The Implications of Predictable Returns in Asset Markets

by

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Duke University
1. Introduction

- Growing realization that stock and bond returns are predictable in both the long run and short run.

- Immediate implications for portfolio strategies.
  - Long horizon portfolios should have little or no fixed income participation.
  - Short horizon portfolios should be managed actively rather than passively.

- Predictability is linked to the state of the economy. Asset prices reveal information about future economic conditions.
Interest rates provide a window to the future.

Yields represent the rate at which people trade wealth today for wealth in some other period.

Hence, yields must contain information about the future state of the economy including future inflation.

Yields of different maturity bonds – called the Term Structure of Interest Rates or the Yield Curve – give information about different horizons.

Can these yields be utilized to forecast the state of the economy?
The yield curve is published every day in the *Wall Street Journal*.

The following is the yield curve for August 23, 1993.
Consider the following intuition that I developed in my thesis (University of Chicago, 1986):

▷ Suppose consumers expect a recession next year.

⇒ Most prefer to avoid being very poor one period and very rich the next period. People prefer to smooth their consumption. This drives the demand for hedging.

▷ To hedge, consumers identify something that will safely payoff when they most need the money – a one-year bond.

▷ Buying pressure on the one-year bond increases price and decreases yields.

▷ Selling pressure on short-term bonds, like Treasury bills, decreases prices and increases yields.
The demand for hedging, based on expectations of economic growth, causes the yield curve to invert (short rates higher than long rates).

- So there should be information in today's yield curve that helps us forecast economic growth.

- My thesis proved this to be the case.
Consider the historical yield curve for the U.S.
Now overlay real GDP growth.
What about other countries?
Germany is particularly interesting. My 1991 publication in *Weltwirtschaftliches Archiv* predicted that Germany was headed for recession after unification.

I argued that my model provided better forecasts than the main forecasting institutes in Germany. Consider the Goldman Sachs publication.

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**Every Yield Curve Tells a Story (2)**

- Were these yield curve/GNP relationships to hold, then 1993 would be the first year since 1988 that the US economy would clearly outperform that of Germany.

- It is also worth highlighting in this regard that the academic literature on yield curve (term structure)/GNP relationships in both Germany and the United States are supportive of the notion that yield curves are good "predictors" of future GNP growth.

- In the case of Germany, the forecast errors are quite small and the term structure has tended to outperform other, respected forecasting bodies. In the United States, the forecast errors are smaller than that contained in more conventional survey forecasts for GNP.

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### Out-of-Sample Forecasting Performance for the Federal Republic of Germany of the Term Structure Model, 1976Q1–1989Q4 (%)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency of the Forecasts</th>
<th>Mean Absolute Error</th>
<th>Root Mean Squared Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term Structure</td>
<td>Quarterly</td>
<td>1.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Term Structure</td>
<td>Semi-annual</td>
<td>1.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Term Structure</td>
<td>Annual</td>
<td>1.1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

### A Comparison of the Forecast Errors of Annual Growth in German Real Gross National Product

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage Error Term Structure</th>
<th>DIW</th>
<th>5 Major Institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>2.01</td>
<td>3.07</td>
<td>3.57</td>
</tr>
<tr>
<td>1984</td>
<td>0.62</td>
<td>3.56</td>
<td>1.06</td>
</tr>
<tr>
<td>1985</td>
<td>0.59</td>
<td>0.33</td>
<td>0.53</td>
</tr>
<tr>
<td>1986</td>
<td>0.57</td>
<td>0.31</td>
<td>0.49</td>
</tr>
<tr>
<td>1987</td>
<td>0.09</td>
<td>0.74</td>
<td>0.74</td>
</tr>
<tr>
<td>1988</td>
<td>0.19</td>
<td>1.48</td>
<td>0.98</td>
</tr>
<tr>
<td>1989</td>
<td>0.90</td>
<td>2.59</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Statistics:
- Mean Error
- Mean Absolute Error
- Root Mean Squared Error

Source: "Interest Rate Based Forecasts of German Economic Growth" by Campbell R. Harvey.
Every Yield Curve Tells a Story (1)

- The essential point we are making regarding the policy mix is that the f/x price of the D-Mark today is supported by a monetary policy (relative to the US) which is not sustainable and a fiscal stance which, like America's before it, will need to be reversed or neutralised.

- The question is not really whether the DM-bloc will weaken against the US$ but when. The build-up to the answer is complex. To begin with, the graphs on this page show the simple relationship between the yield curve (10 year government yields less 3-month money) and lagged GNP growth in the US and Germany. Apart from disturbances caused by major fiscal expansions, the correlations are acceptable.

