# *Business Cycle Variation in the Risk-Return Trade-off*

*- Supplementary Online Appendix -*

*NOT FOR PUBLICATION*

## 1. Recession Dates

Table 1 reports the recession dates obtained by different mechanical rules, along with NBER recession dates.

Figure 1 reports the net flows into US equity and bond mutual funds.

[Figure 1 about here.]

Figure 2 reports the occurrence of the word "recession" in *Le Monde* and *Le Figaro*, along with OECD turning point dates. Figure 3 reports the occurrence of the word "recession" in the newspaper *The Times*, along with OECD turning point dates. For the UK, the 1988 and 2004 recessions do not produce spikes in the occurrence of the word "recession," but the other recessions do. For France, the 1995 and 1998 OECD turning points might have been difficult to spot in the newspapers, but the 2000 and 2008 recessions show up very clearly.

[Figure 2 about here.]

[Figure 3 about here.]

Google Insights for Search analyzes a portion of Google web searches to compute how many searches have been done for the word "recession," relative to the total number of searches done on Google over time. The analysis indicates the likelihood of a random user to search for a particular search term from a certain location at a certain time. Google Insights eliminates repeated queries from a single user over a short period of time, so that the level of interest is not artificially impacted by these type of queries. The numbers reported do not represent absolute search volume numbers, because the data are normalized and presented on a scale from 0 to 100. Each point on the graph is divided by the highest point, or 100. When there are not enough data, 0 is shown. Figure 4 reports the numbers of Google searches of the word "recession" in each of the G7 countries.

[Figure 4 about here.]

"Recession" becomes a very likely research topic at the end of 2007 and start of 2008 in all G7 countries except Japan. Recall that the NBER announced on December 1st, 2008 that the Great Recession started in December 2007. Likewise, the OECD considers that the turning point of the U.S. economy occurred in February 2008. For the other countries, the OECD peaks range from August 2007 (for Canada) to May 2008 (for Italy and Japan). Except for Japan, these turning points correspond to clear spikes in the likelihood of the "recession" queries.

## 2. Robustness Checks

### *2.1. Quarterly Frequency*

Tables 2 and 3 report results for one-quarter and one-year U.S. equity excess returns at quarterly frequency on three samples (1854.1–2009.12, 1854.1–1944.12, and 1945.1–2009.12).

[Table 1 about here.]

[Table 2 about here.]

### *2.2. U.S. Daily Equity Return Volatility*

Table 4 reports conditional moments of U.S. equity return volatility over two samples, 1925.11–2009.12 and 1945.1–2009.12.

[Table 3 about here.]

### *2.3. Foreign Markets*

Tables 5 and 6 report summary statistics on equity excess returns in G7 countries. Let us assume that in expansions (recessions) the investor buys the stock market index in the $n$-th three-month period after the trough (peak) and sells three months later. Tables 7 and 8 report similar summary statistics for one-year investments: the investor buys the stock market index in the $n$-th three-month period after the trough (peak) and sells one year later. Total return series on equity and bills are from the Global Financial Data website. These returns are defined in foreign currencies. The sample is 1955.1–2010.8.

Those two sets of tables provide, again, a clear indication of the cyclical behavior of expected returns conditional on being in an expansion or in a recession. The left panels of these tables look at expansions; the right panels look at recessions. We focus on one-year excess returns, as reported in Tables 7 and 8.

In all equity markets, excess returns and Sharpe ratios are higher during recessions than expansions. Differences in Sharpe ratios are large at the start of these episodes then decline progressively. Four quarters later, the Sharpe ratios are no different after recessions or expansions. Sharpe ratios increase during recessions and decrease during expansions in all G7 countries. Changes in Sharpe ratios are large: from their lowest to their highest values during recessions, ranging from -0.2 to 0.4 in Canada, -0.3 to 0.7 in France, -0.5 to 0.1 in Germany, -0.2 to 1.2 in the U.S., -0.1 to 0.4 in Italy, -0.4 to 0.3 in the U.K., and -0.6 to 0.9 in Japan. On average, Sharpe ratios increase from -0.3 to 0.6 between peaks and four quarters after peaks. During expansions, changes in Sharpe ratios are smaller but still sizable: the average Sharpe ratio decreases from 1.0 to 0.2 between one and four quarters after troughs. Standard errors on Sharpe ratios (obtained by bootstrapping) are around 0.3. As a result, variations in Sharpe ratios along business cycles amount to two to four times the uncertainty around their values. These variations are thus often economically large and statistically significant.

[Table 4 about here.]

[Table 5 about here.]

[Table 6 about here.]

[Table 7 about here.]

## 3. Dividend Yield

Figure 5 plots the log dividend yield (full line) and the adjusted log dividend yield (dashed line).

[Figure 5 about here.]

## 4. Simulation

A toy model needs recession and expansion periods, as well as equity returns, in order to reproduce the empirical procedure of the paper. Let us define recessions as two consecutive quarters of negative consumption growth. Assume that expansions correspond to two consecutive quarters of positive consumption growth. Peaks (troughs) are defined as the quarters preceding recessions (expansions).

How do returns co-move with consumption growth? We consider three cases: (1) consumption growth shocks are *i.i.d.* and returns are *perfectly* correlated to those shocks, (2) consumption growth shocks are *i.i.d.* and returns are *imperfectly* correlated to those shocks, and (iii) consumption growth is persistent and returns are *imperfectly* correlated to consumption growth.

In the first case, consumption growth and returns correspond to:

$$\begin{aligned} \Delta c_{t+1} &= \mu_{\Delta c} + \sigma_{\Delta c}\epsilon_{t+1}, \\ R_{t+1} &= \mu_R + \alpha\sigma_{\Delta c}\epsilon_{t+1}, \end{aligned}$$

where $\epsilon$ are *i.i.d.* random shocks. We pick $\mu_{\Delta c} = 0.5\%$, $\mu_R = 2\%$, $\sigma_{\Delta c} = 1\%$, and $\alpha = 8$. Here, consumption growth and returns are driven by the exact same shocks. Their correlation is thus perfect. The mean annual return is 8%, with an annual volatility of 16%. For consumption growth, the mean and standard deviation are both equal to 2%. There is no persistence in consumption growth or returns.

In the second case, the correlation between consumption and returns is decreased to the empirically-relevant levels by introducing new shocks:

$$\begin{aligned} \Delta c_{t+1} &= \mu_{\Delta c} + \sigma_{\Delta c}\epsilon_{t+1}, \\ R_{t+1} &= \mu_R + \alpha\sigma_{\Delta c}\epsilon_{t+1} + \sigma_R\nu_{t+1}, \end{aligned}$$

where $\epsilon$ and $\nu$ are *i.i.d.*, uncorrelated random shocks, $\alpha = 0.8$, and $\sigma_R = 8\%$. The first two moments of consumption growth and returns are the same as in the previous case. But their correlation is now equal to 0.1, as it is in the data.

In the third case, the consumption and return processes are persistent:

$$\begin{aligned} \Delta c_{t+1} &= \mu_{\Delta c}(1-\rho_{\Delta c}) + \rho_{\Delta c}\Delta c_{t+1} + \sqrt{1-\rho_{\Delta c}^2}\sigma_{\Delta c}\epsilon_{t+1}, \\ R_{t+1} &= \mu_R + \alpha(\Delta c_{t+1} - \mu_{\Delta c}) + \epsilon_{t+1} + \sigma_R \nu_{t+1}. \end{aligned}$$

With $\alpha = 0.7$ and $\rho_{\Delta c} = 0.2$, the first two moments of consumption growth and returns are as before, but their correlation is now equal to 0.8. The novelty is in the persistence of consumption growth: its autocorrelation is now 0.2, while returns are still close to *i.i.d.*

Table 9 reports, for each simulation case, the mean, standard deviation, and first-order autocorrelation of returns (first column) and consumption growth (second column). The third column reports the correlation between consumption growth and returns. Means and standard deviations are annualized (multiplied by 4 and 2 respectively). We first simulate the consumption and return processes, then determine recessions and expansions using the simple two-quarter rule. Finally, we run the same experiment and the same code as in our paper on these simulated series in order to compare annual returns obtained on investment strategies that start $n$ quarters following peaks and troughs ($n = 0, 1, .., 5$, as in the paper).

