reduced for sanctioned banks in the post-Global Settlement period. For non-sanctioned banks, significant analyst affiliation bias remains in the post-Global Settlement period, regardless of the relationship measure used. Indeed, the coefficients uniformly increase in the second sub-period for non-sanctioned banks. Equality of coefficients between sanctioned and non-sanctioned banks is rejected in the second sub-period for equity (p-value=0.002), M&A (0.014), and overall relationships (0.000), but is not rejected for debt relationships (0.145).

The results from Tables 2 and 3 suggest that overall investment banking relationships better capture analyst affiliation bias than relationship measures based solely on equity, debt, or M&A transactions. As noted earlier, this may reflect that relationships spanning multiple functional areas put more pressure on analysts to produce optimistic recommendations or it may be the result of the overall measure better capturing the continuous nature of the underlying investment banking relationship. In unreported results, we examine whether any of the type-specific relationship measures have incremental explanatory power when included in the regression with the overall measure. In each case, the effects of type-specific relationships are subsumed by the overall relationship measure. Given these results, we focus on overall investment banking relationships throughout the rest of the paper.

The specifications described in Tables 2 and 3 follow prior literature by including firm fixed effects. To examine the robustness of the results to this choice and to the specification of the relationship measure, Table 4 reports results from alternative specifications incorporating analyst and investment bank fixed effects using both the indicator and continuous relationship measures. Results for the sub-periods before and after the Global Settlement are provided in Panels A and B, respectively. The first column in each panel of Table 4 repeats the overall relationship specification from Table 3. Comparing this specification to those based on alternative fixed effects and continuous relationship measures shows that the main results are robust to these alternative specifications. For both continuous and discrete measures of investment banking relationships, the results point to significant analyst affiliation bias in the first sub-period, regardless of specification. In the second sub-period, the results become somewhat weaker after incorporating investment bank fixed effects, but remain significant, especially for non-sanctioned banks. Interestingly, results for sanctioned banks are statistically significant based on relationship dummy variables, but insignificant based on continuous relationship measures.

In unreported results, we estimated two other robustness checks. First, we re-estimated the basic model for the subsets of sanctioned and non-sanctioned banks. Second, we re-estimated the model for the subset of firms covered by at least one affiliated and one non-affiliated analyst. In all cases, the findings are consistent with the overall results reported above.

Taken together, the results in Tables 2 through 4 provide strong evidence of analyst affiliation bias in the period following the Global Settlement for at least some investment banks. While this bias is substantially reduced in the post-Global Settlement period for investment banks named in the settlement, it remains significant when measured based on overall investment banking relationships. The coefficients from Table 2 suggest an 81% reduction in the magnitude of the bias for sanctioned banks when measured with the overall relationship. For the banks not named in the Global Settlement, analyst affiliation bias remains large and significant even after the Global Settlement. These results suggest that the reduction in affiliation bias is driven by the punitive and bank-specific requirements of the Global Settlement, rather than the broader regulatory changes that accompanied the settlement.

4.2. Relative Recommendations based on a 3-Tier System

Kadan et al. (2009) point out that, following the Global Settlement, many brokerages shifted from 5-tier to 3-tier recommendation scales, with all ten of the original Global Settlement banks adopting 3-tier scales in 2002 or soon thereafter. If only sanctioned banks shifted to this new recommendation scale or if the shift differs by bank type, it is possible that our measure of relative recommendations is inflated for non-sanctioned banks relative to sanctioned banks. To ensure that our results are not driven by this shift in recommendation scales, we re-estimate our main regressions after redefining all recommendations based on a 3-tier scale. Specifically, we redefine I/B/E/S recommendations such that a 3 represents a Strong Buy or Buy and a 1 represents a Sell or Strong Sell, and recalculate relative recommendations accordingly.

Table 5 reports regression results based on this redefined relative recommendation variable, with results for the sub-periods before and after the Global Settlement reported in Panels A and B, respectively. For completeness, we provide results based on transaction type relationships (equity, debt, and M&A), as well as overall relationships. For both sub-periods, the results are generally consistent with the main results presented in Tables 2 and 3. In the first sub-period, there is evidence of analyst affiliation bias for sanctioned banks based on all relationship measures. For non-sanctioned banks, there is evidence of analyst affiliation bias based on M&A and overall relationships, but insignificant results based on equity and debt relationships.

In the second sub-period, the impact of analyst affiliation is reduced for sanctioned banks, though it remains statistically significant for all relationship measures. For non-sanctioned banks, we again find strong evidence of analyst affiliation bias in the post-settlement period based on both transaction type and overall relationship measures. Thus, our results are not driven by the shift of some investment banks from a 5-tier to a 3-tier recommendation scale.

4.3. Logit Models for Buy/Sell Recommendations

As an alternative test, we follow Kadan et al. (2009) in estimating logit models for the likelihood of buy/strong buy recommendations and the likelihood of sell/strong sell recommendations, where we focus on affiliation effects and differences between sanctioned and non-sanctioned banks. The models follow the specification described in equation (1). However, we define two alternative dependent variables. The first is an indicator variable equal to one if the analyst issues a buy or strong buy recommendation and zero otherwise. The second is an indicator variable equal to one if the analyst issues a sell or strong sell recommendation and zero otherwise. The logit framework has two advantages over the regression specifications presented earlier. First, like the analysis in Table 5, the dependent variables in the logit models are defined based on a 3-tier recommendation scale and are therefore robust to a shift in recommendation scales by some investment banks. Second, the dependent variables in the logit model are defined directly from I/B/E/S recommendations and are therefore unaffected by the definition of "consensus" ranking used in the construction of *RelRec*.

Table 6 presents the results from the logit models for both the full period and the pre/post Global Settlement sub-periods. Again, the findings point to significant analyst affiliation bias. In the models for buy/strong buy recommendations, the results suggest that both sanctioned and non-sanctioned banks are significantly more likely to issue buy or strong buy recommendations when affiliated with the covered firm through an investment banking relationship. For sanctioned banks, this effect is strongest during the first sub-period, but remains statistically significant even after the Global Settlement. For non-sanctioned banks, affiliation bias is statistically significant and similar in magnitude both before and after the Global Settlement.

The logit results for sell/strong sell recommendations point to symmetric effects in terms of pessimistic recommendations, although the results appear to be driven primarily by the period after the Global Settlement. Specifically, during the post-Global Settlement period, both sanctioned and non-sanctioned banks are less likely to issue sell or strong sell recommendations when affiliated with the firm through an investment banking relationship.

The results from the logit models are largely consistent with those based on relative recommendations and suggest that analysts tend to issue more optimistic (or less pessimistic) recommendations on firms with which their employer has an investment banking relationship.

5. The Impact of Lending Activity on Analyst Affiliation Bias

The passage of the Gramm-Leach-Bliley Act in 1999 led to a substantial increase in the role of commercial banks in investment banking and more direct ties between lending and underwriting relationships. For example, Ljungqvist et al. (2006), Drucker and Puri (2005), Yasuda (2005), and Bharath, Dahiya, Saunders, and Srinivasan (2007) find that lending relationships increase the likelihood of a bank being awarded future debt and equity underwriting business, and Corwin and Stegemoller (2014) identify important links between lending and the cross-functional nature of investment banking relationships. In this section, we examine whether lending relationships have any incremental impact on analyst affiliation bias, after controlling for investment banking relationships based on equity, debt, and M&A transactions.[15]

To examine lending relationships, we use Dealscan data to collect the sample of syndicated loans involving our sample firms. We match CRSP firms to Dealscan data using the link table provided by Michael Roberts and Wharton Research Data Services (see Chava and Roberts (2008)). For each loan, we identify the loan amount and all lenders identified as having lead arranger credit. Notably, the Dealscan data include both loans and revolving credit line agreements. We believe credit lines are an important part of a lending relationship, regardless of whether or not the loan is drawn down. However, the fact that these loans may not be drawn down suggests that the total loan values in Dealscan will not be comparable to the transaction values in the equity, debt, and M&A datasets.

To integrate the lending and investment banking datasets, we hand match lender names to our sample of large investment banks. Following the construction of the investment banking variables, we calculate investment bank market share, firm loan proceeds, and firm-lender relationships at the end of each quarter. For each investment bank in our sample, we calculate lending market share based on all loans over the prior twelve months. For each firm in our sample, we calculate lending proceeds as the sum of all loans received over the preceding 36 months. Finally, for each firm-investment bank pair, we calculate the lending relationship as the proportion of the firm's total loan value over the preceding 36 months for which the investment bank was assigned lead arranger credit and we calculate a revised "overall" relationship measure combining lending with equity, debt, and M&A transaction values.

Summary statistics for the lending variables are provided in Panel A of Table 7. Across all quarterly observations in our sample, the lending relationship has a mean value of 2.82% and the overall relationship incorporating lending has a mean value of 5.84%. Investment bank market share has a mean (median) value of 4.56% (0.74%) based on lending alone and 4.58% (2.05%) based on the combined values of lending, equity, debt, and M&A transactions. The average value of three-year lending proceeds

[15] Although they do not analyze recommendations, Chen and Martin (2011) examine the relation between earnings forecast accuracy and lending relationships. They find that forecast accuracy improves after a firm borrows from an affiliated bank, suggesting that lending provides affiliated analysts with an informational advantage over other analysts.

for the firms in our sample is $964.1 million across all observations and $1,818.3 million across observations with positive lending proceeds.

Table 7 describes coefficients from regressions of relative recommendations on the set of control variables and investment banking relationship variables, after incorporating lending, with results for the pre and post-Global Settlement sub-periods in Panels B and C, respectively. To conserve space, coefficients on control variables are not included. The table provides results from four different specifications. The first specification includes only lending relationship indicators. This specification suggests that lending relationships have a positive impact on analyst affiliation bias in the 1998-2001 sub-period, but an insignificant effect after 2002. In the second specification, we include the lending relationship indicator in addition to the overall relationship indicator based on equity, debt, and M&A transactions. This regression suggests that lending may have some incremental impact on affiliation bias beyond that captured by the investment banking relationship, but the impact is again strongest during the first sub-period.

In the third specification, we again include the overall relationship indicator based on combined equity, debt, and M&A transactions, but we add an interaction with the lending relationship indicator. The results from this specification suggest that the affiliation bias associated with investment banking relationships is magnified in cases where there is also a lending relationship, especially during the first sub-period. Finally, in the fourth specification, we provide results based on the redefined overall relationship indicator that incorporates equity, debt, M&A, and lending transactions. This combined measure produces results that are similar to those from the overall relationship measure without lending, with affiliation bias being significant for non-sanctioned banks in both sub-periods and strongest for sanctioned banks in the first sub-period.

The results in Table 7 provide weak evidence that lending leads to incremental affiliation bias effects beyond those captured by investment banking relationships, at least during the first sub-period. However, unlike the main results based on equity, debt, and M&A relationships, the findings in Table 7 are sensitive to the inclusion of alternative fixed effects. In untabulated results, we find that when either analyst or investment bank fixed effects are included in these models, the incremental effects of lending become insignificant. Thus, there is limited evidence of any incremental impact of lending relationships on analyst affiliation bias in the period after the Global Settlement.

6. Conclusion

Previous research provides strong evidence of conflicts of interest between investment banking and research departments within large investment banks. In particular, research shows that analysts tend to issue optimistic recommendations on firms with which their employer has an equity underwriting relationship. One of the major purposes of the 2003 Global Analyst Research Settlement reached between the SEC, NYSE, NASD, New York Attorney General, and North American Securities Administrators Association and 12 of the largest investment banks was to reduce these conflicts of interest. In this study, we use a comprehensive measure of relationships between investment banks and firms to examine the impact of the Global Settlement on analyst affiliation bias.

Our data include all equity, debt, and M&A transactions by U.S. firms, allowing us to analyze a more comprehensive measure of investment banking relationships than has been studied in prior literature. In general, we find evidence of analyst affiliation bias for each individual type of investment banking relationship. However, our results suggest that an overall measure spanning all functional areas does a better job of capturing investment banking relationships and the related affiliation bias.

To better understand the impact of the Global Settlement and contemporaneous regulatory changes on analyst behavior, we separate analysts employed by investment banks named in the Global Settlement (sanctioned banks) and other top investment banks (non-sanctioned banks). Consistent with prior research, our results provide strong evidence of analyst affiliation bias for both groups of banks in the period prior to the Global Settlement. Following the Global Settlements, affiliation bias is substantially reduced, but not eliminated, for those banks named in the Global Settlement. In contrast, we find strong evidence of analyst affiliation bias for non-sanctioned banks even after the Global Settlement.

These findings suggest that the Global Settlement and related regulatory changes were only partially successful in mitigating conflicts of interest between investment banking and analyst research. In particular, the impact appears limited to the subset of sanctioned banks, suggesting that the decline in analyst affiliation bias is driven by the punitive aspects or bank-specific requirements of the Global Settlement more than the broader regulatory changes imposed on the industry.

References

Barber, B., R. Lehavy, and B. Trueman. 2007. Comparing the stock recommendation performance of investment banks and independent research firms. *Journal of Financial Economics* 85: 490–517.

Barniv, R., O.-K. Hope, M. Myring, and W. Thomas. 2009. Do analysts practice what they preach and should investors listen? Effects of recent regulations. *The Accounting Review* 84 (4): 1015-1039.

Beneish, M. 1991. Stock prices and the dissemination of analysts' recommendations. *Journal of Business* 64 (3): 393-416.

Bharath, S., S. Dahiya, A. Saunders, and A. Srinivasan, 2007, So what do I get? The bank's view of lending relationships, *Journal of Financial Economics* 85, 368-419.