- The yield curve/GNP links suggest (a) that a US economic rebound has begun and will become stronger in 1993. This would be consistent with our US growth forecast of 2-3% for 1993 and (b) that a German growth slowdown has begun and that this should extend into 1993, possibly to outright recession.
What about the out-of-sample evidence for the U.S.?

Yield Curve and the Business Cycle
Annual Real GDP Growth (Line) and Lagged 5-Year/3-Month Spread (Dash)
Implications for Treasury Debt management.

- I have been a leading advocate of shortening the maturity of Treasury debt.

- Included is an abridged version of my presentation to the House Ways and Means Committee who will oversee the new Treasury policy.
Stock prices also contain information about future real activity.

The price is just the discounted future cash flows that will accrue to investors.

But stock prices are a noisier indicator of the future for three reasons:

1. The horizon is uncertain.
2. The dividends and capital gains are uncertain.
3. The discount rate can change.
The stock market has correctly predicted nine of the last five recessions!
Nevertheless, if bonds contain information about future real growth and if stocks are also affected by future real growth, we might be able to predict stock returns with the yield curve and other variables.

The implication of predictability for portfolio management is my second major research thrust.

- Indeed, the ability to forecast asset returns is critical for successful asset allocation strategies.
• For many years, it was believed that stock prices followed random walks.

• With the random walk model, the best prediction of the next period’s stock price is today’s price plus a “drift” term.

• The “drift” is just the average return over the history.

• This model implies that stock returns are completely unpredictable.

• My research has shown that stock and bond returns are indeed predictable. However, the degree of predictability is limited.
The Economic Intuition Behind Predictability

If you were asked to forecast next year’s real GDP growth, it unlikely that you would give the average GDP growth over the past 20 years – or even the average growth over the past 5 years.

Your forecast of real GDP growth would be conditioned on important economic information that is available today.

Similarly, if you were asked to forecast next year’s stock return, why use the average return over 5 years?

Your forecast of the stock return for next year should be conditioned on the key economic and financial information available today – like the shape the yield curve.
2. Predictability

A Simple Example:

Consider a U.S. fund manager that chooses to allocate into two portfolios: the S&P 500 and money market instruments (T-bill).

I will examine three strategies:

1. Asset allocation with average risk aversion.

2. Asset allocation with higher than average risk aversion.

3. Asset allocation with average risk aversion using my forecasted stock returns.

Each of these strategies will produce a different investments.

They will be tracked over the January 1970–September 1991 period.

This is a ‘simple’ example because only two asset classes are considered.
4. Asset Allocation

Evaluation:

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Strategy 1 Buy-Hold</th>
<th>Strategy 2 90/10</th>
<th>Strategy 3 w/Forecasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total profit</td>
<td>233.87%</td>
<td>226.40%</td>
<td>346.58%</td>
</tr>
<tr>
<td>Monthly profit</td>
<td>0.90%</td>
<td>0.86%</td>
<td>1.33%</td>
</tr>
<tr>
<td>Monthly std. dev.</td>
<td>4.68%</td>
<td>4.21%</td>
<td>4.10%</td>
</tr>
<tr>
<td>Annual profit</td>
<td>10.76%</td>
<td>10.41%</td>
<td>15.94%</td>
</tr>
<tr>
<td>Annual std. dev.</td>
<td>16.22%</td>
<td>14.59%</td>
<td>14.21%</td>
</tr>
</tbody>
</table>
Strategy that uses forecasts greatly enhances returns and lowers overall risk.

The benefits are impressive given the explanatory accuracy (proportion explained, $R^2$, is less than 10%).

The proportion of correct market entries is 61.5%.

The proportion of correct market exits is 53.8%.

Return enhancement would not be eliminated by reasonable transactions costs.

Potential for even higher returns if filter is applied to forecast. I.e., if forecasted equity return is trivially above the T-bill rate do not enter the equity market.
4. Asset Allocation

Predictability of U.S. Portfolio Returns
from Ferson and Harvey (1991)

Adj. R²

Industries Size Deciles Bonds

Adjusted R-Square
Predictability of Country Equity Returns
from Harvey (1991)

Adj. $R^2$

Country

Adjusted $R$-Square
Predictability of World Industry Returns from Harvey, Solnik and Zhou (1992)
4. Asset Allocation

![Predictability of World Bond Returns](image)

*Predictability of World Bond Returns from Harvey, Solnik and Zhou (1992)*

- Adjusted R-Square

**Countries and Bond Yields:**
- Canada
- France
- Germany
- Japan
- Neth.
- Switz.
- U.K.
- U.S.
- Increased interest (especially in the U.S.) in adding foreign assets to portfolio holdings.