The simulation window has 100,000 periods. All business cycles are taken into account to compute our point estimates of conditional returns. But the table reports two sets of standard errors: either using the whole sample, or a sample of "only" 300 business cycles (i.e., still ten times more than in the data).

We review these three simulations. When consumption growth shocks and returns are perfectly correlated, the look-ahead bias is clearly a concern. The first panel of Figure 6 shows the mean returns after peaks and troughs, along with two-standard error confidence intervals. The horizontal line corresponds to the unconditional mean return. Since the recession date depends on two negative growth rates and since these negative growth rates imply negative returns, the procedure leads to two negative returns after peaks and two positive returns after troughs.

This result is graphically striking and seems to invalidate the methodology put forth in the paper. But it relies on an implausibly high correlation between returns and consumption growth. Let us turn now to the second case. Here, returns exhibit the same mean and total

volatility as before, but following the huge literature on the equity premium, the correlation between returns and consumption growth is low, around 10% as in the data. As the second panel of Figure 6 shows, this assumption is key. Now, the methodology implies that the first two returns following peaks (troughs) are negative (positive), although they are no longer significantly different from the unconditional mean return. The following returns are, of course, not different from their mean. Actually, even with 300 business cycles, this procedure would not lead to returns that are – at the onset of recessions or expansions or at any point of the business cycle – significantly different from their unconditional average. Note that this result is obtained in a simulation that replicates the mean, standard deviation, and cross-correlation of consumption growth and equity returns. It is thus not true that a simple two-quarter rule and its implied look-ahead bias invalidate the methodology in the paper.

The third simulation assumes that consumption growth is persistent, not $i.i.d.$ Such persistence might worsen the look-ahead bias. The consumption growth's autocorrelation is equal to 0.2, as reported in Campbell and Beeler (2009) for quarterly data over the 1947II–2007III period. In the simulation, presented in the third panel of Figure 6, the first two returns following peaks are below the unconditional mean. The first two returns following troughs are higher than the mean. But no return is statistically different from the mean. Recall that we are assuming here that one can observe several orders of magnitude more recessions than in the data, in order to determine these conditional estimates and at least 300 cycles to determine the "small-sample" standard errors. In samples the size of our data set, standard errors would be much larger and point estimates would vary a lot from one sample to the next. If our results were driven by our methodology, it would be extremely surprising that any clear pattern emerges from actual data.

[Figure 6 about here.]

[Table 8 about here.]

Table 1: Recession Dates

The recession dates in this table are obtained by different mechanical rules, along with NBER recession dates (first column). The second and third columns (denoted Prob (1) and Prob (2)) correspond to recession dates determined using two simple rules: (1) a recession occurs when the recession probability is above 80% for three consecutive months, or (2) a recession occurs when the recession probability increases above 60% and lasts until the probability decreases below 30%. The fourth column (denoted CFNAI) corresponds to recessions dates determined with the Chicago Fed index: a recession starts when the index falls below -0.7 and ends when it increases above 0.2. The fifth column (denoted Prob and CFNAI) combines the information in the recession probabilities with the Chicago Fed index: a recession starts when the index is less than -0.7 and the probability above 60%; the recession ends when the index is above 0.2 and the probability below 30%.

| NBER | Prob (1) | Prob (2) | CFNAI | Prob and CFNAI |
|---|---|---|---|---|
| Dec-1969 – Nov-1970 | Oct-1970 – Oct-1970 | Nov-1969 – Nov-1970 | Jan-1970 – Dec-1970 | May-1970 – Nov-1970 |
| | | | Dec-1970 – Jan-1971 | |
| Nov-1973 – Mar-1975 | Oct-1974 – Mar-1975 | Jun-1974 – Apr-1975 | Feb-1974 – Jul-1975 | Jun-1974 – Apr-1975 |
| Jan-1980 – Jul-1980 | May-1980 – Jun-1980 | Mar-1980 – Jul-1980 | Mar-1980 – Aug-1980 | |
| | | | Aug-1980 – Sep-1980 | |
| Jul-1981 – Nov-1982 | Nov-1981 – Jan-1982 | Sep-1981 – Dec-1982 | Sep-1981 – Feb-1983 | Jan-1982 – Dec-1982 |
| | May-1982 – Oct-1982 | | | |
| Jul-1990 – Mar-1991 | | Oct-1990 – Mar-1991 | Jul-1989 – Oct-1993 | Dec-1990 – Mar-1991 |
| Mar-2001 – Nov-2001 | | Feb-2001 – Nov-2001 | Dec-2000 – Oct-2003 | Apr-2001 – Nov-2001 |
| Dec-2007 – Jun-2009 | Jun-2008 – May-2009 | Feb-2008 – Jun-2009 | Feb-2008 – Apr-2010 | Jun-2008 – Jun-2009 |

Table 2: One-Quarter Realized Equity Excess Returns Across Business Cycles: Quarterly Data

The table report moments of excess returns across business cycles: it presents the average stock market excess returns in each quarter following the NBER peaks (left panel) and troughs (right panel). Total return indices are compiled by CRSP. Risk-free rates correspond to returns on Treasury bill indices from Global Financial Data. Data are quarterly. The samples are 1925.IV – 2009.IV, 1945.I – 2009.IV, and 1854.I – 2009.IV. The table reports average excess returns (annualized, i.e., multiplied by 4), standard deviations (not annualized), and Sharpe ratios (annualized, i.e., multiplied by 2). Standard errors are obtained by bootstrapping.

| | **Recessions** | | | | | **Expansions** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *n − th quarter after peak* | | | | | *n − th quarter after trough* | | | | |
| | 1st | 2nd | 3rd | 4th | 5th | 1st | 2nd | 3rd | 4th | 5th |
| **Panel I: 1925.IV – 2009.IV** | | | | | | | | | | |
| Mean | −5.22 | −0.10 | 12.57 | 18.03 | 12.27 | 27.42 | 1.79 | 6.70 | 7.60 | 1.22 |
| s.e | [8.43] | [9.23] | [9.52] | [8.27] | [8.19] | [8.60] | [9.49] | [9.49] | [8.10] | [8.12] |
| Std. Dev. | 11.54 | 13.12 | 13.25 | 11.81 | 11.15 | 17.83 | 9.18 | 9.24 | 8.79 | 7.79 |
| s.e | [1.36] | [1.18] | [2.03] | [1.93] | [1.29] | [1.33] | [1.34] | [2.00] | [1.88] | [1.26] |
| Sharpe Ratio | −0.23 | −0.00 | 0.47 | 0.76 | 0.55 | 0.77 | 0.10 | 0.36 | 0.43 | 0.08 |
| s.e | [0.37] | [0.37] | [0.44] | [0.40] | [0.43] | [0.38] | [0.40] | [0.42] | [0.41] | [0.43] |
| **Panel II: 1945.I – 2009.IV** | | | | | | | | | | |
| Mean | −3.68 | 2.59 | 12.73 | 16.74 | 15.99 | 16.18 | 2.28 | 4.12 | 2.13 | −0.84 |
| s.e | [8.62] | [10.66] | [9.54] | [8.73] | [9.31] | [8.03] | [10.37] | [9.37] | [8.47] | [9.07] |
| Std. Dev. | 9.94 | 12.68 | 11.25 | 10.27 | 11.06 | 7.46 | 9.17 | 9.08 | 8.28 | 7.44 |
| s.e | [1.19] | [1.61] | [2.25] | [2.00] | [1.36] | [1.23] | [1.52] | [2.25] | [1.86] | [1.41] |
| Sharpe Ratio | −0.18 | 0.10 | 0.57 | 0.81 | 0.72 | 1.08 | 0.12 | 0.23 | 0.13 | −0.06 |
| s.e | [0.46] | [0.47] | [0.64] | [0.63] | [0.50] | [0.43] | [0.45] | [0.61] | [0.60] | [0.50] |
| **Panel III: 1854.I – 2009.IV** | | | | | | | | | | |
| Mean | −15.54 | −7.49 | 6.28 | 13.11 | 9.93 | 24.19 | 7.48 | 9.16 | 9.40 | 6.30 |
| s.e | [6.94] | [8.59] | [5.20] | [4.30] | [4.13] | [7.35] | [7.59] | [5.21] | [4.76] | [4.04] |
| Std. Dev. | 15.36 | 16.18 | 10.53 | 8.93 | 8.72 | 12.27 | 7.69 | 7.58 | 7.28 | 7.49 |
| s.e | [4.34] | [4.53] | [1.29] | [1.15] | [0.79] | [4.46] | [4.58] | [1.28] | [1.25] | [0.74] |
| Sharpe Ratio | −0.51 | −0.23 | 0.30 | 0.73 | 0.57 | 0.99 | 0.49 | 0.60 | 0.65 | 0.42 |
| s.e | [0.18] | [0.24] | [0.25] | [0.25] | [0.27] | [0.19] | [0.22] | [0.26] | [0.27] | [0.25] |