Bradshaw, M. 2004. How do analysts use their earnings forecasts in generating stock recommendations? *The Accounting Review* 79 (1): 25-50.

Bradshaw, M., S. Richardson, and R. Sloan. 2006. The relation between corporate financing activities, analysts' forecasts and stock returns. *Journal of Accounting and Economics* 42: 53-85.

Brown, L., A. Call, M. Clement, and N. Sharp. 2014. Inside the "black box" of sell-side financial analysts. *Journal of Accounting Research*, forthcoming.

Chava, S., and M. Roberts, 2008, How does financing impact investment? The role of debt covenants, *Journal of Finance* 63, 2085-2121.

Chen, T., and X. Martin. 2011. Do bank-affiliated analysts benefit from lending relationship? *Journal of Accounting Research* 49 (3): 633-675.

Chen, C.-Y., and P. Chen. 2009. NASD Rule 2711 and changes in analysts' independence in making stock recommendations. *The Accounting Review* 84 (4): 1041-1071.

Clarke, J., A. Khorana, A. Patel, and P. Rau. 2011. Independents' day? Analyst behavior surrounding the Global Settlement. *Annals of Finance* 7: 529-547.

Corwin, S. A., and M. Stegemoller. 2014, The changing nature of investment banking relationships. Working paper, University of Notre Dame and Baylor University.

Cowen, A., B. Groysberg, and P. Healy. 2006. Which types of analyst firms are more optimistic? *Journal of Accounting and Economics* 41: 119-146.

Dechow, P., A. Hutton, and R. Sloan. 2000. The relation between analysts' forecast of long-term earnings growth and stock price performance following equity offerings. *Contemporary Accounting Research* 17 (1): 1-32.

De Franco, G., H. Lu, and F. Vasvari. 2007. Wealth transfer effects of analysts' misleading behavior. *Journal of Accounting Research* 45 (1): 71-110.

Drucker, S., and M. Puri, 2005, On the benefits of concurrent lending and underwriting, *Journal of Finance* 60, 2763-2799.

Dugar, A., and S. Nathan. 1995. The effect of investment banking relationships on financial analysts' earnings forecasts and investment recommendations. *Contemporary Accounting Research* 12 (1): 131-160.

Francis, J. and D. Philbrick. 1993. Analysts' decisions as products of a multi-task environment. *Journal of Accounting Research* 31: 216-230.

Guan, Y., H. Lu, and F. Wong. 2012. Conflict-of-interest reforms and investment bank analysts' research biases. *Journal of Accounting, Auditing, and Finance* 27 (4): 443-470.

Hong, H., and J. Kubik. 2003. Analyzing the analysts: career concerns and biased earnings forecasts. *Journal of Finance* 58: 313–351.

Irvine, P. 1996. Do analysts generate trade for their firms? Evidence from the Toronto stock exchange. *Journal of Accounting and Economics* 30: 209-226.

Kadan, O., L. Madureira, R. Wang, and T. Zach. 2009. Conflicts of interest and stock recommendations – the effect of the Global Settlement and related regulations. *Review of Financial Studies* 22 (10): 4189-4217.

Kadan, O., L. Madureira, R. Wang, and T. Zach. 2012. Analysts' industry expertise. *Journal of Accounting and Economics* 54: 95-120.

Kolasinski, A., and S.P. Kothari. 2008. Investment banking and analyst objectivity: Evidence from analysts affiliated with mergers and acquisitions advisors. *Journal of Financial and Quantitative Analysis* 43 (4): 817-842.

La Porta, R. 1996. Expectations and the cross-sections of returns. *The Journal of Finance* 51 (5): 1715-1742.

Lin, H., and M. McNichols. 1998. Underwriting relationships, analysts' earnings forecasts and investment recommendations. Journal of Accounting and Economics 25 (1): 101-127.

Ljungqvist, A., F. Marston, and W. J. Wilhelm, Jr., 2006, Competing for securities underwriting mandates: Banking relationships and analyst recommendations, *Journal of Finance* 61, 301-340.

Ljungqvist, A., F. Marston, L. Starks, K. Wei, and H. Yan. 2007. Conflicts of interest in sell-side research and the moderating role of institutional investors. *Journal of Financial Economics* 85: 420-456.

Ljungqvist, A., F. Marston, and W. Wilhelm. 2009. Scaling the hierarchy: How and why investment banks compete for syndicate co-management appointments. *The Review of Financial Studies* 22 (10): 3977-4007.

McNichols, M., and P. O'Brien. 1997. Self-selection and analyst coverage. *Journal of Accounting Research* 35 (Supplement): 167-199.

Mehran, H., and R. Stulz. 2007. The economics of conflicts of interest in financial institutions. *Journal of Financial Economics* 85: 267-296.

Michaely, R. and K. Womack. 1999. Conflict of interest and the credibility of underwriter analyst recommendations. *The Review of Financial Studies* 12 (4): 653-686.

O'Brien, P., McNichols, M., Lin, H., 2005. Analyst impartiality and investment banking relationships. *Journal of Accounting Research* 43, 623–650.

Yasuda, A., 2005, Do bank relationships affect the firm's underwriter choice in the corporate bond underwriting market? *Journal of Finance* 60, 1259-1292.

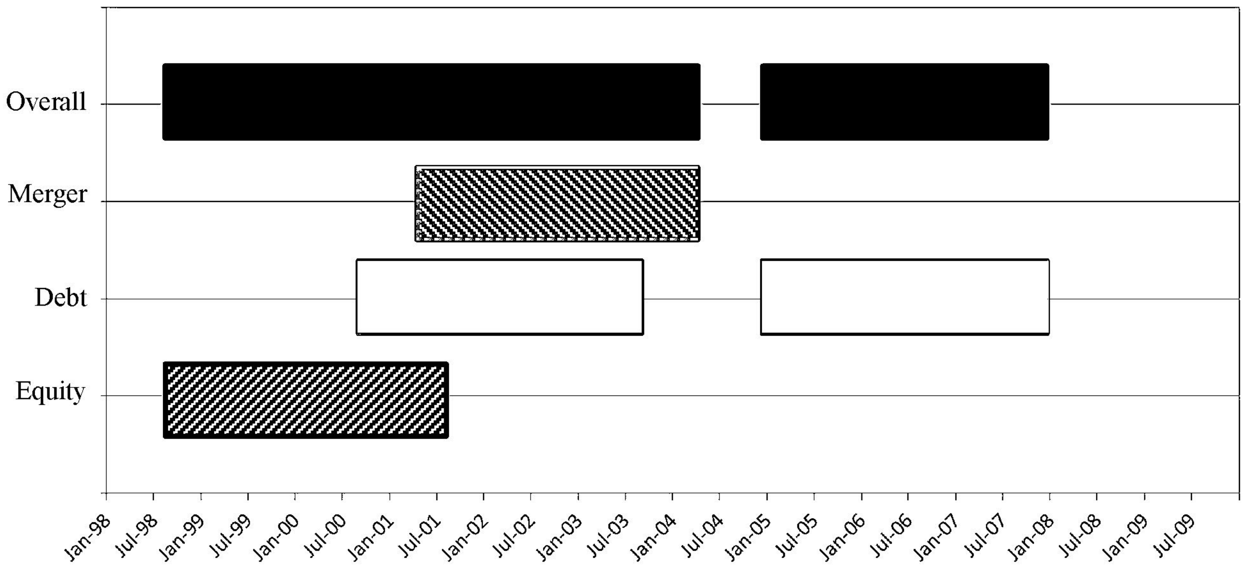
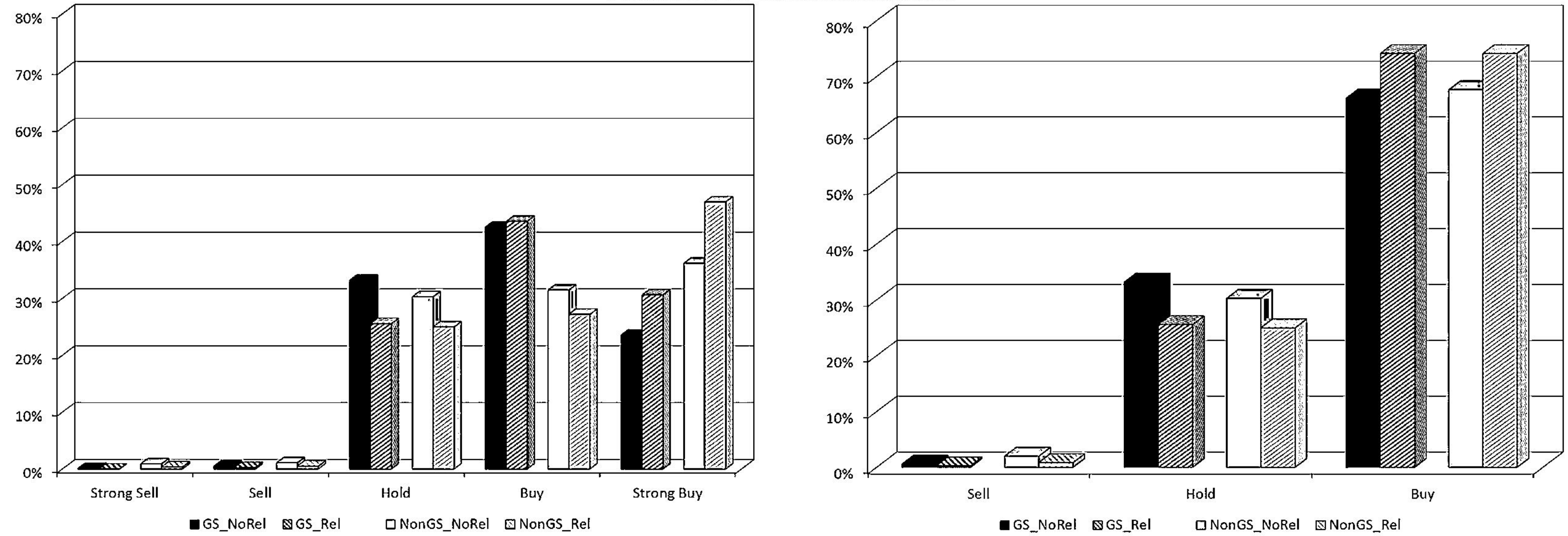


Figure 1 – Relationship Illustration for Convergys Corp and Citi Salomon Smith

This figure provides an illustration of our measures of investment banking relationships. We define a firm-bank pair as having a relationship if at any point during the preceding 36 months, the firm had an equity, debt, or M&A transaction for which the investment bank served as a lead or co-managing underwriter or M&A advisor. Equity, debt, and M&A relationships are defined based only on transactions within each category. The overall relationship is defined based on transactions across all three categories.

Panel A: Pre-Global Settlement



Panel B: Post-Global Settlement

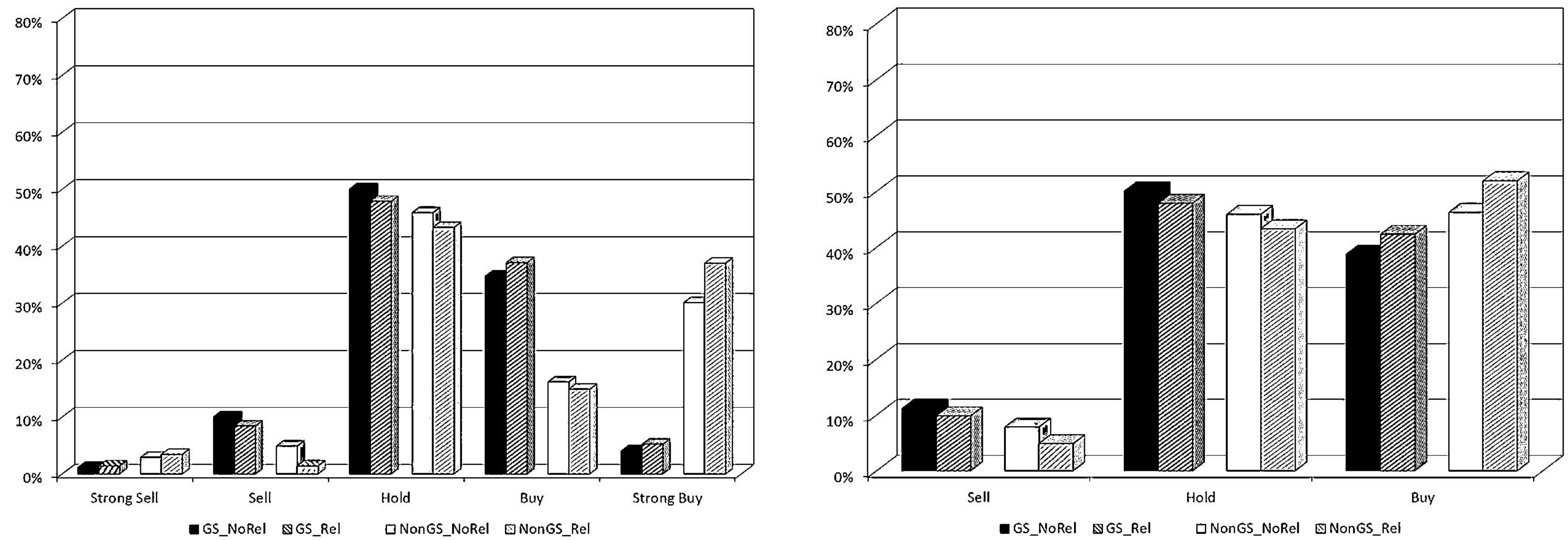


Figure 2 – Recommendation Frequency Before and After Global Settlement

The figure plots recommendation frequencies for our sample of quarterly data, where frequencies are classified on both a five-tier and a three-tier scale. Analysts are classified as being affiliated with either a Global Settlement bank or a non-Global Settlement bank and firm-analyst observations are separated into those that are associated with an investment bank relationship and those that are not, based on the overall investment banking relationship.

