to the present-value of future cash flows, subject to the appropriate discount rates consisting of real interest rates, inflation expectations, and risk premium for holding risky assets. Other things being equal, an increase (decrease) in the expected future discount rates for both stocks and bonds should cause both stock prices and long-term bond prices to fall (rise), resulting in a positive correlation between returns on outstanding stocks and long-term bonds (see Solnik [1996]). In the present research we seek to find whether there is a long-term "normal" ratio between the bond yield and the dividend yield.

Since stocks returns, their associated dividend yields, and the first difference of the bond indexes are found to be cointegrated, we seek to establish whether the ratio of bond yields to dividend yields is I(0). The Phillips-Perron unit root tests for the eight countries establish that the ratios are stationary.[5] The results are statistically significant for all 8 countries and are summarized in Table 6. To further establish whether the ratio follows a random walk process or exhibits mean reversion properties, we ran the following regression (eq. 3).

Equation 3

$$\Delta C_t = \beta_0 + \beta_1 \Delta C_{t-1} + \beta_2 \Delta C_{t-2} + \ldots + \beta_n \Delta C_{t-n} + \mu_t$$

where Δ is the first difference operator and n is the lag length. If the ratio of bond yields to dividend yields truly follows a random walk, then the current change (ΔC_t) in the ratio should be unrelated to all previous changes. Checking whether the coefficients of equation are jointly equal to zero, using the F-test carries out the test. The evidence in Table 7 is unable to reject the hypotheses that the ratios do not follow random walk.[6] Indeed, the negative autocorrelations of the ratios for all countries strongly confirm the mean reversion property; that is, persistence is uniformly present for all the twelve lags in each model.[7]

TABLE 6
Phillips-Perron Unit Root Test Of Bond Yield/Dividend Yield

COUNTRY	PP Test Statistic
CANADA	-11.2029
FRANCE	-11.0573
GERMANY	-11.8914
JAPAN	-11.6283
NETHERLANDS	-11.7458
SWITZERLAND	-12.5411
UNITED KINGDOM	-10.2553
UNITED STATES	-12.3434

1% Critical Value = -3.4819

TABLE 7a
Regressions Of The Ratio Of Bond Yields To Dividend Yields In First Differences
1985:01 To 1994:12
105 Observations

VARIABLE	Coef (t-Stat)	Coef (t-Stat)	Coef (t-Stat)	Coef (t-Stat)
	CANADA	**FRANCE**	**GERMANY**	**JAPAN**
CONSTANT	-0.0024 (-0.3840)	0.0018 (0.4424)	-0.0004 (-0.1536)	-0.0002 (-0.1179)
RATIO (t - 1)	-0.8892 (-8.5943)	-0.9419 (-9.1520)	-0.9082 (-9.2319)	-0.9299 (-9.6661)
RATIO (t - 2)	-0.7142 (-5.2454)	-0.8980 (-6.3589)	-0.8061 (--6.1419)	-0.9975 (-7.5946)
RATIO (t - 3)	-0.5992 (-4.0411)	-0.8006 (-4.7290)	-0.7186 (-4.7696)	-0.9334 (-5.7580)
RATIO (t - 4)	-0.5184 (-3.3895)	-0.7364 (-3.9711)	-0.8593 (-5.2826)	-0.8330 (-4.4930)
RATIO (t - 5)	-0.33355 (-2.1747)	-0.6011 (-2.8576)	-0.7839 (-4.4274)	-0.7965 (-3.9051)
RATIO (t - 6)	-0.2760 (-1.8622)	-0.4684 (-2,1043)	-0.6678 (-3.6026)	-0.7620 (-3.5056)
RATIO (t - 7)	-0.4493 (-3.0620)	-0.4974 (-2.1631)	-0.5436 (-2.9349)	-0.5257 (-2.3829)
RATIO (t - 8)	-0.4167 (-2.7874)	-0.4393 (-1.8920)	-0.4786 (-2.7098)	-0.4172 (-1.9524)
RATIO (t - 9)	-0.3476 (-2.3730)	-0.3657 (-1.6137)	-0.3534 (_2.1821)	-0.3387 (-1.6847)
RATIO (t - 10)	-0.2514 (-18190)	-0.2301 (-1.0808)	-0.2907 (-1.9437)	-0.2604 (-1.4212)
RATIO (t - 11)	-0.1878 (-1.5431)	-0.2257 (-1.2284)	-0.2126 (-1.6347)	-0.1611 (-1.0859)
RATIO (t - 12)	-0.0599 (-0.6622)	-0.1139 (-0.8283)	-0.0579 (-0.5949)	-0.1578 (-1.4452)
R-SQUARED	0.48352	0.4810	0.4837	0.5009

DISCUSSION AND IMPLICATIONS

Financial decision making requires a model in order for portfolio managers to understand the relationships between assets contained in a portfolio. Researchers have established that stock returns and bond yields exhibit mean reverting properties and have identified a small set of variables which can forecast stock returns and bond yields. In this paper, we sought to establish the co-movement between stock returns and bond yields in eight developed countries for the period 1984-1994. We examined the time series properties of stock returns, their associated dividend yields, and bond yields. Unit root tests developed by Phillips and Perron are applied to the time series data. Based on the critical values, the results support the hypothesis that these financial series contain a unit

TABLE 7b
Regressions Of The Ratio Of Bond Yields
To Dividend Yields In First Differences
1985:01 To 1994:12
105 Observations