Table 3: One-Year Realized Equity Excess Returns Across Business Cycles: Quarterly Data

The table reports moments of excess returns obtained by the following investment strategy: in expansions (recessions), the investor buys the stock market index in the $n$-th quarter ($n = 1, 2, ..., 5$) after the NBER trough (peak) and sells one year later. Total return indices are compiled by CRSP. Risk-free rates correspond to returns on Treasury bill indices from Global Financial Data. Data are quarterly. The samples are 1925.IV – 2009.IV, 1945.I – 2009.IV, and 1854.I – 2009.IV. The table reports average excess returns (annualized, i.e., multiplied by 4), standard deviations (not annualized), and Sharpe ratios (annualized, i.e., multiplied by 2). Standard errors are obtained by bootstrapping.

| | **Recessions** | | | | | | **Expansions** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Buy in $n-th$ quarter after peak and sell one year later* | | | | | | *Buy in $n-th$ quarter after trough and sell one year later* | | | | | |
| | 1st | 2nd | 3rd | 4th | 5th | Average | 1st | 2nd | 3rd | 4th | 5th | Average |
| **Panel I: 1925.IV – 2009.IV** | | | | | | | | | | | | |
| Mean | 3.67 | 8.97 | 12.42 | 12.92 | 5.41 | **8.68** | 17.06 | 4.70 | 3.96 | 8.70 | 3.37 | **7.56** |
| s.e | [6.17] | [6.44] | [6.07] | [5.59] | [5.63] | [2.81] | [6.65] | [6.69] | [6.38] | [5.59] | [5.40] | [2.45] |
| Std. Dev. | 12.52 | 12.58 | 12.14 | 11.05 | 11.00 | 11.84 | 14.31 | 8.93 | 8.50 | 7.53 | 8.34 | 9.84 |
| s.e | [1.29] | [1.15] | [1.20] | [1.18] | [1.17] | [0.54] | [1.22] | [1.23] | [1.16] | [1.12] | [1.15] | [1.37] |
| Sharpe Ratio | 0.15 | 0.36 | 0.51 | 0.58 | 0.25 | **0.37** | 0.60 | 0.26 | 0.23 | 0.58 | 0.20 | **0.38** |
| s.e | [0.26] | [0.27] | [0.28] | [0.29] | [0.29] | [0.13] | [0.27] | [0.29] | [0.30] | [0.27] | [0.26] | [0.11] |
| **Panel II: 1945.I – 2009.IV** | | | | | | | | | | | | |
| Mean | 4.53 | 9.66 | 14.36 | 14.84 | 11.13 | **10.91** | 10.15 | 2.20 | 1.64 | 6.26 | 6.72 | **5.39** |
| s.e | [6.68] | [7.14] | [6.43] | [5.82] | [6.02] | [2.72] | [6.32] | [6.86] | [6.50] | [5.98] | [5.95] | [2.13] |
| Std. Dev. | 10.70 | 11.54 | 11.03 | 9.94 | 10.08 | 10.62 | 8.36 | 8.63 | 8.23 | 7.47 | 6.78 | 7.89 |
| s.e | [1.23] | [1.26] | [1.27] | [1.15] | [1.08] | [0.53] | [1.17] | [1.24] | [1.34] | [1.15] | [1.00] | [0.43] |
| Sharpe Ratio | 0.21 | 0.42 | 0.65 | 0.75 | 0.55 | **0.51** | 0.61 | 0.13 | 0.10 | 0.42 | 0.50 | **0.34** |
| s.e | [0.36] | [0.35] | [0.36] | [0.36] | [0.34] | [0.15] | [0.33] | [0.35] | [0.37] | [0.37] | [0.33] | [0.15] |
| **Panel III: 1854.I – 2009.IV** | | | | | | | | | | | | |
| Mean | −4.63 | 2.81 | 8.10 | 10.49 | 7.13 | **4.78** | 16.67 | 8.44 | 7.73 | 9.10 | 4.07 | **9.20** |
| s.e | [4.89] | [4.45] | [3.39] | [3.05] | [3.27] | [1.62] | [4.59] | [4.56] | [3.34] | [3.09] | [3.02] | [1.28] |
| Std. Dev. | 13.40 | 13.28 | 9.64 | 8.70 | 8.78 | 11.01 | 10.33 | 7.46 | 7.51 | 7.38 | 8.03 | 8.26 |
| s.e | [2.73] | [2.81] | [0.73] | [0.73] | [0.72] | [1.04] | [2.71] | [2.97] | [0.81] | [0.72] | [0.72] | [0.70] |
| Sharpe Ratio | −0.17 | 0.11 | 0.42 | 0.60 | 0.41 | **0.22** | 0.81 | 0.57 | 0.51 | 0.62 | 0.25 | **0.56** |
| s.e | [0.17] | [0.20] | [0.18] | [0.19] | [0.21] | [0.08] | [0.16] | [0.20] | [0.18] | [0.19] | [0.19] | [0.08] |

Table 4: Robustness Checks: U.S. Daily Equity Return Volatility, Monthly Frequency

The table reports moments of excess returns obtained by the following investment strategy: in expansions (recessions), the investor buys the stock market index in the n-th three-month period (n = 1, 2, ..., 5) after the NBER trough (peak) and sells one year later. Total return indices are compiled by CRSP. Risk-free rates correspond to returns on Treasury bill indices from Global Financial Data. Equity volatility corresponds to the standard deviation of daily equity returns over each calendar month. The source of daily equity returns is CRSP. Daily values are available starting in 1925.12. Data are monthly. The samples are 1925.12–2009.12 and 1945.1–2009.12. The table reports average excess returns (annualized, i.e., multiplied by 12), standard deviations (multiplied by $\sqrt{256}$), and Sharpe ratios (annualized, i.e., multiplied by $12/\sqrt{256}$). Standard errors are obtained by bootstrapping.

| | **Recessions** | | | | | **Expansions** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Starting in $n-th$ 3-month period after peak* | | | | | *Starting in $n-th$ 3-month period after trough* | | | | |
| | 1st | 2nd | 3rd | 4th | 5th | 1st | 2nd | 3rd | 4th | 5th |
| **Panel I: 1925.12 – 2009.12** | | | | | | | | | | |
| Mean | 4.52 | 12.29 | 9.64 | 10.69 | 8.32 | 8.75 | 3.71 | 5.03 | 3.66 | 6.72 |
| s.e | [5.34] | [5.58] | [5.42] | [4.83] | [4.90] | [5.39] | [5.21] | [5.62] | [4.43] | [4.99] |
| Std. Dev. | 15.93 | 15.93 | 16.26 | 15.20 | 15.28 | 14.35 | 14.39 | 13.48 | 12.96 | 12.74 |
| s.e | [0.90] | [0.80] | [0.86] | [0.64] | [0.62] | [0.84] | [0.85] | [0.86] | [0.63] | [0.65] |
| Sharpe ratio | 0.28 | 0.77 | 0.59 | 0.70 | 0.54 | 0.61 | 0.26 | 0.37 | 0.28 | 0.53 |
| s.e | [0.34] | [0.36] | [0.34] | [0.33] | [0.32] | [0.35] | [0.31] | [0.32] | [0.34] | [0.36] |
| **Panel II: 1945.1 – 2009.12** | | | | | | | | | | |
| Mean | 7.53 | 14.13 | 11.45 | 12.96 | 10.49 | 6.74 | 2.53 | 1.89 | 5.59 | 8.67 |
| s.e | [4.87] | [5.33] | [5.52] | [4.36] | [4.64] | [5.07] | [5.18] | [5.15] | [4.39] | [4.47] |
| Std. Dev. | 14.78 | 15.19 | 15.54 | 14.28 | 14.09 | 12.44 | 12.89 | 12.47 | 11.48 | 10.78 |
| s.e | [0.87] | [0.98] | [0.97] | [0.73] | [0.63] | [0.90] | [0.96] | [1.04] | [0.72] | [0.63] |
| Sharpe ratio | 0.51 | 0.93 | 0.74 | 0.91 | 0.74 | 0.54 | 0.20 | 0.15 | 0.49 | 0.80 |
| s.e | [0.36] | [0.36] | [0.35] | [0.33] | [0.33] | [0.38] | [0.34] | [0.36] | [0.34] | [0.37] |