Table 1 – Summary Statistics

This table provides descriptive statistics for the variables used in this study. Variable definitions are contained in Appendix Table A1. Panel A provides summary statistics for the full sample, including 216,242 quarterly observations. The non-zero proceeds variables are based on 55,221 observations for equity, 80,823 observations for debt, 76,491 observations for M&A, and 140,997 observations for all combined transactions (overall). Panel B provides mean values for the subsamples of observations related to sanctioned and Non-sanctioned bank analysts. The *p*-value in the last column of Panel B is from a test of difference in means across sanctioned and Non-sanctioned banks based on analysis of variance.

Panel A: Full Sample Summary Statistics					
	Mean	Median	Min	Max	Std. Dev.
Recommendation and Forecast Measures:					
Analyst Recommendation	3.61	4.00	1.00	5.00	0.91
Relative Recommendation	0.0025	0.00	-4.00	3.00	0.80
Adjusted Forecast Bias	-0.0351	0.00	-9.24	5.57	0.96
Adjusted Forecast Accuracy	0.0437	0.00	-9.11	5.34	0.87
IB Relationship Measures:					
IBRel_Equity (%)	3.24	0.00	0.00	1.00	15.51
IBRel_Debt (%)	2.72	0.00	0.00	1.00	13.03
IBRel_Merger (%)	2.43	0.00	0.00	1.00	14.14
IBRel_Overall (%)	5.90	0.00	0.00	1.00	19.49
IB Characteristics:					
IB_Size	88.74	85.00	1.00	250.00	49.65
IB_MktShare_Equity (%)	4.55	2.81	0.00	22.11	4.84
IB_MktShare_Debt (%)	4.77	2.13	0.00	21.64	5.63
IB_MktShare_Merger (%)	4.38	1.70	0.00	34.13	5.67
IB_MktShare_Overall (%)	4.47	2.18	0.00	23.06	5.17
Analyst Characteristics:					
RelAccuracy (%)	41.23	40.96	0.00	100.00	10.33
AllStar	0.19	0.00	0.00	1.00	0.39
Seniority	5.43	4.92	0.00	16.18	3.47
Seasoning	2.33	1.39	0.00	16.18	2.46
NFollow	10.96	10.00	1.00	103.00	7.22
JobMove	0.03	0.00	0.00	1.00	0.18
Firm/Stock Characteristics:					
ANF	10.02	9.00	2.00	51.00	6.18
InstHoldings (%)	62.10	69.81	0.00	100.00	29.44
MV	9,592.51	1,886.44	0.76	602,432.92	28,686.62
Proceeds_Equity	76.61	0.00	0.00	12,189.10	312.10
Proceeds_Debt	427.87	0.00	0.00	34,879.74	1,335.85
Proceeds_Merger	1,054.52	0.00	0.00	153,653.35	5,672.22
Proceeds_Overall	1,575.53	152.30	0.00	178,009.68	6,477.18
Proceeds_Equity$^+$	300.01	139.20	0.70	12,189.10	560.73
Proceeds_Debt$^+$	1,144.78	491.25	3.00	34,879.74	1,988.39
Proceeds_Merger$^+$	2,981.15	591.59	0.95	153,653.35	9,231.15
Proceeds_Overall$^+$	2,416.34	498.18	0.70	178,009.68	7,893.76

Table 1 – continued

Panel B: Sanctioned vs. Non-Sanctioned Banks			
	Sanctioned Banks	Non-Sanctioned Banks	*p*-value for difference
N	123,708	92,534	-
Recommendation and Forecast Measures:			
Analyst Recommendation	3.48	3.78	0.000
Relative Recommendation	-0.0777	0.1098	0.000
Adjusted Forecast Bias	-0.0395	-0.0293	0.013
Adjusted Forecast Accuracy	0.0442	0.0430	0.739
IB Relationship Measures:			
IBRel_Equity (%)	4.42	1.67	0.000
IBRel_Debt (%)	4.46	0.81	0.000
IBRel_Merger (%)	3.45	1.07	0.000
IBRel_Overall (%)	8.32	2.67	0.000
IB Characteristics:			
IB_Size	116.15	52.09	0.000
IB_MktShare_Equity (%)	7.20	1.01	0.000
IB_MktShare_Debt (%)	7.35	1.31	0.000
IB_MktShare_Merger (%)	7.20	0.60	0.000
IB_MktShare_Overall (%)	7.24	0.78	0.000
Analyst Characteristics:			
RelAccuracy (%)	41.05	41.47	0.000
AllStar	0.28	0.06	0.000
Seniority	5.48	5.37	0.000
Seasoning	2.46	2.16	0.000
NFollow	11.49	10.25	0.000
JobMove	0.03	0.04	0.000
Firm/Stock Characteristics:			
ANF	10.12	9.88	0.000
InstHoldings (%)	63.18	60.66	0.000
MV	10,253.75	8,708.50	0.000
Proceeds_Equity	81.28	70.37	0.000
Proceeds_Debt	479.30	359.12	0.000
Proceeds_Merger	1,131.00	952.27	0.000
Proceeds_Overall	1,708.67	1,397.54	0.000
Proceeds_Equity^{+}	343.35	251.06	0.000
Proceeds_Debt^{+}	1,195.89	1,063.66	0.000
Proceeds_Merger^{+}	3,102.64	2,806.65	0.000
Proceeds_Overall^{+}	2,593.51	2,173.63	0.000

Table 2 – Full Period Regressions for Relative Recommendations

This table provides the results from estimating regressions of relative recommendations on investment bank relationship measures, investment bank characteristics, analyst characteristics, and stock characteristics for the full sample period 1998 to 2009. Columns 1 through 3 respectively use equity, debt, and M&A investment banking relationship measures while column 4 uses an overall relationship measure. *p*-values based on robust standard errors are presented in parentheses below the coefficients, where standard errors are clustered by firm. Each model contains year and firm fixed effects. *GS* and *NonGS* refer to sanctioned and non-sanctioned banks, respectively. Variable definitions are contained in Appendix Table A1.

	Equity Relationship	Debt Relationship	M&A Relationship	Overall Relationship
Intercept	0.168	0.263	0.162	0.169
	(.001)	(.000)	(.002)	(.001)
Post	-0.134	-0.139	-0.143	-0.122
	(.000)	(.000)	(.000)	(.000)
IB Relationship Measures:				
IBRel_GS	0.122	0.129	0.108	0.160
	(.000)	(.000)	(.000)	(.000)
IBRel_GS*Post	-0.121	-0.102	-0.068	-0.129
	(.000)	(.000)	(.024)	(.000)
IBRel_NonGS	0.171	0.162	0.172	0.171
	(.000)	(.004)	(.001)	(.000)
IBRel_NonGS*Post	-0.030	-0.055	-0.023	-0.010
	(.590)	(.390)	(.748)	(.789)
IB Characteristics:				
Ln(IB_Size)	-0.044	-0.084	-0.042	-0.048
	(.000)	(.000)	(.000)	(.000)
IB_MktShare	-0.573	0.735	-0.650	-0.548
	(.000)	(.000)	(.000)	(.000)
IB_NonGS	0.019	0.064	0.011	0.028
	(.071)	(.000)	(.296)	(.009)
IB_NonGS*Post	0.200	0.198	0.205	0.187
	(.000)	(.000)	(.000)	(.000)
Analyst Characteristics:				
RelAccuracy	-0.010	-0.004	-0.008	-0.008
	(.707)	(.878)	(.760)	(.778)
AllStar	-0.013	-0.034	-0.013	-0.018
	(.153)	(.000)	(.156)	(.038)
Ln(Seniority)	0.023	0.023	0.023	0.023
	(.000)	(.000)	(.000)	(.000)
Ln(Seasoning)	0.010	0.013	0.010	0.010
	(.084)	(.033)	(.101)	(.088)
Ln(NFollow)	-0.045	-0.037	-0.043	-0.043
	(.000)	(.000)	(.000)	(.000)
JobMove	-0.006	-0.004	-0.007	-0.004
	(.565)	(.698)	(.499)	(.717)
Stock Characteristics:				
Ln(ANF)	0.048	0.046	0.047	0.048
	(.000)	(.000)	(.000)	(.000)
Ln(MV)	0.005	0.005	0.006	0.005
	(.325)	(.297)	(.267)	(.329)
Ln(Proceeds)	-0.001	0.000	-0.001	0.000
	(.670)	(.905)	(.505)	(.783)
InstHoldings	-0.165	-0.201	-0.196	-0.157
	(.467)	(.375)	(.386)	(.489)

Table 2 - continued

Combined Post Effects:				
GS Banks	0.001	0.028	0.041	0.031
	(.951)	(.087)	(.038)	(.009)
Non-GS Banks	0.142	0.107	0.150	0.161
	(.000)	(.019)	(.001)	(.000)
Adjusted R^2	.051	.052	.051	.052
N	216,242	216,242	216,242	216,242

Table 3 – Sub-period Regressions for Relative Recommendations

This table provides the results from estimating regressions of relative recommendations on investment bank relationship measures, investment bank characteristics, analyst characteristics, and stock characteristics. Results for the sub-periods before (1998-2001) and after (2003-2009) Global Settlement period are provided in Panels A and B, respectively. Columns 1 through 3 respectively use equity, debt, and M&A investment banking relationship measures while column 4 uses an overall relationship measure. *p*-values based on robust standard errors are presented in parentheses below the coefficients, where standard errors are clustered by firm. Each model contains year and firm fixed effects. *GS* and *NonGS* refer to sanctioned and non-sanctioned banks, respectively. Variable definitions are contained in Appendix Table A1.

	Equity Relationship	Debt Relationship	M&A Relationship	Overall Relationship
	Panel A: 1998 – 2001			
Intercept	-0.272	-0.214	-0.265	-0.237
	(.003)	(.022)	(.004)	(.011)
IB Relationship Measures:				
IBRel_GS	0.072	0.121	0.063	0.119
	(.005)	(.000)	(.022)	(.000)
IBRel_NonGS	0.050	0.097	0.136	0.106
	(.294)	(.122)	(.029)	(.003)
IB Characteristics:				
Ln(IB_Size)	0.065	0.031	0.058	0.052
	(.000)	(.002)	(.000)	(.000)
IB_MktShare	-0.223	1.126	0.236	0.259
	(.043)	(.000)	(.032)	(.027)
IB_NonGS	0.104	0.156	0.120	0.129
	(.000)	(.000)	(.000)	(.000)
Analyst Characteristics:				
RelAccuracy	0.049	0.062	0.052	0.053
	(.284)	(.178)	(.260)	(.253)
AllStar	-0.013	-0.053	-0.027	-0.036
	(.363)	(.000)	(.054)	(.011)
Ln(Seniority)	-0.007	-0.006	-0.008	-0.008
	(.554)	(.607)	(.539)	(.501)
Ln(Seasoning)	0.054	0.051	0.053	0.052
	(.000)	(.000)	(.000)	(.000)
Ln(NFollow)	-0.049	-0.037	-0.045	-0.043
	(.000)	(.000)	(.000)	(.000)
JobMove	-0.039	-0.040	-0.037	-0.033
	(.008)	(.007)	(.012)	(.023)
Stock Characteristics:				
Ln(ANF)	0.036	0.035	0.036	0.038
	(.008)	(.010)	(.009)	(.006)
Ln(MV)	-0.004	-0.004	-0.004	-0.005
	(.664)	(.648)	(.670)	(.631)
Ln(Proceeds)	0.000	-0.003	-0.001	-0.005
	(.989)	(.405)	(.593)	(.171)
InstHoldings	-0.845	-0.855	-0.852	-0.838
	(.024)	(.022)	(.022)	(.025)
Adjusted R^2	.047	.052	.047	.049
N	59,703	59,703	59,703	59,703
PERMCO clusters	3,367	3,367	3,367	3,367
GS – NonGS = 0	.694	.709	.275	.743

Table 3 – continued

	Equity Relationship	Debt Relationship	M&A Relationship	Overall Relationship
	Panel B: 2003 – 2009			
Intercept	0.307	0.408	0.302	0.298
	(.000)	(.000)	(.000)	(.000)
IB Relationship Measures:				
IBRel_GS	0.010	0.037	0.045	0.042
	(.612)	(.025)	(.032)	(.001)
IBRel_NonGS	0.161	0.107	0.176	0.179
	(.000)	(.020)	(.000)	(.000)
IB Characteristics:				
Ln(IB_Size)	-0.076	-0.131	-0.080	-0.080
	(.000)	(.000)	(.000)	(.000)
IB_MktShare	-1.124	0.648	-1.023	-1.000
	(.000)	(.000)	(.000)	(.000)
IB_NonGS	0.170	0.230	0.171	0.173
	(.000)	(.000)	(.000)	(.000)
Analyst Characteristics:				
RelAccuracy	-0.044	-0.042	-0.037	-0.037
	(.233)	(.249)	(.312)	(.308)
AllStar	-0.007	-0.024	-0.009	-0.012
	(.583)	(.039)	(.444)	(.331)
Ln(Seniority)	0.028	0.027	0.026	0.027
	(.000)	(.001)	(.001)	(.001)
Ln(Seasoning)	-0.005	-0.001	-0.006	-0.006
	(.480)	(.940)	(.449)	(.456)
Ln(NFollow)	-0.036	-0.032	-0.031	-0.033
	(.000)	(.000)	(.000)	(.000)
JobMove	0.022	0.022	0.018	0.020
	(.124)	(.127)	(.208)	(.165)
Stock Characteristics:				
Ln(ANF)	0.033	0.031	0.031	0.033
	(.001)	(.002)	(.002)	(.001)
Ln(MV)	-0.004	-0.003	-0.002	-0.003
	(.639)	(.678)	(.769)	(.720)
Ln(Proceeds)	-0.001	-0.001	-0.001	-0.001
	(.793)	(.726)	(.513)	(.598)
InstHoldings	-0.003	-0.011	-0.014	0.009
	(.992)	(.975)	(.967)	(.980)
Adjusted R^2	.068	.067	.069	.068
N	136,193	136,193	136,193	136,193
PERMCO clusters	3,473	3,473	3,473	3,473
GS – NonGS = 0	.002	.145	.014	.000

Table 4 – Alternative Models for Relative Recommendations

This table provides results from regressions of relative recommendations on overall investment bank relationship measures, investment bank characteristics, analyst characteristics, and stock characteristics. Results for the sub-periods before (1998-2001) and after (2003-2009) Global Settlement period are provided in Panels A and B, respectively. Columns 1 through 3 use an indicator variable for the overall investment banking relationship while columns 4 through 6 use a continuous variable for the overall relationship measure. Columns 1 and 4 include firm fixed effects, columns 2 and 5 use analyst fixed effects, and columns 3 and 6 use investment bank fixed effects. All models contain year fixed effects. *p*-values based on robust standard errors are presented in parentheses below the coefficients, where standard errors are clustered by firm. Variable definitions are contained in Appendix Table A1.