- Do foreign assets enhance reward to risk profiles.

- What are the risks and the risk premiums in international investment?
5. Emerging Markets

<table>
<thead>
<tr>
<th>Are listed stocks freely available to foreign investors?</th>
<th>Repatriations of income</th>
<th>Repatriations of capital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Free entry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Brazil</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Columbia</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Jordan</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Portugal</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Turkey</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td><strong>Relatively free entry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>Free</td>
<td>After 1 year</td>
</tr>
<tr>
<td>Greece</td>
<td>Some restrictions</td>
<td>Some restrictions</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Some restrictions</td>
<td>Some restrictions</td>
</tr>
<tr>
<td>Mexico</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Thailand</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Venezuela</td>
<td>Some restrictions</td>
<td>Some restrictions</td>
</tr>
<tr>
<td><strong>Special classes of shares</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Philippines</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Restricted</td>
<td>Restricted</td>
</tr>
<tr>
<td><strong>Authorized investors only</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>Some restrictions</td>
<td>Some restrictions</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td><strong>Closed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>Some restrictions</td>
<td>Some restrictions</td>
</tr>
</tbody>
</table>
• Data on portfolios of active stocks within a country provided by the International Finance Corporation of the World Bank.

• Returns calculated in both U.S. dollars and local currency terms.

• Most of the analysis is conducted in U.S. dollar terms.

• For some countries, currency fluctuations are an important determinant of the variance of the local returns.
Markets small but active.

Capitalization of emerging markets is smaller than their contribution to world GDP.

Market size grows as standard of living increases.

Many markets are larger than some smaller developed countries markets.

Turnover rates exceed rates in developed countries in a number of emerging markets.

High average returns and high volatility.
I investigate a number of measures to explain the cross-sectional dispersion of volatility.

(a) Dollar capitalization.

(b) Number of companies in index.

(c) Dollar volume.

(d) Percent capitalization of top 10 firms

(e) Percent trading volume of top 10 firms

(f) Asset concentration factor.

(g) Sector concentration factor.

(h) Mean cross-correlation.
Emerging returns are also predictable.

- What are the implications for portfolio management?

- Although emerging returns are very volatile, they reduce overall portfolio risk.
• Harvey (1991) finds the average cross-correlation of developed equity markets is 41%.

• Dramatically lower cross-correlations in Implications of Predictability. Average cross-correlation is 10%.
  → Brazil negatively correlated with Argentina, Venezuela, and Mexico.
  → Pakistan and India are negatively correlated.

• Correlations with developed countries only 13% on average.

• Average correlation with the MSCI world index is only 15%.

• Average correlation with the U.S. index is only 16%.
Obvious gains to “diversification” if Implications of Predictability included in portfolio programs.

- U.S. portfolio unconditionally dominated by a portfolio of U.S. and emerging stocks.

- With all countries in the program, the volatility of the minimum variance portfolio is cut in half!

- Results are not sensitive to short-selling constraints.
Out-of-sample performance also impressive.

<table>
<thead>
<tr>
<th>Performance</th>
<th>Strategy 1</th>
<th>Strategy 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All countries</td>
<td>Developed only</td>
</tr>
<tr>
<td>Annual profit</td>
<td>17.4%</td>
<td>16.6%</td>
</tr>
<tr>
<td>Annual std. dev.</td>
<td>11.4%</td>
<td>15.8%</td>
</tr>
</tbody>
</table>
6. Summary

- Asset prices reveal information about the future state of the economy.

- Forecasts of economic growth from the bond market are better than more expensive and complex models.

- Stock returns are also affected by the future state of the economy and partially forecastable based on current information.

- Successful asset allocation strategies must incorporate the best possible forecasts of asset returns.
Managing the structure of Treasury debt

BY CAMPBELL R. HARVEY

This article is based on testimony by Campbell R. Harvey, associate professor of finance at Fuqua, to the Committee on Ways and Means of the U.S. House of Representatives.

Today's adjustable-rate mortgages are much cheaper than their fixed-rate counterparts—more than 2 percent cheaper. With today's interest rate environment, the U.S. Treasury should supplement its bond offerings with new adjustable-rate—or floating-
rate—bonds. The interest cost of these bonds is sharply lower than fixed-rate coupon bonds.