Table 5: One-Quarter Realized Equity Excess Returns Across Business Cycles: G7 Countries, Part I

In expansions (recessions), the investor buys the stock market index in the $n$-th three-month period after the OECD trough (peak) and sells three months later. This table reports moments of excess returns on this investment strategy applied to the total return indices compiled by Global Financial Data. Risk-free rates correspond to returns on Treasury bill indices (also from Global Financial Data). The sample comprises 1958.1–2010.8. The table reports the average excess return on this investment strategy (annualized, i.e., multiplied by 12), the standard deviation (not annualized) and the Sharpe ratio (annualized, i.e., multiplied by $\sqrt{12}$). Standard errors are obtained by bootstrapping.

| | **Recessions** | | | | | **Expansions** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Buy in $n-th$ 3-month period after peak* | | | | | *Buy in $n-th$ 3-month period after trough* | | | | |
| | 1st | 2nd | 3rd | 4th | 5th | 1st | 2nd | 3rd | 4th | 5th |
| **Canada** | | | | | | | | | | |
| Mean | −7.74 | −4.89 | −2.13 | 8.72 | 3.52 | 16.81 | 13.51 | 10.32 | −1.61 | −7.67 |
| s.e | [8.90] | [9.39] | [10.03] | [8.48] | [9.54] | [8.69] | [9.02] | [9.99] | [8.63] | [9.98] |
| Std. Dev. | 5.10 | 5.23 | 5.75 | 4.83 | 5.70 | 3.28 | 3.64 | 3.24 | 4.96 | 5.24 |
| s.e | [0.48] | [0.53] | [0.78] | [0.61] | [0.83] | [0.48] | [0.52] | [0.76] | [0.57] | [0.83] |
| Sharpe Ratio | −0.44 | −0.27 | −0.11 | 0.52 | 0.18 | 1.48 | 1.07 | 0.92 | −0.09 | −0.42 |
| s.e | [0.51] | [0.52] | [0.51] | [0.53] | [0.54] | [0.49] | [0.51] | [0.52] | [0.53] | [0.53] |
| **France** | | | | | | | | | | |
| Mean | −10.74 | −21.00 | −5.07 | 5.90 | 23.64 | 19.09 | 18.83 | 10.21 | 2.92 | 5.77 |
| s.e | [9.21] | [10.01] | [10.51] | [8.26] | [8.40] | [8.04] | [10.13] | [10.04] | [8.29] | [8.45] |
| Std. Dev. | 5.44 | 6.27 | 6.26 | 5.14 | 5.26 | 4.60 | 4.96 | 5.67 | 6.11 | 5.36 |
| s.e | [0.45] | [0.57] | [0.83] | [0.64] | [0.74] | [0.46] | [0.57] | [0.82] | [0.61] | [0.79] |
| Sharpe Ratio | −0.57 | −0.97 | −0.23 | 0.33 | 1.30 | 1.20 | 1.10 | 0.52 | 0.14 | 0.31 |
| s.e | [0.46] | [0.45] | [0.50] | [0.46] | [0.41] | [0.45] | [0.46] | [0.48] | [0.45] | [0.40] |
| **Germany** | | | | | | | | | | |
| Mean | −5.55 | −7.81 | −23.64 | 4.01 | 3.07 | 32.59 | 36.15 | 12.02 | 18.56 | 9.59 |
| s.e | [8.66] | [8.94] | [8.95] | [9.20] | [7.86] | [9.24] | [8.75] | [9.10] | [9.24] | [7.56] |
| Std. Dev. | 5.15 | 5.03 | 5.23 | 5.38 | 4.37 | 4.85 | 4.55 | 3.96 | 4.22 | 3.62 |
| s.e | [0.53] | [0.59] | [0.61] | [0.72] | [0.72] | [0.52] | [0.60] | [0.58] | [0.69] | [0.76] |
| Sharpe Ratio | −0.31 | −0.45 | −1.31 | 0.22 | 0.20 | 1.94 | 2.30 | 0.88 | 1.27 | 0.76 |
| s.e | [0.52] | [0.48] | [0.47] | [0.50] | [0.50] | [0.50] | [0.48] | [0.46] | [0.49] | [0.50] |
| **U.S.** | | | | | | | | | | |
| Mean | −2.79 | 0.07 | −9.61 | −2.64 | 16.71 | 17.23 | 10.65 | 8.71 | 4.65 | −5.27 |
| s.e | [7.29] | [6.42] | [8.49] | [9.24] | [7.91] | [7.38] | [6.14] | [8.51] | [9.26] | [7.63] |
| Std. Dev. | 4.60 | 4.07 | 5.45 | 5.89 | 5.03 | 3.27 | 3.86 | 4.16 | 4.08 | 4.85 |
| s.e | [0.42] | [0.33] | [0.52] | [0.53] | [0.54] | [0.40] | [0.31] | [0.58] | [0.56] | [0.54] |
| Sharpe Ratio | −0.18 | 0.00 | −0.51 | −0.13 | 0.96 | 1.52 | 0.80 | 0.60 | 0.33 | −0.31 |
| s.e | [0.46] | [0.45] | [0.43] | [0.43] | [0.46] | [0.42] | [0.45] | [0.44] | [0.43] | [0.48] |

Table 6: One-Quarter Realized Equity Excess Returns Across Business Cycles: G7 Countries, Part II

In expansions (recessions), the investor buys the stock market index in the $n$-th three-month period after the OECD trough (peak) and sells three months later. This table reports moments of excess returns on this investment strategy applied to the total return indices compiled by Global Financial Data. Risk-free rates correspond to returns on Treasury bill indices (also from Global Financial Data). The sample comprises 1958.1–2010.8. The table reports the average excess return on this investment strategy (annualized, i.e., multiplied by 12), the standard deviation (not annualized), and the Sharpe ratio (annualized, i.e., multiplied by $\sqrt{12}$). Standard errors are obtained by bootstrapping.