	Overall Relationship Dummy			Overall Relationship Continuous		
			Panel A: 1998 – 2001			
Intercept	-0.237	-0.098	-0.684	-0.245	-0.099	-0.691
	(.011)	(.355)	(.000)	(.008)	(.347)	(.000)
IB Relationship Measures:						
IBRel_GS	0.119	0.098	0.104	-	-	-
	(.000)	(.000)	(.000)			
IBRel_NonGS	0.106	0.072	0.070	-	-	-
	(.003)	(.009)	(.011)			
IBRelC_GS				0.098	0.098	0.102
	-	-	-	(.000)	(.000)	(.000)
IBRelC_NonGS				0.118	0.085	0.090
	-	-	-	(.014)	(.019)	(.011)
IB Characteristics:						
Ln(IB_Size)	0.052	0.002	0.135	0.052	0.002	0.135
	(.000)	(.922)	(.000)	(.000)	(.938)	(.000)
IB_MktShare	0.259	0.517	0.281	0.356	0.562	0.341
	(.027)	(.003)	(.141)	(.002)	(.001)	(.073)
IB_NonGS	0.129	0.028		0.127	0.027	
	(.000)	(.249)	-	(.000)	(.270)	-
Analyst Characteristics:						
RelAccuracy	0.053	0.121	0.123	0.054	0.120	0.123
	(.253)	(.066)	(.001)	(.246)	(.068)	(.001)
AllStar	-0.036	0.003	-0.013	-0.034	0.003	-0.012
	(.011)	(.887)	(.272)	(.016)	(.900)	(.334)
Ln(Seniority)	-0.008	-0.031	-0.006	-0.008	-0.030	-0.006
	(.501)	(.317)	(.524)	(.524)	(.328)	(.546)
Ln(Seasoning)	0.052	0.030	0.042	0.052	0.030	0.042
	(.000)	(.001)	(.000)	(.000)	(.001)	(.000)
Ln(NFollow)	-0.043	-0.041	-0.018	-0.043	-0.041	-0.018
	(.000)	(.000)	(.014)	(.000)	(.000)	(.012)
JobMove	-0.033	-0.029	-0.032	-0.035	-0.030	-0.033
	(.023)	(.038)	(.020)	(.017)	(.035)	(.016)
Stock Characteristics:						
Ln(ANF)	0.038	0.048	0.044	0.037	0.047	0.043
	(.006)	(.000)	(.000)	(.007)	(.000)	(.000)
Ln(MV)	-0.005	0.011	0.004	-0.004	0.011	0.005
	(.631)	(.001)	(.125)	(.654)	(.001)	(.101)
Ln(Proceeds)	-0.005	-0.001	-0.002	-0.003	0.000	-0.001
	(.171)	(.625)	(.190)	(.305)	(.870)	(.563)
InstHoldings	-0.838	-0.711	-0.738	-0.846	-0.715	-0.746
	(.025)	(.003)	(.001)	(.023)	(.003)	(.001)
Fixed Effects	Firm	Analyst	IB	Firm	Analyst	IB
Adjusted R^2	.049	.122	.052	.047	.122	.051
N	59,703	59,703	59,703	59,703	59,703	59,703

Table 4 – continued

	Overall Relationship Dummy			Overall Relationship Continuous		
	Panel B: 2003 – 2009					
Intercept	0.298	-0.278	0.157	0.284	-0.280	0.155
	(.000)	(.008)	(.002)	(.000)	(.008)	(.002)
IB Relationship Measures:						
IBRel_GS	0.042	0.039	0.020	-	-	-
	(.001)	(.001)	(.090)			
IBRel_NonGS	0.179	0.097	0.066	-	-	-
	(.000)	(.000)	(.014)			
IBRelC_GS				-0.003	0.029	-0.003
	-	-	-	(.884)	(.143)	(.895)
IBRelC_NonGS				0.260	0.117	0.084
	-	-	-	(.000)	(.005)	(.042)
IB Characteristics:						
Ln(IB_Size)	-0.080	-0.078	-0.103	-0.078	-0.077	-0.102
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
IB_MktShare	-1.000	-0.427	-0.745	-0.939	-0.387	-0.728
	(.000)	(.021)	(.000)	(.000)	(.038)	(.000)
IB_NonGS	0.173	0.162		0.175	0.165	
	(.000)	(.000)	-	(.000)	(.000)	-
Analyst Characteristics:						
RelAccuracy	-0.037	0.046	0.007	-0.040	0.046	0.006
	(.308)	(.385)	(.837)	(.274)	(.386)	(.856)
AllStar	-0.012	-0.012	-0.004	-0.009	-0.011	-0.003
	(.331)	(.452)	(.723)	(.447)	(.479)	(.779)
Ln(Seniority)	0.027	0.060	0.009	0.027	0.061	0.009
	(.001)	(.006)	(.198)	(.001)	(.006)	(.183)
Ln(Seasoning)	-0.006	0.002	0.006	-0.006	0.001	0.005
	(.456)	(.794)	(.404)	(.448)	(.836)	(.431)
Ln(NFollow)	-0.033	-0.012	-0.018	-0.034	-0.012	-0.018
	(.000)	(.113)	(.001)	(.000)	(.108)	(.001)
JobMove	0.020	0.013	0.028	0.020	0.013	0.028
	(.165)	(.356)	(.041)	(.166)	(.366)	(.042)
Stock Characteristics:						
Ln(ANF)	0.033	0.053	0.035	0.033	0.053	0.035
	(.001)	(.000)	(.000)	(.001)	(.000)	(.000)
Ln(MV)	-0.003	0.035	0.031	-0.003	0.035	0.030
	(.720)	(.000)	(.000)	(.742)	(.000)	(.000)
Ln(Proceeds)	-0.001	0.000	-0.001	0.000	0.001	0.000
	(.598)	(.947)	(.545)	(.913)	(.384)	(.969)
InstHoldings	0.009	0.189	-0.188	0.014	0.170	-0.196
	(.980)	(.287)	(.244)	(.967)	(.340)	(.225)
Fixed Effects	Firm	Analyst	IB	Firm	Analyst	IB
Adjusted R^2	.068	.107	.060	.068	.107	.060
N	136,193	136,193	136,193	136,193	136,193	136,193

Table 5 – Relative Recommendations based on a 3-Tier System

This table provides the results from estimating regressions of relative recommendations on investment bank relationship measures, investment bank characteristics, analyst characteristics, and stock characteristics Results for the sub-periods before (1998-2001) and after (2003-2009) Global Settlement period are provided in Panels A and B, respectively. In this table, relative recommendations are measured based on a 3-tier system where a strong buy or buy recommendations are coded as 3 and strong sell or sell recommendations are coded as 1. Columns 1 through 3 respectively use equity, debt, and M&A investment banking relationship measures, while column 4 uses an overall relationship measure. *p*-values based on robust standard errors are presented in parentheses below the coefficients, where standard errors are clustered by firm. Each model contains year and firm fixed effects. Variable definitions are contained in Appendix Table A1.

	Equity Relationship	Debt Relationship	M&A Relationship	Overall Relationship
	Panel A: 1998 – 2001			
Intercept	0.088	0.102	0.086	0.093
	(.144)	(.086)	(.149)	(.120)
IB Relationship Measures:				
IBRel_GS	0.032	0.080	0.044	0.073
	(.037)	(.000)	(.011)	(.000)
IBRel_NonGS	0.011	0.011	0.075	0.035
	(.659)	(.724)	(.018)	(.049)
IB Characteristics:				
Ln(IB_Size)	0.009	0.001	0.009	0.006
	(.138)	(.847)	(.155)	(.295)
IB_MktShare	0.033	0.338	0.109	0.082
	(.631)	(.000)	(.104)	(.251)
IB_NonGS	-0.013	0.002	-0.010	-0.005
	(.076)	(.824)	(.199)	(.546)
Analyst Characteristics:				
RelAccuracy	0.071	0.074	0.072	0.072
	(.011)	(.008)	(.010)	(.011)
AllStar	-0.008	-0.018	-0.010	-0.014
	(.379)	(.038)	(.240)	(.113)
Ln(Seniority)	-0.003	-0.003	-0.003	-0.004
	(.677)	(.736)	(.678)	(.642)
Ln(Seasoning)	0.016	0.015	0.016	0.016
	(.016)	(.023)	(.018)	(.019)
Ln(NFollow)	-0.021	-0.017	-0.020	-0.019
	(.000)	(.001)	(.000)	(.000)
JobMove	-0.021	-0.021	-0.020	-0.019
	(.019)	(.017)	(.020)	(.034)
Stock Characteristics:				
Ln(ANF)	-0.023	-0.023	-0.024	-0.023
	(.012)	(.014)	(.012)	(.014)
Ln(MV)	-0.019	-0.019	-0.019	-0.019
	(.003)	(.003)	(.003)	(.002)
Ln(Proceeds)	0.001	-0.001	0.000	0.000
	(.626)	(.547)	(.931)	(.875)
InstHoldings	-0.758	-0.756	-0.753	-0.750
	(.004)	(.005)	(.005)	(.005)
Adjusted R^2	.057	.059	.057	.058
N	59,703	59,703	59,703	59,703

Table 5 – continued

	Equity Relationship	Debt Relationship	M&A Relationship	Overall Relationship
		Panel B: 2003 – 2009		
Intercept	0.519	0.508	0.515	0.489
	(.000)	(.000)	(.000)	(.000)
IB Relationship Measures:				
IBRel_GS	0.030	0.036	0.048	0.042
	(.057)	(.007)	(.007)	(.000)
IBRel_NonGS	0.086	0.096	0.145	0.113
	(.001)	(.000)	(.000)	(.000)
IB Characteristics:				
Ln(IB_Size)	-0.057	-0.069	-0.061	-0.052
	(.000)	(.000)	(.000)	(.000)
IB_MktShare	-1.207	-0.381	-1.090	-1.375
	(.000)	(.000)	(.000)	(.000)
IB_NonGS	-0.042	0.000	-0.042	-0.048
	(.000)	(.979)	(.000)	(.000)
Analyst Characteristics:				
RelAccuracy	-0.026	-0.027	-0.018	-0.018
	(.349)	(.328)	(.507)	(.514)
AllStar	-0.011	-0.018	-0.014	-0.013
	(.207)	(.044)	(.113)	(.143)
Ln(Seniority)	0.015	0.015	0.014	0.015
	(.009)	(.009)	(.015)	(.011)
Ln(Seasoning)	0.005	0.006	0.005	0.004
	(.382)	(.291)	(.425)	(.510)
Ln(NFollow)	-0.019	-0.020	-0.013	-0.015
	(.000)	(.000)	(.006)	(.002)
JobMove	0.007	0.006	0.002	0.003
	(.512)	(.576)	(.811)	(.728)
Stock Characteristics:				
Ln(ANF)	-0.008	-0.008	-0.009	-0.008
	(.344)	(.327)	(.241)	(.303)
Ln(MV)	-0.029	-0.028	-0.027	-0.027
	(.000)	(.000)	(.000)	(.000)
Ln(Proceeds)	-0.001	0.000	-0.001	-0.001
	(.734)	(.846)	(.396)	(.434)
InstHoldings	-0.214	-0.211	-0.224	-0.205
	(.440)	(.447)	(.420)	(.460)
Adjusted R^2	.050	.047	.052	.053
N	136,193	136,193	136,193	136,193

Table 6 – Logit Models for Buy/Sell Recommendations

This table provides the results from estimating logistic regressions of the probability that an analyst issues a buy or strong buy (sell or strong sell) recommendation on overall investment bank relationship measures, investment bank characteristics, analyst characteristics, and stock characteristics in columns 1 to 3 (4 to 6). Results for the full sample period from 1998 to 2009 are presented in columns 1 and 4. The remaining columns present results for the sub-periods before (1998-2001) and after (2003-2009) Global Settlement. *p*-values based on robust standard errors are presented in parentheses below the coefficients, where standard errors are clustered by firm. Each model contains year and firm fixed effects. Variable definitions are contained in Table A1 of Appendix 1.