In addition to reducing the cost of servicing the government's debt, this strategy would reduce long-term interest rates. It would relieve some of the burden on the long-maturity, fixed-coupon bonds. Reducing the supply of the fixed-coupon bonds would increase prices and decrease long-term yields. Another 1 percent reduction in long-term interest rates should help spur spending, construction and capital expenditures.

This idea is a proven winner in the corporate world. In the Eurobond market, there is a large supply (over $100 billion) of floating-rate corporate bonds. The coupon adjusts according to a formula based on interest rates on Certificates of Deposit (in U.S. dollars) in London banks. Investment banks also earn profits by purchasing U.S. Treasuries and transforming them into floating-rate bonds. The Treasury could easily bypass the middle-person and issue their own floating rate bonds.

Indeed, we have seen long-term rates drop almost a full percentage point in the last six months. This is encouraging. However, long-term interest rates still are almost 4 percent higher than short-term rates. This huge spread is virtually unprecedented over the past 35 years.

There are a number of forces that affect long-term interest rates. Two of the most important forces are the supply of bonds and the market expectations of long-term inflation.

As a result, one way to lower long-term rates is to reduce the immense burden of long-term bonds in the market. As the supply is reduced, bond prices rise and interest rates fall. A reduction in the deficit will lessen the pressure on the long-term bond market and reduce rates. Another option is to shorten the maturity structure of the bond offerings, i.e. offer more short-term debt and less long-term debt. This would decrease long-term rates and increase short-term rates.

**Long-term rates**

The overwhelming economic goal is to accelerate job creation and economic growth without sparking inflation. While considerable previous attention has focused on lowering short-term rates, most of the economic kick comes from long-term rates. Capital investment, consumer credit and mortgage rates all are linked closely to long-term rates—not short-term rates. Any plan that reduces long-term rates will increase investment, spending, housing starts and employment.
The floating-rate bond scenario is another possibility for success, but it has received no attention. Currently, the Treasury is issuing 30-year bonds with an effective yield of about 6.8 percent. If the Treasury issued a 30-year floating-rate bond (with a coupon rate that changes as short-term interest rates change), it could save at least 300 basis points (3 percent) in interest servicing costs in the first year. With an estimated $1.41 trillion of debt hitting the market in 1993, the interest savings would be impressive if some floating-rate debt was issued.

The introduction of floating-rate bonds would diminish the supply of the long-term fixed rate bonds and hence long-term interest rates will decrease. Lower rates reduce the interest servicing cost of new long-term, fixed-rate debt. In addition, the lower long-term rates provide an environment that encourages capital investment, spending and construction.

### Coupon adjustment

I envision the floating coupon being determined by the weighted average of the 26-week Treasury bill auction yields over the previous six months. Given that this market is extremely liquid, there is little likelihood that any one investor could manipulate the coupon rate. The weighting ensures that smaller auctions receive a lesser weight in determining the coupon rate.

This coupon-setting strategy also dominates the inflation-indexed coupon. Last year there was some discussion of creating a “real bond.” The bond is real in the sense that the coupon increases as inflation increases and this allows investors to hedge against price inflation.

Unfortunately, the inflation rate is imprecisely measured and usually five weeks stale when it is released. As a result, a lot of people know the numbers before the official release date. In addition, the index numbers are subject to revision. Finally, the items that we include in the consumer’s basket could change over time.

Resetting the coupon based on the Treasury bill auction bypasses all of the inflation-related difficulties. It creates a bond that has real qualities: as inflation increases so will short-term interest rates and hence the coupon rises on the floating-rate bond. Investors can use the floating-rate bond as an inflation hedge. In addition, the information on the coupon set is easily calculated and readily available to all investors.

### Expected inflation

The other important factor that determines long-term interest rates is expected inflation. Indeed, the present yield curve (difference between long-term rates and short-term rates) suggests that investors expect increased inflation in the future. The fact that the Treasury is offering 30-year bonds at 6.8 percent suggests that the Treasury agrees with the market.

If the Treasury really believes that inflation is going to be lower in the long term, then it does not make sense to finance at 6.8 percent. If the Treasury believes that the market is attaching an unreasonably high inflation premium to the long-term bonds, then it should pursue a strategy of shorter-maturity financing—or floating-rate bonds.