| | **Recessions** | | | | | **Expansions** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Buy in $n-th$ 3-month period after peak* | | | | | *Buy in $n-th$ 3-month period after trough* | | | | |
| | 1st | 2nd | 3rd | 4th | 5th | 1st | 2nd | 3rd | 4th | 5th |
| **Italy** | | | | | | | | | | |
| Mean | 1.57 | 2.77 | −12.18 | −12.65 | 22.02 | 12.15 | 22.14 | 18.45 | 8.53 | 6.15 |
| s.e | [8.74] | [11.87] | [13.97] | [14.15] | [11.55] | [8.12] | [11.34] | [14.72] | [14.19] | [11.33] |
| Std. Dev. | 5.01 | 7.00 | 8.65 | 8.53 | 6.96 | 5.59 | 6.17 | 7.05 | 6.47 | 5.41 |
| s.e | [0.42] | [0.81] | [1.04] | [0.86] | [0.71] | [0.43] | [0.79] | [1.08] | [0.90] | [0.67] |
| Sharpe Ratio | 0.09 | 0.11 | −0.41 | −0.43 | 0.91 | 0.63 | 1.04 | 0.76 | 0.38 | 0.33 |
| s.e | [0.49] | [0.48] | [0.52] | [0.51] | [0.48] | [0.48] | [0.48] | [0.52] | [0.52] | [0.45][ |
| **UK** | | | | | | | | | | |
| Mean | −4.90 | −8.43 | −9.70 | −10.33 | −2.51 | 29.25 | 20.06 | 7.42 | 11.16 | 0.81 |
| s.e | [7.29] | [8.13] | [11.35] | [11.34] | [9.25] | [7.30] | [8.35] | [10.61] | [10.89] | [9.79] |
| Std. Dev. | 3.99 | 4.50 | 6.00 | 6.09 | 5.16 | 3.88 | 3.82 | 4.66 | 4.89 | 4.91 |
| s.e | [0.58] | [0.59] | [0.95] | [0.86] | [0.66] | [0.58] | [0.58] | [0.96] | [0.93] | [0.61] |
| Sharpe Ratio | −0.35 | −0.54 | −0.47 | −0.49 | −0.14 | 2.18 | 1.52 | 0.46 | 0.66 | 0.05 |
| s.e | [0.61] | [0.52] | [0.53] | [0.51] | [0.54] | [0.56] | [0.53] | [0.51] | [0.55] | [0.59] |
| **Japan** | | | | | | | | | | |
| Mean | −0.58 | −19.01 | −6.15 | −9.48 | 23.15 | 32.52 | 23.45 | 5.51 | 16.82 | −2.03 |
| s.e | [9.37] | [7.78] | [8.57] | [9.01] | [9.27] | [9.05] | [7.84] | [8.68] | [8.88] | [8.82] |
| Std. Dev. | 5.44 | 4.59 | 5.06 | 5.20 | 5.43 | 4.45 | 4.72 | 5.11 | 4.12 | 4.35 |
| s.e | [0.62] | [0.76] | [0.77] | [0.62] | [0.60] | [0.61] | [0.79] | [0.77] | [0.58] | [0.61] |
| Sharpe Ratio | −0.03 | −1.20 | −0.35 | −0.53 | 1.23 | 2.11 | 1.43 | 0.31 | 1.18 | −0.13 |
| s.e | [0.50] | [0.43] | [0.48] | [0.50] | [0.52] | [0.51] | [0.41] | [0.49] | [0.52] | [0.54] |
| **Average** | | | | | | | | | | |
| Mean | −4.39 | −8.33 | −9.78 | −2.35 | 12.80 | 22.81 | 20.68 | 10.38 | 8.72 | 1.05 |
| s.e | [8.49] | [8.93] | [10.27] | [9.96] | [9.11] | [8.26] | [8.80] | [10.24] | [9.91] | [9.08] |
| Std. Dev. | 4.96 | 5.24 | 6.06 | 5.87 | 5.42 | 4.27 | 4.53 | 4.84 | 4.98 | 4.82 |
| s.e | [0.50] | [0.60] | [0.78] | [0.69] | [0.69] | [0.50] | [0.59] | [0.79] | [0.69] | [0.69] |
| Sharpe Ratio | −0.26 | −0.47 | −0.48 | −0.07 | 0.66 | 1.58 | 1.32 | 0.64 | 0.55 | 0.08 |
| s.e | [0.51] | [0.48] | [0.49] | [0.49] | [0.49] | [0.49] | [0.47] | [0.49] | [0.50] | [0.50] |

Table 7: One-Year Realized Equity Excess Returns Across Business Cycles: G7 Countries, Part I

In expansions (recessions), the investor buys the stock market index in the $n$-th three-month period after the OECD trough (peak) and sells one year later. This table reports moments of excess returns on this investment strategy applied to the total return indices compiled by Global Financial Data. Risk-free rates correspond to returns on Treasury bill indices (also from Global Financial Data). The sample comprises 1958.1–2010.8. The table reports the average excess return on this investment strategy (annualized, i.e., multiplied by 12), the standard deviation (not annualized) and the Sharpe ratio (annualized, i.e., multiplied by $\sqrt{12}$). Standard errors are obtained by bootstrapping.

| | **Recessions** | | | | | **Expansions** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Buy in $n-th$ 3-month period after peak* | | | | | *Buy in $n-th$ 3-month period after trough* | | | | |
| | 1st | 2nd | 3rd | 4th | 5th | 1st | 2nd | 3rd | 4th | 5th |
| **Canada** | | | | | | | | | | |
| Mean | −3.84 | −6.43 | −0.99 | 5.60 | 6.26 | 11.24 | 5.12 | 2.09 | −0.53 | −1.93 |
| s.e | [4.90] | [5.37] | [5.24] | [4.65] | [4.05] | [4.90] | [5.49] | [4.96] | [4.72] | [4.27] |
| Std. Dev. | 5.00 | 5.38 | 5.09 | 4.55 | 4.46 | 3.42 | 4.18 | 4.20 | 4.28 | 4.67 |
| s.e | [0.32] | [0.41] | [0.42] | [0.37] | [0.37] | [0.36] | [0.41] | [0.44] | [0.39] | [0.40] |
| Sharpe Ratio | −0.22 | −0.34 | −0.06 | 0.36 | 0.41 | 0.95 | 0.35 | 0.14 | −0.04 | −0.12 |
| s.e | [0.27] | [0.29] | [0.28] | [0.31] | [0.28] | [0.29] | [0.31] | [0.28] | [0.32] | [0.32] |
| **France** | | | | | | | | | | |
| Mean | −6.72 | −1.11 | 6.82 | 10.16 | 13.61 | 12.79 | 9.14 | 7.66 | 4.67 | 8.12 |
| s.e | [5.39] | [5.31] | [5.26] | [4.74] | [5.08] | [5.60] | [5.28] | [5.16] | [4.70] | [4.95] |
| Std. Dev. | 5.84 | 5.87 | 5.54 | 5.10 | 5.61 | 5.41 | 5.62 | 5.43 | 5.33 | 5.32 |
| s.e | [0.38] | [0.43] | [0.43] | [0.37] | [0.41] | [0.37] | [0.41] | [0.41] | [0.37] | [0.40] |
| Sharpe Ratio | −0.33 | −0.05 | 0.36 | 0.58 | 0.70 | 0.68 | 0.47 | 0.41 | 0.25 | 0.44 |
| s.e | [0.27] | [0.26] | [0.25] | [0.26] | [0.27] | [0.27] | [0.28] | [0.27] | [0.25] | [0.27] |
| **Germany** | | | | | | | | | | |
| Mean | −9.46 | −6.69 | −9.01 | −3.57 | 1.39 | 23.94 | 18.81 | 13.40 | 7.48 | 4.93 |
| s.e | [5.26] | [5.24] | [5.19] | [5.12] | [5.25] | [5.47] | [5.49] | [5.20] | [5.05] | [5.17] |
| Std. Dev. | 5.36 | 5.20 | 5.13 | 5.05 | 5.31 | 4.48 | 4.20 | 4.20 | 4.36 | 4.49 |
| s.e | [0.35] | [0.42] | [0.42] | [0.39] | [0.52] | [0.39] | [0.42] | [0.38] | [0.38] | [0.50] |
| Sharpe Ratio | −0.51 | −0.37 | −0.51 | −0.20 | 0.08 | 1.54 | 1.29 | 0.92 | 0.50 | 0.32 |
| s.e | [0.28] | [0.29] | [0.28] | [0.28] | [0.29] | [0.29] | [0.27] | [0.30] | [0.29] | [0.30] |
| **U.S.** | | | | | | | | | | |
| Mean | −4.25 | 0.29 | 6.48 | 13.14 | 16.83 | 12.00 | 5.37 | 4.43 | 2.03 | −1.09 |
| s.e | [4.39] | [4.66] | [4.49] | [4.34] | [3.88] | [4.37] | [4.56] | [4.79] | [4.04] | [3.62] |
| Std. Dev. | 4.91 | 5.11 | 5.15 | 4.76 | 4.23 | 3.76 | 4.31 | 4.35 | 4.27 | 4.21 |
| s.e | [0.27] | [0.30] | [0.31] | [0.29] | [0.26] | [0.26] | [0.31] | [0.32] | [0.31] | [0.26] |
| Sharpe Ratio | −0.25 | 0.02 | 0.36 | 0.80 | 1.15 | 0.92 | 0.36 | 0.29 | 0.14 | −0.07 |
| s.e | [0.25] | [0.25] | [0.28] | [0.29] | [0.26] | [0.24] | [0.27] | [0.26] | [0.28] | [0.28] |