	Buy or Strong Buy			Sell or Strong Sell		
	Full Period	1998-2001	2003-2009	Full Period	1998-2001	2003-2009
Post	-0.741	-	-	1.879	-	-
	(.000)			(.000)		
IB Relationship Measures:						
IBRel_GS	0.529	0.455	-	-0.786	-0.579	-
	(.000)	(.000)		(.000)	(.130)	
IBRel_GS*Post	-0.345	-	0.178	0.520	-	-0.261
	(.000)		(.000)	(.015)		(.000)
IBRel_NonGS	0.400	0.256	-	-1.313	-0.612	-
	(.000)	(.030)		(.000)	(.144)	
IBRel_NonGS*Post	-0.107	-	0.324	0.513	-	-0.809
	(.318)		(.000)	(.168)		(.000)
IB Characteristics:						
Ln(IB_Size)	-0.190	-0.125	-0.172	0.251	-1.155	0.355
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
IB_MktShare	-2.763	0.663	-4.712	5.931	-1.266	5.708
	(.000)	(.077)	(.000)	(.000)	(.558)	(.000)
IB_NonGS	-0.243	-0.046	-	1.277	0.166	-
	(.000)	(.278)		(.000)	(.415)	
IB_NonGS*Post	0.192	-	-0.136	-1.007	-	0.362
	(.000)		(.000)	(.000)		(.000)
Analyst Characteristics:						
RelAccuracy	0.228	0.583	0.049	0.178	-0.927	0.411
	(.004)	(.000)	(.630)	(.253)	(.141)	(.013)
AllStar	-0.021	-0.017	-0.021	0.178	-0.165	0.185
	(.409)	(.712)	(.499)	(.000)	(.476)	(.000)
Ln(Seniority)	0.08	0.008	0.057	-0.167	-0.367	-0.140
	(.000)	(.844)	(.006)	(.000)	(.036)	(.000)
Ln(Seasoning)	-0.108	-0.104	-0.066	0.130	0.548	0.112
	(.000)	(.003)	(.001)	(.000)	(.001)	(.001)
Ln(NFollow)	-0.116	-0.149	-0.071	0.115	0.127	0.071
	(.000)	(.000)	(.000)	(.000)	(.349)	(.015)
JobMove	0.071	0.026	0.099	-0.027	0.103	-0.054
	(.009)	(.588)	(.005)	(.648)	(.593)	(.408)
Stock Characteristics:						
Ln(ANF)	-0.430	-0.599	-0.286	0.143	0.021	0.172
	(.000)	(.000)	(.000)	(.002)	(.914)	(.002)
Ln(MV)	0.653	0.833	0.627	-0.650	-0.534	-0.591
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Ln(Proceeds)	0.005	-0.023	0.011	0.001	0.000	0.006
	(.365)	(.062)	(.072)	(.89)	(.991)	(.552)
InstHoldings	0.066	0.177	0.053	-0.037	-0.042	-0.022
	(.000)	(.000)	(.000)	(.016)	(.440)	(.217)

Table 6 – continued

Combined Post Effects:						
GS Banks	0.184	-	-	-0.266	-	-
	(.000)			(.000)		
NonGS Banks	0.293	-	-	-0.800	-	-
	(.000)			(.000)		
Pseudo R^2	.078	.060	.027	.112	.163	.034
N	212,107	54,219	133,483	171,542	11,111	109,467

Table 7 – Analyst Affiliation Effects and Lending

This table provides results related to the incremental effects of lending relationships on analyst affiliation bias. Panel A provides descriptive statistics for the lending variables. Panels B and C presents the results from regressions of relative recommendations on overall investment banking and lending relationship measures, and a set of control variables related to investment bank, analyst, and stock characteristics, with results for the sub-period before Global Settlement (1998-2001) in Panel B and results for the post period (2003-2009) in Panel C. *p*-values based on robust standard errors are presented in parentheses below the coefficients, where standard errors are clustered by firm. Coefficients on the control variables are not reported. Each model contains year and firm fixed effects. Variable definitions are contained in Table A1 of Appendix 1.

Panel A – Summary Statistics

	N	Mean	Median	Min	Max	Std. Dev.
IB Relationship Measures:						
IBRel_Lending (%)	216,242	2.82	0.00	0.00	1.00	14.16
IBRel_Overall (+loan) (%)	216,242	5.84	0.00	0.00	1.00	18.38
IB Characteristics:						
IB_MktShare_Lending (%)	216,242	4.56	0.74	0.00	35.92	8.29
IB_MktShare_Overall (+loan) (%)	216,242	4.58	2.05	0.00	23.83	5.50
Firm/Stock Characteristics:						
Proceeds_Lending	216,242	964.14	40.00	0.00	73,197.78	2,730.11
Proceeds_Overall (+loans)	216,242	2,538.37	375.00	0.00	251,207.45	8,315.22
Proceeds_Lending$^+$	114,659	1,818.33	675.00	0.50	73,197.78	3,536.08
Proceeds_Overall (+loans)$^+$	164,818	3,330.35	798.75	0.50	251,207.45	9,385.00

Panel B: Regression Results, 1998–2001

IBRel_GS$_{Overall}$	-	0.108	0.101	-
		(.000)	(.000)	
IBRel_NonGS$_{Overall}$	-	0.080	0.077	-
		(.023)	(.042)	
IBRel_GS$_{Lending}$	0.095	0.154	-	-
	(.008)	(.000)		
IBRel_NonGS$_{Lending}$	0.110	0.234	-	-
	(.009)	(.000)		
IBRel_GS$_{Overall}$*IBRel_GS$_{Lending}$	-	-	0.176	-
			(.000)	
IBRel_NonGS$_{Overall}$*IBRel_NonGS$_{Lending}$	-	-	0.207	-
			(.040)	
IBRel_GS$_{Overall+Lending}$	-	-	-	0.093
				(.000)
IBRel_NonGS$_{Overall+Lending}$	-	-	-	0.135
				(.000)
Adjusted R^2	.058	.050	.049	.052
N	59,703	59,703	59,703	59,703

Table 7 – continued

Panel C: Regressions Results, 2003–2009				
IBRel_GS$_{Overall}$	-	0.028 (.035)	0.026 (.068)	-
IBRel_NonGS$_{Overall}$	-	0.159 (.000)	0.152 (.000)	-
IBRel_GS$_{Lending}$	0.025 (.246)	0.072 (.001)	-	-
IBRel_NonGS$_{Lending}$	0.064 (.113)	0.069 (.109)	-	-
IBRel_GS$_{Overall}$*IBRel_GS$_{Lending}$	-	-	0.067 (.008)	-
IBRel_NonGS$_{Overall}$*IBRel_NonGS$_{Lending}$	-	-	0.082 (.201)	-
IBRel_GS$_{Overall+Lending}$	-	-	-	0.030 (.014)
IBRel_NonGS$_{Overall+Lending}$	-	-	-	0.121 (.000)
Adjusted R^2	.067	.069	.068	.067
N	136,193	136,193	136,193	136,193

APPENDIX

Table A1 – Variable Definitions

Variable		Definition
Analyst Recommendation and Global Settlement Variables:		
$RelRec_{ijkt}$	=	Relative Recommendation. The most recent recommendation issued by analyst *i* (from investment bank *j*) for firm *k* during the one-year window ending in quarter *t*, normalized by subtracting the consensus (median) recommendation across all analysts covering firm *k* (whether or not they are in our sample) in the same one-year window.
$Post_t$	=	Post Global Settlement. An indicator variable that equals one for all quarters after the Global Analyst Research Settlement and zero otherwise. Following Kadan et al. (2009), we define the beginning of the post Global Settlement period as September 2002.
IB Relationship Measures:		
$IBRelC_{jkt}$	=	Investment Bank Relationship (Continuous). The proportion of a firm *k*'s total transaction value over the 36 months ending in quarter *t* for which investment bank *j* acted as a lead or co-managing underwriter or an M&A advisor. This variable is calculated separately based on equity, debt, and M&A transactions, as well as the combined set of transactions across all three areas.
$IBRel_{jkt}$	=	Investment Bank Relationship (Dummy). A dummy variable equal to one if *IBREL* for a particular transaction category (equity, debt, M&A, lending, or overall) is positive and zero otherwise.
IB Characteristics:		
IB_Size_{jt}	=	Investment Bank Size. The number of analysts employed by investment bank *j* during quarter *t*, according to the I/B/E/S recommendations file.
$IBMktShare_{jt}$	=	Investment Bank Market Share. The proportion of total deal value in a particular transaction category (equity, debt, M&A, lending, or all four combined) during the previous 12 months for which investment bank *j* acted as lead underwriter or advisor.
IB_GS_j (IB_NonGS_j)	=	Global Settlement (Non-Global Settlement) Investment Bank. Indicator variables to identify whether or not investment bank *j* was one of the 12 investment banks included in the Global Analyst Research Settlement (including subsequent name variations as shown in Appendix Table A2). The twelve investment banks included in the Global Settlement are: Bear Stearns; Citigroup (Salomon Smith Barney); CS First Boston; Deutsche Bank; Goldman Sachs; JP Morgan; Lehman Brothers; Merrill Lynch; Morgan Stanley; Thomas Weisel, UBS Warburg; and U.S. Bancorp Piper Jaffray.
Analyst Characteristics:		
$RelAccuracy_{ijt}$	=	Relative Analyst Accuracy. The relative forecast accuracy of the analyst, as defined in Hong and Kubik (2003). For each analyst *i* following firm *k*, we first estimate the absolute value of the difference between the analyst's most recent forecast of fiscal-year earnings (issued between January 1 and July 1 of year *t*) and actual earnings, scaled by price (as of the end of year *t-1*). We then rescale such that the most accurate analyst following firm *k* scores 1 and the least accurate analyst scores 0. Finally, each analyst's relative forecast accuracy is defined as the mean score across all stocks followed by the analyst over years *t*-2 through *t*.

Table A1 continued

$AllStar_{ijt}$	=	All Star Analyst. An indicator variable that equals 1 if the analyst is a ranked as an All-Star by *Institutional Investor* magazine during year *t-1*, and 0 otherwise.
$Seniority_{ijt}$	=	Analyst Seniority. The number of years since analyst *i* first appeared in I/B/E/S.
$Seasoning_{ijt}$	=	Analyst Seasoning. The number of years since analyst *i* initiated coverage of firm *k*, according to I/B/E/S.
$NFollow_{ijt}$	=	Number of Firms Followed. The number of firms followed by analyst *i* during quarter *t*, according to I/B/E/S.
$JobMove_{ijt}$	=	Analyst Job Move. An indicator variable that equals 1 if analyst *i* changed employers during quarter *t*, according to I/B/E/S.
Stock Characteristics:		
ANF_{kt}	=	Analyst Following. The number of analysts issuing recommendations for firm *k* during the previous 12 months, according to the I/B/E/S recommendations file.
MV_{kt}	=	Market Value. The market value of equity for firm *k* at the end of year *t-1*, according to CRSP.
$DealValue_{kt}$	=	Aggregate Deal Value. The total deal value by firm *k* in a particular transaction category (equity, debt, M&A, lending, or all four combined) during the previous 36 months.
$InstHoldings_{kt}$	=	Institutional Holdings. The percentage of shares of firm *k* held by institutional investors at the end of quarter *t*, according to Thomson Reuters' 13F filings.

Table A2 – Sample Investment Banks

This table lists the investment banks included in our final sample, including all predecessor banks in the case of mergers. Investment Banks that were sanctioned in the Global Settlement and subsequent name variations that are also treated as sanctioned banks in our analysis are listed in bold type. Merrill Lynch and Lehman were included in the Global Settlement but are not included in our sample because they are missing from the I/B/E/S data for all or part of our sample period.

Ultimate IB Name	**Predecessor IBs**
Sanctioned Banks:	
Bank of America Merrill Lynch	Advest; Banc America; Bank of America; **Bank of America Merrill Lynch**
Citigroup Salomon Smith Barney	Schroder; **Salomon Smith Barney**; **Citigroup Salomon Smith Barney**
CS First Boston	DLJ; **CS First Boston**
Deutsche Alex Brown	**Deutsche Bank**; **Deutsche Alex Brown**
Goldman Sachs	**Goldman Sachs**
JP Morgan Chase	**Bear Stearns**; Chase HQ; Robert Flemming; **JP Morgan**; **JP Morgan Chase**
Morgan Stanley Dean Witter	**Morgan Stanley**; **Morgan Stanley Dean Witter**
Thomas Weisel	**Thomas Weisel**
UBS Paine Webber[a]	JC Bradford; **Paine Webber**; **UBS**; **UBS Warburg**; **UBS Paine Webber**
US Bancorp Piper Jaffray	US Bancorp; **Piper Jaffray**; **US Bancorp Piper Jaffray**
Non-Sanctioned Banks:	
ABN AMRO	ABN AMRO
BNP Paribas	Paribas; BNP Paribas
CIBC	CIBC
Commerzbank	Dresdner Kleinwort; Commerzbank
Friedman	Friedman
HSBC	HSBC
ING Barings Furman	ING Barings Furman
Lazard	Lazard
Needham	Needham
Prudential Securities	Vector Securities; Volpe Brown Whelan; Prudential Securities
Raymond James	Raymond James
RBC Capital Markets	Dain Rauscher Wessels; Ferris; Tucker Anthony Sutro; RBC Capital Markets
Robert Baird	Robert Baird
Scotia	Scotia
SG Cowen	Societe Generale; SG Cowen
Stephens	Stephens
Sun Trust Robinson	Sun Trust Equitable; Sun Trust Robinson
Wells Fargo	Black; JW Charles; Everen; First Union; First Van Kasper; Wachovia; Wachovia Corp; Wells Fargo
William Blair	William Blair

[a] In the case of UBS Paine Webber, occurrences of UBS, UBS Warburg, and Paine Webber prior to the UBS-Paine Webber merger are also classified as sanctioned banks. These three investment banks account for only 191 (0.09%) of the quarterly observations in our analysis.