Adopting a policy of floating-rate bonds or shortening the maturity structure, sends a strong signal to the market that investors’ long-term inflation expectations are too high. I believe that initiating this policy would cause the market to revise their long-term inflation expectations and reduce long-term interest rates by another 1 percent—irrespective of the supply effect previously discussed.

There is another important angle on the floating-rate and shorter maturity financing. It provides the incentives for the government to be policy consistent. That is, a deviation from the policy of low inflation will be very costly. Higher inflation immediately raises short-term rates and, consequently, the Treasury must pay more in financing costs. Investors like these types of policies. There are strong built-in incentives to keep inflation under control. These are the types of policies that cause investors to revise their expectations of long-term inflation downward, thereby reducing long-term interest rates.

Finally, it is an automatic stabilizing policy. During the last five recessions, the yield curve has been positively sloping (short-term rates lower than long-term rates). The interest servicing cost on floating-rate debt is cheapest exactly when the government needs extra funds for stimulative expenditures.

### Operation Twist

The floating-rate bond offers a number of advantages over the strategy of shortening the maturity structure of the Federal debt, also known as Operation Twist.

Operation Twist refers to the strategy followed by the Federal Reserve in 1961. The Fed purchased long-term bonds and sold short-maturity securities. This reduced the supply of the long-term bonds and thereby raised their prices. Higher prices for the long-term bonds meant lower yields. The opposite happened with the short-term securities.

Operation Twist was designed to twist the yield curve. The objectives were to decrease long-term rates, to support the dollar and to provide the conditions for accelerated economic growth.

Of course, if the Federal Reserve mounted the same strategy today, it would surely fail. With over $4 trillion in Treasury debt outstanding, the Federal Reserve is not a large enough player in the market to substantially impact the yield curve. However, it is possible that the Treasury could successfully initiate a modern-day Operation Twist.

Managing the maturity structure will have a significant effect on the shape of the yield curve. Last summer, when long-term rates were more than 4 percent
above short-term rates. I suggested that the Treasury consider a shift in the maturity structure. By decreasing the reliance on (but not eliminating) the long-term bonds and replacing them with short-term bonds, I estimated that the Treasury could save over $5 billion in interest servicing costs.

The downside

There is an important downside to Operation Twist. A shortening of the maturity structure will likely increase short-term rates. Increased supply of shorter maturity debt will drive prices down and yields upward.

Another disadvantage is that the Treasury must continually go to the market. That is, if a 30-year bond is replaced with 90-day bills, the Treasury must issue those bills 120 times. The Treasury bears the cost of going to the market each time. In addition, the investor must bear the transactions costs of rolling over the Treasury bills.

One possible solution is to combine a shortening of the maturity structure with some floating-rate bonds. The floating-rate bonds reduce long-term rates because the supply of long-term bonds is decreased. It is not clear that there would be the same upward pressure on short-term rates.

With floating rate bonds, you are not replacing long-term bonds with Treasury bills. The amount of Treasury bills could remain constant. However, some of the current Treasury bill investors might be drawn to the floating-rate bonds. This might provide some mild upward pressure on short-term rates.

Benefits of change

The changes in the Treasury’s financing strategy that I am proposing should lead to a further reduction in long-term interest rates. The introduction of floating-rate coupon bonds will reduce the burden placed on the long-term fixed coupon bonds and hence reduce the long-term rates. Given that consumer spending, construction and capital expenditures are linked to long-term interest rates, changes in the Treasury’s financing strategy will have a stimulative effect on economic growth. In addition, the strategy reduces the government’s interest servicing costs.

Of course, variable-rate debt could be expensive if interest rates go up. However, short-term interest rates have to rise dramatically to meet today’s long-term rates. In addition, my research on the business cycle and the yield curve shows that the interest servicing costs will be the lowest in recessions and highest in recoveries. As a result, the policy stabilizes or reduces the volatility of the business cycle.

Batterymarch honors Harvey

Associate professor Campbell R. Harvey has received the prestigious 1993 Batterymarch Fellowship. The award honors his pioneering research in finance and investment theory. It comes with a $75,000 stipend to support Harvey’s research initiatives for a one-year period beginning in July.

Established in 1969, Batterymarch has $5.7 billion in assets under management. Investing in 42 countries, the firm manages U.S., international and emerging markets portfolios. Dean LeBaron, the founder of Boston-based Batterymarch Financial Management, established the award in 1989 to demonstrate the firm’s appreciation of the academic world. The selection committee included LeBaron, Deborah H. Miller of Batterymarch and former Batterymarch Fellows.