Table 8: One-Year Realized Equity Excess Returns Across Business Cycles: G7 Countries, Part II

In expansions (recessions), the investor buys the stock market index in the $n$-th three-month period after the OECD trough (peak) and sells one year later. This table reports moments of excess returns on this investment strategy applied to the total return indices compiled by Global Financial Data. Risk-free rates correspond to returns on Treasury bill indices (also from Global Financial Data). The sample comprises 1958.1–2010.8. The table reports the average excess return on this investment strategy (annualized, i.e., multiplied by 12), the standard deviation (not annualized), and the Sharpe ratio (annualized, i.e., multiplied by $\sqrt{12}$). Standard errors are obtained by bootstrapping.

| | **Recessions** | | | | | **Expansions** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Buy in $n-th$ 3-month period after peak* | | | | | *Buy in $n-th$ 3-month period after trough* | | | | |
| | 1st | 2nd | 3rd | 4th | 5th | 1st | 2nd | 3rd | 4th | 5th |
| **Italy** | | | | | | | | | | |
| Mean | −2.85 | 1.65 | 4.76 | 0.84 | 10.34 | 17.59 | 18.16 | 13.31 | 8.30 | 5.21 |
| s.e | [7.15] | [7.37] | [7.71] | [6.52] | [6.86] | [6.85] | [7.21] | [7.66] | [7.10] | [6.70] |
| Std. Dev. | 7.08 | 7.50 | 7.62 | 7.34 | 7.13 | 6.65 | 6.51 | 6.40 | 5.91 | 5.50 |
| s.e | [0.55] | [0.53] | [0.51] | [0.49] | [0.45] | [0.52] | [0.52] | [0.57] | [0.47] | [0.49] |
| Sharpe Ratio | −0.12 | 0.06 | 0.18 | 0.03 | 0.42 | 0.76 | 0.81 | 0.60 | 0.41 | 0.27 |
| s.e | [0.29] | [0.27] | [0.27] | [0.28] | [0.27] | [0.27] | [0.27] | [0.28] | [0.26] | [0.27] |
| **UK** | | | | | | | | | | |
| Mean | −7.26 | −5.53 | −6.24 | 1.72 | 7.90 | 17.77 | 10.35 | 10.10 | 11.23 | 2.32 |
| s.e | [5.80] | [5.73] | [5.95] | [8.03] | [8.57] | [5.48] | [5.63] | [5.97] | [7.69] | [8.24] |
| Std. Dev. | 5.06 | 5.23 | 5.42 | 7.59 | 7.54 | 4.22 | 4.58 | 4.66 | 4.46 | 4.59 |
| s.e | [0.44] | [0.46] | [0.46] | [1.62] | [1.46] | [0.46] | [0.46] | [0.44] | [1.52] | [1.47] |
| Sharpe Ratio | −0.41 | −0.30 | −0.33 | 0.07 | 0.30 | 1.22 | 0.65 | 0.63 | 0.73 | 0.15 |
| s.e | [0.31] | [0.30] | [0.30] | [0.32] | [0.29] | [0.31] | [0.29] | [0.29] | [0.32] | [0.29] |
| **Japan** | | | | | | | | | | |
| Mean | −10.56 | −6.11 | 4.90 | 7.54 | 16.42 | 20.25 | 13.54 | 7.20 | 7.92 | 3.03 |
| s.e | [4.61] | [4.83] | [4.90] | [5.24] | [5.11] | [4.73] | [4.70] | [4.99] | [5.36] | [4.97] |
| Std. Dev. | 4.91 | 4.82 | 5.38 | 5.41 | 5.31 | 4.68 | 4.58 | 4.63 | 4.58 | 4.54 |
| s.e | [0.36] | [0.38] | [0.40] | [0.32] | [0.32] | [0.39] | [0.39] | [0.41] | [0.33] | [0.35] |
| Sharpe Ratio | −0.62 | −0.37 | 0.26 | 0.40 | 0.89 | 1.25 | 0.85 | 0.45 | 0.50 | 0.19 |
| s.e | [0.28] | [0.28] | [0.28] | [0.28] | [0.29] | [0.27] | [0.29] | [0.28] | [0.29] | [0.28] |
| **Average** | | | | | | | | | | |
| Mean | −6.42 | −3.42 | 0.96 | 5.06 | 10.39 | 16.51 | 11.50 | 8.31 | 5.87 | 2.94 |
| s.e | [5.36] | [5.50] | [5.54] | [5.52] | [5.54] | [5.34] | [5.48] | [5.53] | [5.52] | [5.42] |
| Std. Dev. | 5.45 | 5.59 | 5.62 | 5.68 | 5.65 | 4.66 | 4.85 | 4.84 | 4.74 | 4.76 |
| s.e | [0.38] | [0.42] | [0.42] | [0.55] | [0.54] | [0.39] | [0.42] | [0.42] | [0.54] | [0.55] |
| Sharpe Ratio | −0.35 | −0.19 | 0.04 | 0.29 | 0.56 | 1.05 | 0.68 | 0.49 | 0.35 | 0.17 |
| s.e | [0.28] | [0.28] | [0.28] | [0.29] | [0.28] | [0.28] | [0.28] | [0.28] | [0.29] | [0.29] |

Table 9: Simulations: Summary Statistics on Consumption Growth and Returns

This table reports, for each simulation case, the mean, standard deviation, and first-order autocorrelation of returns (first column) and consumption growth (second column). The third column reports the correlation between consumption growth and returns. The three panels correspond to three different cases: (1) consumption growth shocks are *i.i.d.* and returns are *perfectly* correlated to those shocks, (2) consumption growth shocks are *i.i.d.* and returns are *imperfectly* correlated to those shocks, and (3) consumption growth is persistent and returns are *imperfectly* correlated to consumption growth. The simulation window has 100,000 periods. Standard errors are obtained by bootstrapping (10,000 times).

| | Returns | Consumption | Corr. (Ret., Cons) |
|---|---|---|---|
| | | Case I: *i.i.d.*, perfect correlation | |
| Mean | 8.08 | 1.98 | 1.00 |
| s.e | [0.10] | [0.04] | [0.00] |
| Std | 16.06 | 2.02 | |
| s.e | [0.04] | [0.01] | |
| A.C | 0.00 | −0.00 | |
| s.e | [0.00] | [0.01] | |
| | | Case II: *i.i.d.*, imperfect correlation | |
| Mean | 8.03 | 2.01 | 0.10 |
| s.e | [0.10] | [0.01] | [0.00] |
| Std | 16.06 | 2.01 | |
| s.e | [0.04] | [0.01] | |
| A.C | −0.00 | 0.00 | |
| s.e | [0.00] | [0.00] | |
| | | Case III: persistent, imperfect correlation | |
| Mean | 8.02 | 2.01 | 0.08 |
| s.e | [0.10] | [0.01] | [0.00] |
| Std | 16.04 | 2.01 | |
| s.e | [0.04] | [0.00] | |
| A.C | −0.00 | 0.20 | |
| s.e | [0.00] | [0.00] | |