Powell says duration of low interest rates 'will be measured in years'

PUBLISHED FRI, SEP 4 20203:52 PM EDT
Jeff Cox

Federal Reserve Chairman Jerome Powell, wearing a face mask, testifies before the House of Representatives Financial Services Committee during a hearing on oversight of the Treasury Department and Federal Reserve response to the outbreak of the coronavirus disease (COVID-19), on Capitol Hill in Washington, U.S., June 30, 2020.

Interest rates are likely to stay low for years as the economy fights its way back from the coronavirus pandemic, Federal Reserve Chairman Jerome Powell said in remarks published Friday afternoon.

"We think that the economy's going to need low interest rates, which support economic activity, for an extended period of time," Powell told NPR in an interview after the nonfarm payrolls report was released earlier in the day. "It will be measured in years."

The statement aligns with comments from Powell and other Fed officials over the past week or so.

In a major change to its approach to monetary policy, the central bank now has set a stated directive that inflation will be allowed to float above the Fed's 2% target for a period time after running below, as has been the case for most of the past decade.

The move effectively means that the Fed no longer will hike rates in order to head off inflation that historically had come with lower unemployment rates.

Powell called the Friday jobs repot "a good one." Nonfarm payrolls rose by 1.37 million and the unemployment rate slid to 8.4%, still higher than anything since the early days of the financial crisis recovery but a good deal better than the pandemic peak of 14.7%.

Powell again tied the progress of the economy to the coronavirus, and he encouraged following safety guidelines like wearing masks and maintaining social distancing.

"There's actually enormous economic gains to be had nationwide from people wearing masks and keeping their distance," he said.

Expectations and the Structure of Share Prices

John G. Cragg and
Burton G. Malkiel

The University of Chicago Press

Chicago and London

Table 2.16 **Analysis of Forecasts by Industrial Category: 1963 Predictions vs. 1963–68 Actual Earnings**

Pred.	Correlation	T	T^M	T^{BI}	T^{WI}	No. of Observations
1	.21	.75	.32	.23	.63	173
2	.25	.73	.31	.20	.62	171
3	.48	.66	.31	.18	.55	122
4	.75	.46	.05	.21	.41	59
5	.42	.62	.12	.17	.58	172
6	.69	.45	.07	.11	.43	37
7	.51	.58	.16	.22	.51	60
g_{p1}	.42	.65	.07	.26	.59	153
g_{p2}	.39	.71	.09	.32	.63	131
g_{p3}	.47	.66	.04	.19	.63	121
g_{p4}	.45	.77	.04	.17	.75	156

would be 4 for the most difficult industry (in years when there were four predictors compared), 8 for the next most difficult, and so on. In this case, the coefficient of concordance (Kendall's W) would be unity. The values of Kendall's W were significantly different from zero beyond the 0.05 level for most of the years as were differences between industries for the correlation coefficients for most of the predictors.[11] These findings indicate that there were industry differences. For the long-term predictions, correlation coefficients between forecasts and realizations tended to be highest in the oil, food and stores, and "cyclical" industries. For the short-term predictions, there was really no industry that was particularly easy to predict compared with the others; that is, prediction performances were uniformly mediocre across industries.

The electric utility industry turned out to be one of the more difficult industries for which to make long-term forecasts. This would come as a distinct surprise to the participating security analysts who claimed at the outset that they had some reservations about their abilities to predict earnings for the metals and other "cyclical" companies, but had confidence that they could make accurate predictions for the utilities.[12] It turned out that the long-term predictions for the utility industry were considerably worse than for the metals and "cyclicals."

In general, we had little success in associating forecasting performance with industry or company characteristics. Forecasting differences between industries were only moderately related to the average realized

11. The latter was tested on the basis of the asymptotic distribution of the correlation coefficient and the assumption that the data were distributed normally.

12. This confidence was also reflected in the fact that for the electric utility industry there was high agreement among the forecasters, whereas agreement was relatively low for the cyclical group.

The Consensus and Accuracy of Some Predictions of the Growth of Corporate Earnings
Author(s): J. G. Cragg and Burton G. Malkiel
Reviewed work(s):
Source: *The Journal of Finance*, Vol. 23, No. 1 (Mar., 1968), pp. 67-84
Published by: Blackwell Publishing for the American Finance Association
Stable URL: http://www.jstor.org/stable/2325310
Accessed: 21/06/2012 10:36

THE CONSENSUS AND ACCURACY OF SOME PREDICTIONS OF THE GROWTH OF CORPORATE EARNINGS

J. G. CRAGG* AND BURTON G. MALKIEL*

FOR YEARS ECONOMISTS HAVE EMPHASIZED the importance of expectations in a variety of problems.[1] The extent of agreement on the significance of expectations is almost matched, however, by the paucity of data that can be considered even reasonable proxies for these forecasts. One area in which expectations are highly important is the valuation of the common stock of a corporation. The price of a share is—or should be—determined primarily by investors' current expectations about the future values of variables that measure the relevant aspects of corporations' performance and profitability, particularly the anticipated growth rate of earnings per share.[2] This theoretical emphasis is matched by efforts in the financial community where security analysts spend considerable effort in forecasting the future earnings of companies they study. These forecasts are of particular interest because one can observe divergence of opinion among different individuals dealing with the same quantities. This paper is devoted to the analysis of a small sample of such predictions and certain related variables obtained from financial houses.[3]

I. NATURE AND SOURCES OF DATA

The principal data used in this study consisted of figures representing the expected growth of earnings per share for 185 corporations[4] as of the end of 1962 and 1963. These data were collected from five investment firms. The participants were recruited through requests to two organizations. One was a group of firms who used computers for financial analysis and who met periodically to discuss mutual problems, the other was the New York Society of

* University of British Columbia and Princeton University, respectively. This Research was supported by the Institute for Quantitative Research in Finance, the National Science Foundation, and the Graduate School of Business, University of Chicago. We are indebted to Paul Cootner for helpful comments.

1. A number of studies of anticipations data have been collected in two National Bureau Volumes [12] and [13]. Some more recent work on the assessment of expectations or forecasts has been done by Zarnowitz [16].

2. The classic theoretical statement of the anticipations view of the determination of share valuation may be found in J. B. Williams [15]. This position is also adopted in the standard textbook in the field [3]. The emphasis on the importance of earnings growth may also be found in [4], [5], and [19].

3. One of the few attempts to conduct a study of this type was made by the Continental Illinois Bank and Trust Company of Chicago [1] in 1963. The bank collected a sample of earnings estimates one year in advance from three investment firms. An analysis of these projections revealed that the financial firms tended to overestimate earnings and that over-all quality of the estimates tended to be poor.

4. The 185 companies for which the growth-rate estimates were made tended to be the large corporations in whose securities investment interest is centered. This selection was made on the basis of availability of data and was not chosen as a random sample.

Financial Analysts. As a result, eleven firms agreed to participate in the proposed study. From the original eleven, however, only five were able to supply comparable sets of long-term earnings forecasts for use in this study.[5] Even among these five there was not complete overlap in the corporations for which predictions were available. One of them had no data for 1962. For only two were data available for the full set of 185 companies.

Of the five participating firms, two are large New York City banks heavily involved in trust management, one is an investment banker and investment adviser doing mainly an institutional brokerage business, one is a mutual fund manager, and the remaining firm does a general brokerage and investment advisory business. We would not argue that these estimates give an accurate picture of general market expectations. It would, however, seem reasonable to suggest that they are representative of opinions of some of the largest professional investment institutions and that they may not be wholly unrepresentative of more general expectations. Since investors consult professional investment institutions in forming their own expectations, individuals' expectations may be strongly influenced—and so reflect—those of their advisers.[6] Also, insofar as investors follow the same sorts of procedures as those used by security analysts in forming expectations, the investors' expectations would resemble those of the analysts. It should be noted, however, that security analysts are not limited to published data in forming their expectations. They frequently visit the companies they study and discuss the corporations' prospects with their executives.

Each growth-rate figure was reported as an average annual rate of growth expected to occur in the next five years. At first thought, such a rate of growth depends on what earnings are expected to be in five years' time and on the base-year earnings figures. However, this dependence need not be very great if the growth rate is regarded more as a parameter of the process determining earnings than as an arithmetic quantity linking the current value to the expected future value. Discussion with the suppliers of the data indicated that all firms were attempting to predict the same future figure, the long-run average ("normalized") earnings level, abstracting from cyclical or special circumstances. The bases used were less clear. Some firms explicitly used their estimates of "normalized" earnings during the year in which the prediction was made. Others provided different figures as bases: in one case the firm estimated actual earnings, in another a prediction of earnings four years in the future was furnished. These differences did not seem to be reflected in the growth rates, however, since attempts to adjust the rates for differences in

5. We are deeply grateful to the participating firms, who wish to remain anonymous. Not all volunteers were able to supply data useful to this study, either because the actual supply of data would have been too burdensome (being kept for internal records in a form that made their extraction difficult) or because the data supplied were not comparable to data used here (either being of a short-term nature or being made at different dates). Because one of our main objectives is to examine differences and similarities in predictions of the same quantities, such data were not used in the present paper.

6. That several of our participating firms find it worthwhile to publish these projections and provide them to their customers provides *prima facie* evidence that a certain segment of the market places some reliance on such information in forming its own expectations.

base figures introduced rather than removed disparities among the predictions.

The growth rates were given as single numbers for each corporation. No indication was provided of the confidence with which these point estimates were held. One firm did provide an instability index of earnings which represented a measure of the past variability of earnings (around trend) adjusted by the security analyst to indicate potential future variability. Moreover, two firms provided quality ratings, which classified companies into three or four quality categories.

Two of the firms provided estimates of past growth rates as well as predictions. The figures represented perceived growth over the past 8-10 years, the past 4-5 years, the past 6 years, and the last year. It may seem unnecessary to rely on the participating firms for estimates of historic growth rates. However, the past growth of a company's earnings is not, in any meaningful sense, a well-defined concept. Earnings—being basically a small difference between two large quantities—can exhibit large year-to-year fluctuations. They also can be negative, which creates problems for most mechanical calculations. In addition, the accounting definition of earnings is not an exact conformity with the economically relevant concept of profits or return on investors' capital. For these reasons, calculated growth rates are sensitive to the particular method employed and the period chosen for the calculation. Consequently, such calculations may be a poor reflection of what growth is generally considered to have been, and may not be useful in assessing the past performance of corporations. Furthermore, it may be supposed that in assessing security analysts' predictions of growth their own estimates of past growth are more likely to be relevant than objectively calculated rates. The extent of agreement among the two types of measures is among the subjects considered in the next section.

Our participating firms also supplied an industrial classification. While other classifications are available, the concept of industry is not really precise enough to get a fixed, unquestionable assignment of corporations to industries. Particular problems are presented by conglomerate companies. Perceived industry may be more relevant than any other grouping when investigating anticipations. The classification we use represents a consensus about industry among our participants. Where disagreements occurred (as was often the case with conglomerates), the corporation was simply classified as "miscellaneous." The classification represented considerable aggregation over finer classifications and only eight industries were distinguished. These were:

1) Electricals and Electronics
2) Electric Utilities
3) Metals
4) Oils
5) Drugs and Specialty Chemicals
6) Foods and Stores
7) "Cyclical"—including companies such as automobile and aircraft manufacturers, and meat packers
8) "Miscellaneous"

II. Agreement among Predictors

The agreement among the growth-rate projections is described and summarized in this section. In the course of this description, the extent of agreement about base-earnings figures and the closeness of the projections to past, perceived, and calculated growth rates are also considered.

A. *Comparisons of Predictions of Future Growth Rates.*

The extent of agreement among the predictors about future growth rates is summarized in Table 1. Of the five predictors, the correlations among predictors A, B, C and E were all roughly of the same orders of magnitude.[7] Predictor D showed some tendency towards lower agreement. (Predictor D also had the highest average growth forecast and standard deviation for the companies for which it and others made forecasts.) Over-all agreement among

TABLE 1
Agreement Among Growth-Rate Predictions*

I. Correlation Coefficients
(Simple correlations in lower left portion, Spearman rank correlations in upper right portion)

	1962					1963				
	A	B	C	D		A	B	C	D	E
A	1.000	.768	.751	.388	A	1.000	.795	.717	.374	.709
B	.840	1.000	.728	.597	B	.832	1.000	.760	.518	.821
C	.889	.819	1.000	.690	C	.854	.764	1.000	.750	.746
D	.563	.621	.848	1.000	D	.537	.567	.898	1.000	.450
					E	.827	.835	.889	.704	1.000

II. Kendall's Coefficient of Concordance for Ranks of Companies by Different Predictors

Predictors	(A,B,C)	(A,B,D)	(A,B,C,D)	(A,B,C,D,E)
1962	.82	.73	.78	
1963	.83	.71	.81	.79

III. Proportions of Total Variance Due to Variance in Average Predictions

Predictors	(A,B,C)	(A,B,D)	(A,B,C,D)	(A,B,C,D,E)
1962	.87	.70	.79	
1963	.85	.68	.83	.87

* The numbers of observations on which this table and other tables are based varies between cells. For the correlations, the numbers of observations are reported below:

	1962				1963			
	A	B	C		A	B	C	D
B	185			B	185			
C	60	60		C	62	62		
D	178	178	58	D	182	182	61	
				E	125	125	39	124

For other comparisons, the number of observations is the minimum of the numbers of observations used to compute the correlations.