	NETHERLANDS	SWITZERLAND	UNITED KINGDOM	UNITED STATES
CONSTANT	0.0002 (0.0549)	0.0004 (0.2201)	0.0002 (0.1217)	-0.0012 (-0.5091)
RATIO (t - 1)	-0.9459 (-9.7762)	-0.9911 (-9.5451)	-0.8628 (-7.5174)	-0.6761 (-6.6382)
RATIO (t - 2)	-0.8711 (-6.5673)	-0.9425 (-6.4730)	-0.6666 (-4.5142)	-0.6117 (-5.0407)
RATIO (t - 3)	-0.8125 (-5.2238	-0.9835 (-5.7903)	-0.6062 (-3.7099)	-0.4775 (-3.6616)
RATIO (t - 4)	-0.7095 (-4.1523)	-0.9363 (-4.9512)	-0.5490 (-3.2544)	-0.5141 (-4.0558)
RATIO (t - 5)	-0.6146 (-3.4164)	-0.8462 (-4.2453)	-0.6066 (-3.4929)	-0.6671 (-5.0861)
RATIO (t - 6)	-0.5466 (-2.9764)	-0.7558 (-3.7098)	-0.5557 (-3.0965)	-0.4977 (-3.6474)
RATIO (t - 7)	-0.4823 (-2.6283)	-0.6982 (-3.4499)	-0.3434 (-1.8962)	-0.3905 (-2.9402)
RATIO (t - 8)	-0.4049 (-2.2509)	-0.6329 (-3.2359)	-0.3796 (-2.1779)	-0.2904 (-2.3555)
RATIO (t - 9)	-0.3511 (-2.0568)	-0.4651 (-2.5407)	-0.3953 (-2.3420)	-0.2329 (-2.0930)
RATIO (t - 10)	-0.2478 (-1.5977)	-0.3594 (-2.2297)	-0.3034 (-1.8785)	-0.2650 (2.6964)
RATIO (t - 11)	-0.1441 (-1.0893)	-0.1431 (-1.0459)	-0.2908 (-1.9949)	-0.1614 (-1.9472)
RATIO (t - 12)	-0.0897 (-0.9300)	-0.0784 (-0.7993)	-0.2730 (-2.4018)	-0.0901 (-1.5623)
R-SQUARED	0.4765	0.5197	0.4316	0.4379

root in the level, but are stationary in their first difference. We established that stock returns and their associated dividend yields and bond yields (in real terms) share a common trend and possess at most one cointegrating vector. The empirical investigation is conducted by means of the Jorgansen cointegration test and the error correction modeling strategy.

The persistence properties of stock returns and bond yields suggested the estimation of a simple and parsimonious ARIMA model from which the residuals in each model were added to the other model to see if the residuals improve the explanatory value of each model. In each case, it was found that the models improved substantially. Moreover, the sign of the residuals is consistently positive, implying that stocks and bonds are complementary in the portfolio of wealth in all countries regardless of the original and development of the financial system. In addition, the error correction models of each country demonstrate that the application of standard Granger causality tests will incorrectly specify the relation between cointegrated variables. The error correction models not only established that feedback exists between stock returns and bond yields, but adjustment was completed for most countries within a month. Finally, we explore the possibility of a long-term stable relationship between dividend yields and bond yields in each country. We find that the dividend yields and bond yields are cointegrated according to the Johansen methodology and that the ratio of bond yields to dividend yields is stationary. This suggests the estimation of an autoregression model of the ratio, because if the dividend yield and bond yields are cointegrated they will not meander too far apart because of their deterministic relation to each other. Indeed, a twelve-lag model estimated for each country established that such models possess a reasonable explanatory power.

ENDNOTES

1. For instance, see Belvers, Cosimano, and McDonald (1990), Campbell and Shiller (1992), Cutler, Poterba and Summers (1991), Fama and French (1995, 1993, 1992, 1988), Ferson and Harvet (1991), Goetzmann and Jorion (1993), Jagadeesh (1990), Lo and MacKinlay (1988), Poterba and Summers (1988), and Schwert, (1987).
2. Similar to the stock return proxies, the bond yield proxies do not include accrued interest.
3. Granger pairwise statistical causality tests confirm that the best results are obtained with a lag of one month. We also confirm the presence of a stable relation between bond yields and dividend yields through autoregression-distributed lags of the ratio of bond yields on dividend yields.
4. Although correctly specifying the ARIMA for each model signifies that the error term should be white noise (i.e., $\mu = 0$), it can still be used as an explanatory variable in another ARIMA. The purpose of this model is not forecasting accuracy or goodness of fit because the R square term is low in all of our equations. The purpose is to determine whether residuals from any one equation (for instance, the bond equation) can help predict a variable within another equation (for instance, the stock equation). This method has been used extensively in forecasting financial variables such as bond yields, stock returns, and exchange rates. See Fama (1996, 1995, 1993, 1992, 1988).
5. If the equations are stationary, they can be modeled. If they are non-stationary, they cannot be modeled. Since the models are found to be stationary, our objective is to determine if the ratio is forecastable from its own past history, which we find to be the case for all the countries under study.
6. The justification for using an F-test is that we are testing the overall explanatory power of the model. If the autoregressive terms follow a random walk, they should be zero. Conversely, if they do not follow a random walk, the model should have some explanatory power and this would be indicted as a joint F-test of the coefficients.
7. There is no serial correlation because all the equations contain several lag terms which usually eliminates serial correlation which is the theory behind the Augmented Dicky-Fuller test relative to the simple Dicky-Fuller test.

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