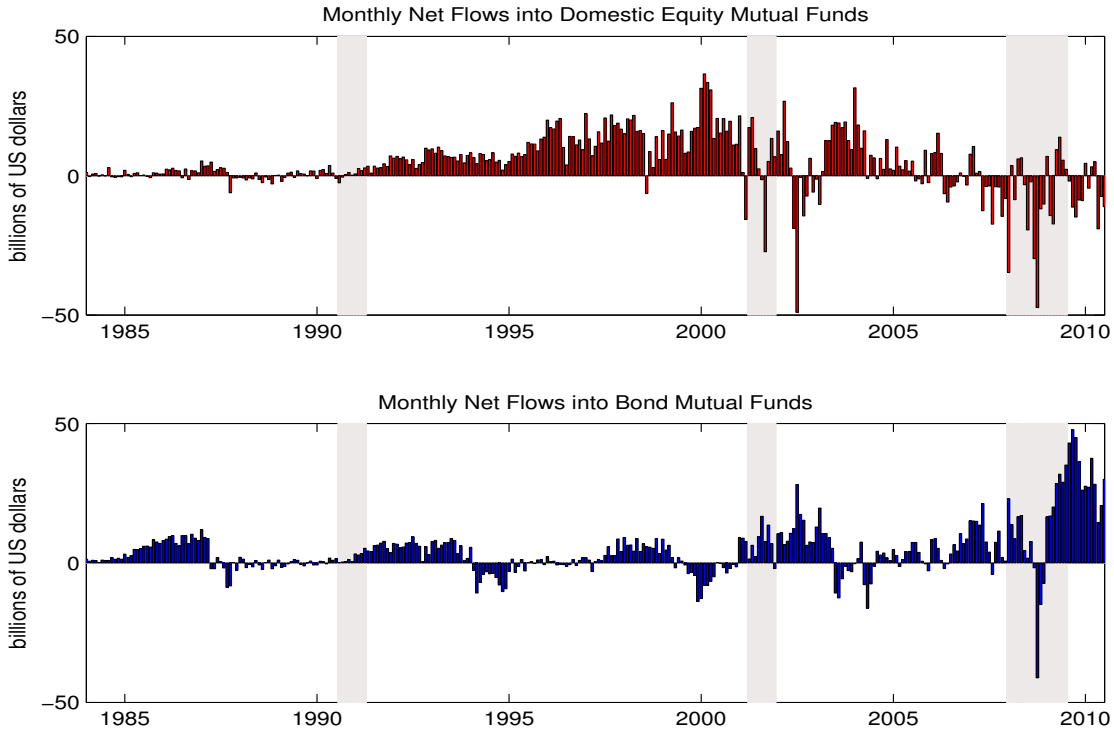


Figure 1: **Net Flows into Equity and Bond Mutual Funds**. This figure reports the net flows into U.S. long-term equity and bond mutual funds. Data are monthly and the sample is 1984.8–2010.7. The source is the Investment Company Institute. Shaded areas correspond to NBER recession dates.

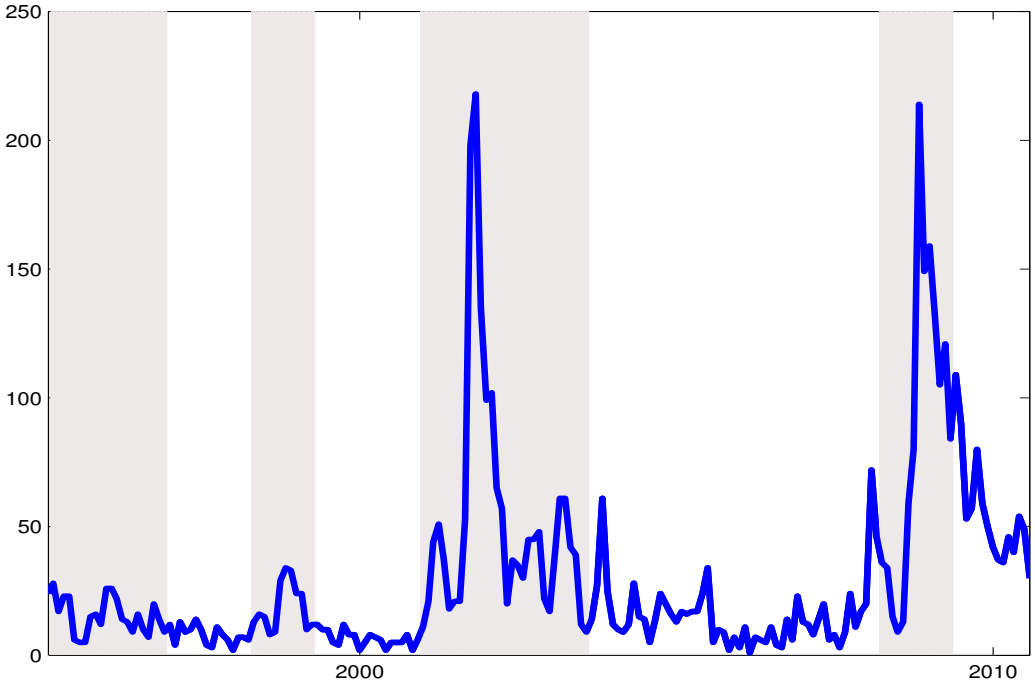


Figure 2: **"Recession" in the News – France**. This figure reports the occurrence of the word "recession" in *Le Monde* and *Le Figaro*, along with OECD turning point dates. The source of word counts is Factiva and the sample is 1995.1–2010.6.

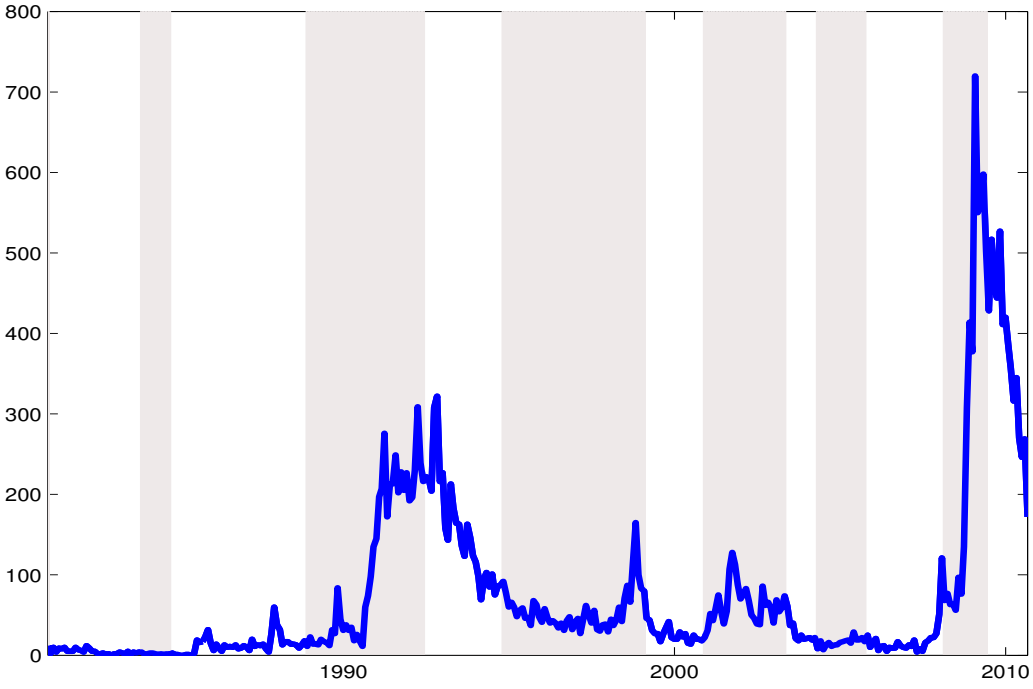


Figure 3: **"Recession" in the News – UK**. This figure reports the occurrence of the word "recession" in *The Times*, along with OECD turning point dates. The source of word counts is Factiva and the sample is 1981.1–2010.6.