7. The analysis is presented mainly for the raw growth figures, but very similar impressions would be obtained from examining their logarithms.

the predictors is further summarized in the second and third parts of Table 1, which show the values of Kendall's coefficient of concordance and the proportion of total variance of the predictions that can be accounted for by differences in the mean prediction among companies.[8] It may be remarked that the entries in Table 1 are based on different numbers of observations. In each case, we used the maximum number of observations (companies) for which a comparison could be made. The impressions to be gained from Table 1 would be little changed, however, by basing all calculations only on the set for which all predictors provided data.

Though Table 1 suggests considerable agreement, the lack of agreement it also reveals can hardly be considered negligible. In addition to the lack of correlation, there were also some systematic differences among the predictors. For the matched set of observations the means and the standard deviations were of roughly the same sizes. However, the differences among the central tendencies were significant according to both parametric and nonparametric tests.

B. *Analysis of Predictions Within Industrial Classifications.*

One might suspect that the correlations among the predictors reflect little more than consensus about the industries that are expected to grow most rapidly rather than agreement about the relative rates of growth of firms within industries. This possibility was investigated by decomposing the correlation coefficients into two parts, one due to correlation within industries (r_w) and one due to correlation among the industry means (r_a).

$$r = r_w + r_a$$

where

$$r_w = \frac{\sum_{j=1}^{J}\sum_{i=1}^{N_j}(x_{ij}-\bar{x}_j)(y_{ij}-\bar{y}_j)}{\sqrt{\sum_{j=1}^{J}\sum_{i=1}^{N_j}(x_{ij}-\bar{x})^2\sum_{j=1}^{J}\sum_{i=1}^{N_j}(y_{ij}-\bar{y})^2}},$$

and

$$r_a = \frac{\sum_{j=1}^{J}N_j(\bar{x}_j-\bar{x})(\bar{y}_j-\bar{y})}{\sqrt{\sum_{j=1}^{J}\sum_{i=1}^{N_j}(x_{ij}-\bar{x})^2\sum_{j=1}^{J}\sum_{i=1}^{N_j}(y_{ij}-\bar{y})^2}}$$

with

8. The values shown in all parts of Table 1 are significant well beyond the conventionally used levels of significance. We may note that Tukey's test for interaction in a two-way analysis of variance [11, pp. 129-37]—the typical model in which the breakdown of variance used in Part 3 of Table 1 is employed—indicated a small but highly "significant" proportion of variance attributable to interaction. However, the usual analysis-of-variance model does not seem appropriate for this data, not only because of interactions, but also because of possible lack of homogeneity of variance.

x_{ij}, y_{ij} being the i^{th} observations in the j^{th} class (industry),
N_j being the number of observations in the j^{th} class,
J being the number of classes,
$\bar{x}_j$, $\bar{y}_j$ being the averages within the classes, and
$\bar{x}$, $\bar{y}$ being the over-all averages.

This decomposition indicated that agreement concerning industry growth rates is not the major factor accounting for the correlations among the forecasts. The first part of Table 2 shows the values of r_a using the industrial classification obtained from the participating firms. As comparison with Table 1 shows, only a small part of the correlations among the predictions are due to correlations among the industry means. Further light can be shed on this question by calculating the partial correlations between the predictions, holding industry classification constant. The second panel of Table 2 reveals

TABLE 2
INDUSTRIAL CLASSIFICATION AND AGREEMENT AMONG PREDICTORS

I. Values of r_a

	1962 A	1962 B	1962 C		1963 A	1963 B	1963 C	1963 D
B	.299			B	.305			
C	.285	.323		C	.230	.315		
D	.090	.184	.300	D	.057	.137	.317	
				E	.266	.348	.366	.194

II. Partial Correlations Holding Industrial Classification Constant

	1962 A	1962 B	1962 C		1963 A	1963 B	1963 C	1963 D
B	.799			B	.786			
C	.861	.760		C	.838	.690		
D	.656	.665	.887	D	.657	.650	.861	
				E	.828	.790	.897	.777

that these partial correlations tended to be only slightly less than the simple correlations and, in the case of Predictor D, the partial correlations were actually higher.

It is also interesting to examine the extent to which the correlations among predictors' forecasts varied over the different industry groups. This should indicate whether certain industry groups are more difficult to forecast in an *ex ante* sense. The correlations among forecasters tended to be lowest in the oil and cyclical industry groups, and highest for electric utility companies. These differences were significant for all pairs of predictions considered. Ranking the correlations over industries, and then comparing these ranks among pairs of predictors, showed substantial concordance over the ordering of the correlations.[9]

9. The test for individual pairs of predictions was the likelihood-ratio test. Note that the ranking comparison is not based on independent observations so a statistical test of the concordance is not appropriate. This suggests that the "significance" of the over-all correlations mentioned earlier should really be treated only as descriptive indications of their sizes. The hypothesis that

C. *Comparisons of Predictions and Past Growth Rates.*

The extent of agreement among the predictors can usefully be evaluated by comparisons of the predicted growth rates with earlier predictions and with the past growth rates of earnings. The correlations of the 1963 predictions with the 1962 ones were: .94, .95, .96, and .88 for predictors A through D respectively. All of these are considerably higher than the correlations of the predictions with each other. On the other hand, changes in expected growth rates were not highly correlated among predictors.[10]

TABLE 3
PREDICTIONS AND PAST GROWTH RATES*
(CORRELATIONS OF PREDICTED WITH PAST GROWTH RATES)

	1962				1963				
	A	B	C	D	A	B	C	D	E
g_{p1}	.78	.68	.75	.41	.85	.73	.84	.56	.67
g_{p2}	.75	.67	.72	.51	.79	.69	.80	.58	.76
g_{p3}	.77	.71	.82	.61	.75	.72	.79	.70	.74
g_{p4}	.34	.37	.59	.44	.33	.45	.70	.75	.58
g_{c1}	.55	.46	.65	.32	.63	.52	.61	.30	.58
g_{c2}	.67	.60	.68	.18	.72	.58	.73	.20	.56
g_{c3}	.75	.63	.73	.17	.79	.66	.76	.17	.57
g_{c4}	.82	.68	.79	.24	.83	.69	.79	.29	.60

* g_{p1} is 8-10 year historic growth rate supplied by A
g_{p2} is 4-5 year historic growth rate supplied by A
g_{p3} is 6 year historic growth rate supplied by D
g_{p4} is preceding 1 year growth rate supplied by D
g_{c1} is log-regression trend fitted to last 4 years
g_{c2} is log-regression trend fitted to last 6 years
g_{c3} is log-regression trend fitted to last 8 years
g_{c4} is log-regression trend fitted to last 10 years.

Correlations of the predictions with eight past growth figures are shown in Table 3. Four of these past growth rates were supplied by the participating firms and represent the firms' perceptions of the growth of earnings per share that had occurred in different preceding periods. The others were calculated as the coefficient in the regression of the logarithms of earnings per share on time over the past 4, 6, 8, and 10 years. These correlations generally are not much lower than those found in comparing the predictions with each other. Among the perceived past growth rates, the correlations are apt to be lowest with the growth rates over the most recent year. With the calculated growth rates, there

the correlations are all zero within industries could, however, be rejected well beyond conventional significance levels. Predictor C was dropped from these tests due to paucity of data in many industries.

10. These correlations, for the participants supplying data in both years were:

	A	B	C
B	.19		
C	.04	.04	
D	.07	.11	.29

Only the two largest of these correlations would be significant at the .05 level.

was a tendency for the correlations to increase with the length of period over which the calculations were made.[11]

These comparisons of past with predicted growth rates suggest that the apparent agreement among the predictors may reflect little more than use by all of them of the historic figures. In investigating this possibility, the partial correlations among the predictions, holding constant past perceived growth rates, holding constant past calculated growth rates, and holding both sets constant were calculated. The first two sets of partial correlations were not much smaller than the simple correlations. Holding both sets constant produced the partial correlations shown in Table 4. These are considerably

TABLE 4
PARTIAL CORRELATIONS OF PREDICTIONS
HOLDING PAST GROWTH RATES CONSTANT

	1962				1963			
	A	B	C		A	B	C	D
B	.49			B	.49			
C	.49	.18		C	.25	.03		
D	.35	.39	.22	D	.56	.46	.40	
				E	.56	.62	−.11	.51
				NUMBERS OF OBSERVATIONS				
	1962				1963			
	A	B	C		A	B	C	D
B	111			B	112			
C	49	49		C	50	50		
D	111	111	49	D	112	112	50	
				E	78	78	36	78

smaller than the simple correlations, though all but the four smallest entries would be significant beyond the .05 level. Thus, while a substantial part of the agreement among predictors appears to result from their use of historic growth figures, there is also evidence that security analysts tend to make similar adjustments to the past growth rates.[12]

Examination of the correlations among past growth rates help both to evaluate the correlations among the predictions and to indicate the sensitivity of measurements of growth rates to the methods by which they were calculated. Table 5 presents correlations between 13 such past growth rates for our 1962 data. The correlations between the different measures of past growth are fairly low. When exactly the same data are used in the calculations, however, the

11. This effect was also found when the calculated growth rates were based on either 1) the regression of earnings per share on time; or, 2) the appropriate root of the ratio of earnings per share at the end of the period to earnings at the beginning.

12. The numbers of observations on which Table 4 is based are considerably smaller than those for which predictions were available. Only a small part of this loss was due to inability to calculate past growth rates due to negative earnings figures. Much more important was the fact that the predictors did not give numerical figures for past growth rates when these would be negative. One might think that the companies for which past growth rates were easily calculated would be ones with highest simple correlations among the predictors. However, the only cases for which this appeared to be true were the correlations of predictor D with A, B, and E.

correlations among the growth rates calculated by different methods are relatively high, though probably not so high that the choice of method of calculation would be a matter of no importance. Finally, the perceived growth rates furnished by the security firms tend to be more highly correlated with the growth rates calculated over longer periods. The increase in correlation coefficients did not continue, however, when calculations over more than ten years were made and, as shown in Table 5, it stopped before ten years in some cases. Correlations for other periods and for the 1963 data were of about the same magnitude as those in Table 5.

TABLE 5
PAST GROWTH CORRELATIONS, 1962*

	g_{p1}	g_{p2}	g_{p3}	g_{p4}	g_{c1}	g_{c2}	g_{c3}	g_{c4}	g_{c5}	g_{c6}	g_{c7}	g_{c8}
g_{p2}	.70											
g_{p3}	.82	.87										
g_{p4}	.49	.39	.37									
g_{c1}	.34	.47	.48	.15								
g_{c2}	.68	.74	.76	.05	.62							
g_{c3}	.81	.89	.97	.15	.49	.90						
g_{c4}	.93	.80	.87	.27	.41	.75	.93					
g_{c5}	.14	.19	.25	.39	.38	.24	.16	.15				
g_{c6}	.34	.46	.47	.14	.96	.59	.45	.37	.53			
g_{c7}	.92	.67	.78	.32	.48	.67	.83	.95	.33	.46		
g_{c8}	.36	.56	.49	.23	.99	.63	.50	.43	.40	.90	.51	
g_{c9}	.87	.75	.88	.18	.46	.77	.93	.99	.17	.40	.91	.43

* $g_{p1} - g_{p4}$, $g_{c1} - g_{c4}$ as defined in footnote to Table 3

g_{c5} is 1 year growth rate calculated from first differences of logarithm

g_{c6} is 4 year growth rate calculated from average of first differences of logs

g_{c7} is 10 year growth rate calculated from average of first differences of logs

g_{c8} is 4 year growth rate calculated from regression of earnings on time

g_{c9} is 10 year growth rate calculated from regression of earnings on time

D. *Comparisons of Predictions with Price-Earnings Ratios.*

Finally, we may examine the extent of agreement among predictors by comparing their forecasts with the price-earnings ratios of the corresponding securities. By utilizing a normative valuation model (see e.g., [4] or [8]) it is possible to calculate an implicit growth rate from the market-determined earnings multiple of a security. Thus, comparisons of the predictions with price-earnings ratios may be interpreted as examinations of the relationship between the forecasts and market-expected growth rates. Correlations with two versions of the price-earnings ratio are shown in Table 6. The prices used were the closing prices for the last day of the year. The earnings were either the actual earnings or the average of the base-earnings figures supplied by A and B for their growth rates. These latter figures represent "normalized" or trend-earnings figures. Specifically, they represent an attempt to estimate what earnings would be in the absence of cyclical or special factors. The correlation coefficients in the table are about the same as those obtained when the forecasts were compared with each other. Since price-earnings ratios are

TABLE 6
CORRELATIONS OF PREDICTIONS WITH PRICE-EARNINGS RATIOS*

	1962				
	A	B	C	D	
P/E	.76	.80	.86	.56	
P/NE	.82	.83	.83	.55	
	1963				
	A	B	C	D	E
P/E	.77	.74	.86	.67	.85
P/NE	.81	.76	.80	.60	.85

* P/E is the price/earnings ratio. P/NE is price/average of base (normalized) earnings of A and B.

affected by several variables other than expected growth rates, this exercise underscores the extent of disagreement among the forecasters.

III. ACCURACY OF PREDICTIONS

In assessing the forecasting abilities of the predictors, we encountered one major difficulty. The five years in the future for which the forecasts were made have not yet elapsed. As a result, we were forced to compare the forecasts with the realized growth of actual and normalized earnings (as estimated by Predictors A and B) through 1965. Since the latter figures represent what earnings are thought to be on their long-run growth path, perhaps not too much violence is done to the intentions of the forecasters by making these a standard of comparison.

A. *Method of Evaluation.*

The forecasts were evaluated by the use of simple correlations and by the inequality coefficient,[13]

$$U^2 = \frac{\Sigma(P_i - R_i)^2}{\Sigma R_i^2}, \qquad (1)$$

where P_i is the predicted and R_i the realized growth rates for the i^{th} company. It will be noticed that the inequality coefficient, in effect, gives a comparison between perfect prediction ($U^2 = 0$) and a naive prediction of zero growth for all corporations ($U^2 = 1$).