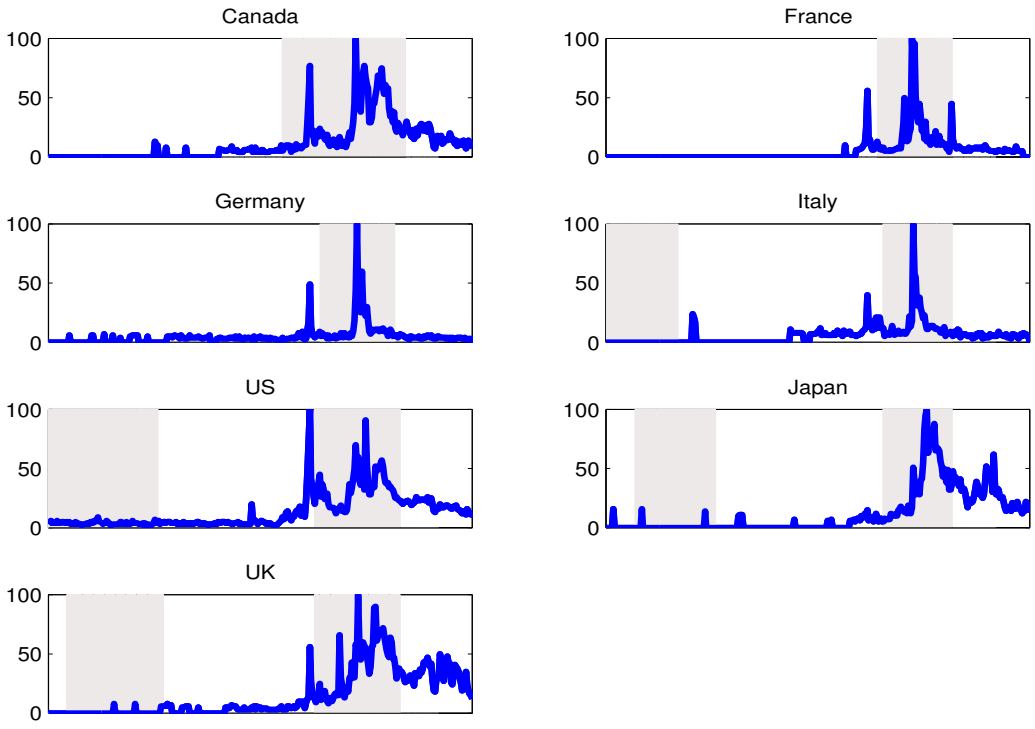


Figure 4: **"Recession" Searches in Google Insights**. This figure reports the number of Google searches of the word "recession." These numbers do not represent absolute search volume numbers, because the data is normalized and presented on a scale from 0 to 100. The source is Google Insights and the sample is 2004.1–2010.6.

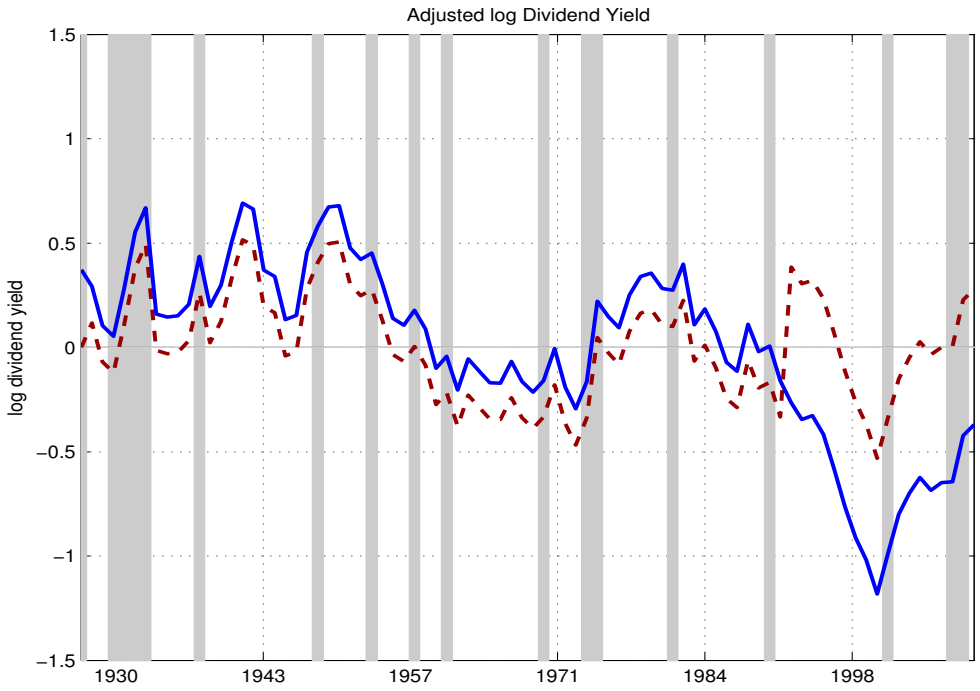


Figure 5: Dividend Yield

The figure plots the log dividend yield (full line) and the adjusted log dividend yield (dashed line). Annual data. The shaded areas are NBER recessions.

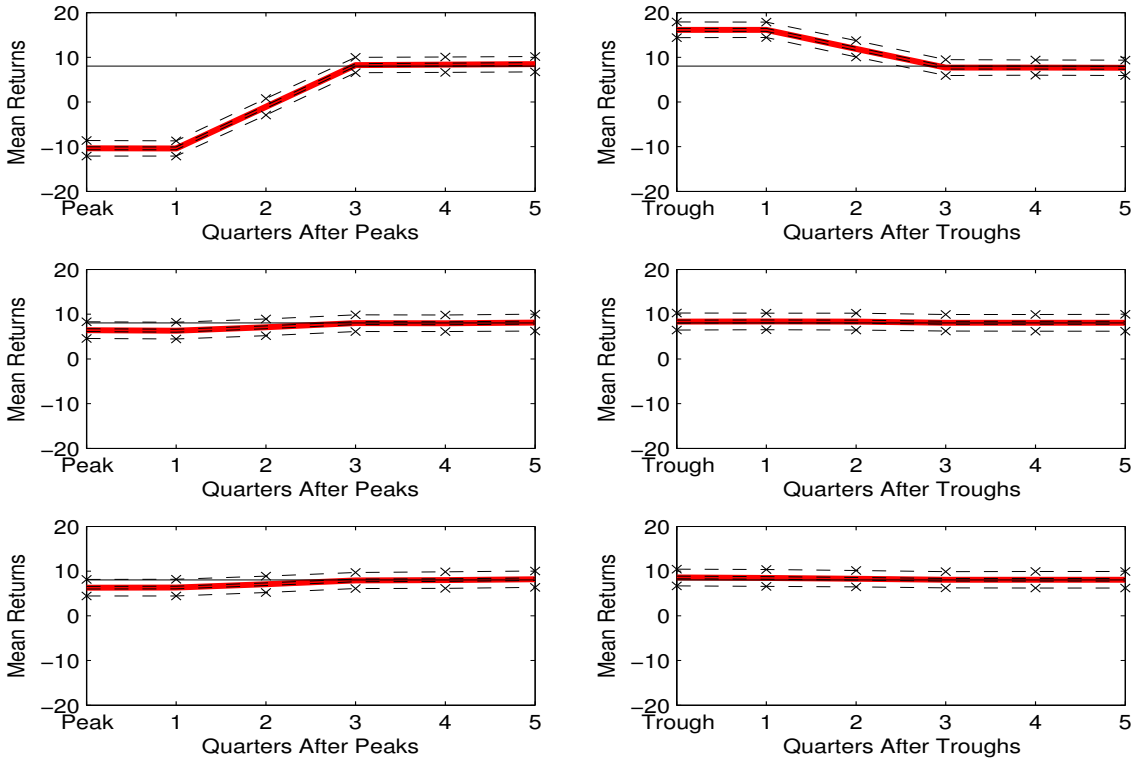


Figure 6: Look-Ahead Bias in Simulated Returns Across Business Cycles

The figure plots average simulated returns after business cycle peaks (left column) and troughs (right column). Recessions correspond to two consecutive quarters of negative consumption growth. Expansions are defined by two consecutive quarters of positive consumption growth. The horizontal line corresponds to the unconditional mean return. The simulation window has 100,000 periods. Standard errors are obtained by bootstrapping (10,000 times). Dashed lines represent two-standard error confidence intervals computed on the whole sample. Dashed lines with cross markers correspond to standard errors computed on a smaller sample of 300 recessions. The first panel corresponds to *i.i.d.* returns, perfectly correlated to consumption growth. The second panel corresponds to *i.i.d.* returns, imperfectly correlated to consumption growth. The third panel corresponds to persistent consumption growth and imperfectly correlated returns.