We also investigated the extent to which errors in predictions were related to 1) errors in predicting the average over-all earnings growth of the sample firms; 2) errors in predicting the average growth rate of particular industries; and 3) errors in predicting the growth rates of firms within industries. To accomplish this, we decomposed the numerator of (1) into three parts. The first comes from the average prediction for all companies not being equal to the average realization. The second part arises from differences among the

13. Note that this is similar to the inequality coefficient introduced by Theil [14].

average industry predictions not being equal to the corresponding differences in industry realizations. The third arises from the differences in predictions for the corporations within an industry not being the same as the differences in realization.[14] The proportions of U^2 arising from these three sources will be called U^M, U^{BI}, and U^{WI} respectively for mean errors, between-industry errors, and within-industry errors.

B. *Over-all Accuracy of the Forecasts.*

Statistics summarizing the forecasting abilities of the predictors and the success of using perceived past growth rates to predict the future are presented in Table 7. By and large, the correlations of predicted and realized growth rates are low, though most of them are significantly greater than zero, and the inequality coefficients are large. The major exception to this is Predictor C's forecasts. However, this apparent superiority is largely illusory since C tended to concentrate on large, relatively stable companies and, we suspect, predictions were made only when there was *a priori* reason to believe that the forecasts would be reliable. That this conjecture has some validity is borne out by the fact that the set of companies for which C made forecasts had a lower average instability index than did our whole sample. Moreover, all the other forecasts, including the perceived past growth rates, did better for this set of companies than for the larger set.[15]

Several additional points about the over-all accuracy of the forecasts are worth mentioning. First, the forecasts based on perceived past growth rates, including even growth over the most recent year, do not perform much differently from the predictions. There seems to be no clear-cut forecasting advantage to the careful and involved procedures our predictors employed over their perceptions of past growth rates either in terms of correlation or of the inequality coefficient.

Second, all predictors had a better record than the no-growth forecast for each company. However, it is possible to find a single growth rate that would yield lower mean square errors than any of the predictions. This is a result of the average realized growth rates being considerably higher than the average

14. Letting P_{kj} and R_{kj} be the predicted and realized growth rates for the k^{th} company ($k = 1, \ldots, N_j$) in the j^{th} industry ($j = 1, \ldots, J$), we can write the numerator of (1) as:

$$\sum_{j=1}^{J}\sum_{k=1}^{N_j}(P_{kj}-R_{kj})^2 = \left[\sum_{j=1}^{J} N_j(\bar{P}-\bar{R})^2\right] + \left[\sum_{j=1}^{J} N_j\{(\bar{P}_j-\bar{P})-(\bar{R}_j-\bar{R})\}^2\right]$$
$$+\left[\sum_{j=1}^{J}\sum_{i=1}^{N_j}\{(P_{kj}-\bar{P}_j)-(R_{kj}-\bar{R}_j)\}^2\right],$$

when $\bar{P}_j$, $\bar{R}_j$ are the averages for the j^{th} industry and $\bar{P}$ and $\bar{R}$ are the overall means. The three terms in square brackets are the ones referred to in the text.

15. For this smaller group of companies, the differences among predictors was far less than is suggested by Table 7. It is worth noting that C had a higher correlation and lower inequality index than the others in 1962 (with D a very close second), but both D and E were slightly better on the matched set in 1963.

TABLE 7

ACCURACY OF PREDICTIONS

I. 1962 Predictions Compared with Growth of Actual Earnings 1962-1965

Predictor	A	B	C	D	g_{p1}	g_{p2}	g_{p3}	g_{p4}
Correlation	.07	.16	.66	.45	.22	—.01	.23	.16
U	.80	.78	.57	.67	.74	.88	.74	.78
U^M	.31	.32	.20	.24	.17	.12	.10	.20
U^{BI}	.11	.10	.08	.06	.11	.04	.04	.12
U^{WI}	.58	.58	.71	.70	.73	.84	.75	.68
Number of Observations	185	185	60	178	168	140	140	145

II. 1962 Predictions Compared with Growth of Normalized Earnings 1962-1965

Predictor	A	B	C	D	g_{p1}	g_{p2}	g_{p3}	g_{p4}
Correlation	.26	.32	.68	.45	.23	.16	.38	.09
U	.74	.72	.57	.62	.72	.80	.67	.76
U^M	.25	.25	.08	.13	.09	.12	.09	.19
U^{BI}	.07	.06	.06	.08	.08	.07	.05	.08
U^{WI}	.68	.69	.86	.79	.83	.80	.86	.73
Number of Observations	180	180	59	175	164	136	138	142

III. 1963 Predictions Compared with Growth of Actual Earnings 1963-1965

Predictor	A	B	C	D	E	g_{p1}	g_{p2}	g_{p3}	g_{p4}
Correlation	.05	.16	.78	.47	.29	.20	.31	.22	.55
U	.85	.84	.59	.73	.81	.78	.75	.77	.62
U^M	.33	.34	.27	.28	.40	.20	.19	.16	.27
U^{BI}	.12	.11	.11	.07	.11	.09	.06	.06	.05
U^{WI}	.54	.55	.62	.66	.49	.70	.74	.79	.69
Number of Observations	185	185	62	182	125	167	143	138	169

IV. 1963 Predictions Compared with Growth of Normalized Earnings 1963-1965

Predictor	A	B	C	D	E	g_{p1}	g_{p2}	g_{p3}	g_{p4}
Correlation	.27	.29	.70	.34	.49	.36	.52	.41	.32
U	.78	.78	.61	.70	.74	.69	.64	.67	.69
U^M	.35	.35	.22	.23	.40	.22	.33	.23	.12
U^{BI}	.07	.06	.08	.09	.09	.08	.09	.05	.06
U^{WI}	.58	.59	.70	.68	.50	.70	.57	.72	.82
Number of Observations	180	180	61	177	123	163	139	136	165

expectation of each predictor. This may simply indicate a failure to anticipate the continuation of the expansion through the period considered, but it may also reflect the underestimation of change frequently found in investigating forecasts.[16]

Third, with the exception of the past growth rate in the year immediately preceding the forecast date, all predicted and perceived past growth rates were better at predicting the average normalized growth rates than the actual ones. However, whether this is because normalized earnings gave a better picture

16. See, for example, Zarnowitz [16]. Since almost all the actual growth rates were positive, we do not know whether underestimation of change would also characterize predictions when earnings were generally declining. No forecasters predicted a negative rate of growth.

of the true growth of corporations or because normalized earnings calculations are influenced by past growth-rate forecasts is open to question.

C. *Analysis of the Forecasts by Industrial Categories.*

Turning to the industry breakdown of the forecasts, we find that failure to forecast industry means (U^{BI}) accounted for only a very small proportion of the inequality coefficient. The main sources of inequality were the within-industry errors.

Looking at the correlations of predictions with future growth rates within industries permits us to assess which industries were most difficult to forecast in an *ex post* sense. The extent to which forecasters found the various industries difficult to predict is indicated in Table 8. To calculate the table, we first ranked each predictor's correlation coefficients between his forecasts and realizations over the eight industry groups. The industry for which the predictor had the most difficulty (worst correlation) was given a rank of one. In Table 8, we present the sums of the ranks for each industry over the four predictors.[17] If the difficulty ranking for all predictors was identical, the rank totals would be 4 for the most difficult industry (in 1963 when there are four predictors compared), 8 for the next most difficult, etc., and the coefficient of concordance (Kendall's W) would be unity. For each of the sets presented, the values of Kendall's W are significant (beyond the .05 level) as were the differences between industries for the correlation coefficients for each predictor.[18] Correlation coefficients between forecasts and realizations tended to

TABLE 8
RANK SCORES OF CORRELATIONS OF PREDICTIONS AND REALIZATIONS SUMMED OVER PREDICTORS*

	1962-65 Growth of Actual Earnings	1962-65 Growth of Normalized Earnings	1963-65 Growth of Actual Earnings	1963-65 Growth of Normalized Earnings	Total
Industry					
1)	20	23	20	28	91
2)	18	22	14	25	79
3)	9	11	24	14	58
4)	10	10	8	7	35
5)	5	7	24	26	62
6)	8	5	5	10	28
7)	14	15	20	20	69
8)	24	15	29	14	82
Kendall's W	.76	.74	.72	.65	.32

* Entries are sums of ranks over predictors for correlations of predictions with growth rates indicated in column headings.

17. Predictor C could not be included in this calculation because of a lack of observations in some industries.

18. The latter, however, was tested only on the basis of the asymptotic distribution of the correlation coefficient and the assumption that the data were distributed normally.

be highest in industries (1) electricals and electronics, (8) "miscellaneous," and (2) electric utilities; they were lowest in (6) foods and stores and (4) oils. Industry (5) drugs, showed very low correlations for the 1962 predictions and high ones for the 1963 predictions. Similar patterns emerged, though more weakly, when perceptions of past growth rates over more than one year were used as forecasts. It is interesting to note that certain industries which were "difficult to forecast" in an *ex ante* sense (see Section II. B) actually turned out to be difficult to predict, *ex post*. For example, there was high (low) agreement among predictors concerning the growth rates for the electric utilities (oils) and also high (low) correlation between predictions and realizations.

In general, we had little success in associating forecasting success with any industry or company characteristics. The differences between industries in forecasting success were only moderately related either to the average growth rates to be realized or to the variances of the realized growth rates. Two of the industries where the highest correlations were found, industries (1) and (2), had respectively the highest and the lowest average growth rates and variances. The third industry where success occurred, (8), fell in the middle range for both quantities. The rank-totals of the last column of Table 8 had a rank correlation with the rank-totals for average growth rates of .14 and of .37 with the rank-totals for the variances.

To further investigate how forecasting ability was related to company characteristics, the corporations were classified according to the quality ratings supplied by two of the predicting firms. There was a tendency for the correlations to be lowest (and negative) in the poorest-quality grouping, but they did not get systematically higher with quality, the highest correlations tending to occur in the middle classes. Similarly, classifying by high, low, or medium values of the instability index showed no pronounced differences in performance. The forecasting performances were again worst for the lowest-quality corporations and best in the middle category. When the corporations were classified by high, medium, or low price-earnings multiple, or past growth rate of earnings, or future growth rates of earnings, sales or assets, no pronounced or significant patterns emerged.

IV. An Appraisal of the Forecasts

The rather poor over-all forecasting performances of the predictors and the fact that their past perceptions of growth rates were about as reliable forecasts as their explicit predictions raises two questions: 1) Does any naive forecasting device based on historic data yield as good forecasts as the painstaking efforts of security analysts? 2) Is it the basically volatile nature of earnings that explains our results and would the predictions appear more accurate if they were taken to be forecasts of more stable measures of the growth of corporations?

To investigate the first of these questions, past growth rates calculated on the basis of arithmetic and logarithmic regressions and on the geometric means of first ratios, calculated over periods up to 14 years, were compared with

TABLE 9
CORRELATIONS OF CALCULATED PAST GROWTH RATES ON REALIZATIONS*

	Growth of Actual Earnings 1962-65	Growth of Normalized Earnings 1962-65	Growth of Actual Earnings 1963-65	Growth of Normalized Earnings 1963-65
	I. Correlations			
g_{c1}	.03	.42	.01	.26
g_{c2}	—.15	.19	—.15	.06
g_{c3}	—.13	.15	—.16	.02
g_{c4}	—.10	.09	—.11	—.02
g_{c5}	.22	.62	.18	.46
g_{c6}	.12	.51	.06	.34
g_{c7}	.01	.24	—.01	.12
g_{c8}	—.02	.37	—.03	.23
g_{c9}	—.12	.09	—.14	—.01
	II. Inequality Coefficients			
g_{1c}	.93	.79	.93	.85
g_{c2}	1.03	.95	1.01	.96
g_{c3}	.95	.88	.96	.91
g_{c4}	.88	.82	.90	.86
g_{c5}	1.27	1.22	1.11	1.08
g_{c6}	.89	.73	.90	.80
g_{c7}	.83	.75	.86	.80
g_{c8}	.98	.85	.96	.87
g_{c9}	.89	.83	.91	.86

* For definition of g's see footnote to Table 5.

the realized growth rates through 1965. A selection of these comparisons based on data ending in 1962 is found in Table 9.[19]

It is interesting to note first that the calculated growth rates tend to be more closely correlated with the growth rates of normalized earnings than with the growth rates of actual earnings. This is an even more pronounced feature of the calculated growth rates than of the data considered earlier. Second, while the correlations of the calculated growth rates with the realized growth rates tended to be lower than those found for the predictions and perceptions, and fewer of them differed significantly from zero, these differences are not pronounced. However, unlike the earlier data, the calculations seem to have almost no forecasting ability, a finding similar to that of I. M. D. Little [7] for British corporations. Among the calculated rates, those for shorter periods of time tend to be somewhat better in terms of correlation than those for longer ones, a feature highlighted by the strong showing of the growth rates calculated over only one year (g_{c5}). Third, while one would have expected that extrapolations using as the last year for the calculation the same year that is used for the first year in calculation of the realization would have a lower correlation than extrapolations where the data ended a year earlier, in

19. The figures there are typical both of what was found when other periods were used and of the comparisons of calculations ending in 1961 and 1963 with the perceived growth after 1962 and 1963 respectively.

fact the reverse tendency manifested itself. Finally, among the possible ways of calculating growth rates, those based on the geometric means of the first ratios surpassed those based on regressions.

The superiority of the past perceived growth rates over the calculated ones should not be taken too seriously, however, for it was largely due to the fact that negative perceived growth rates were not reported by our participants. The survey respondents only indicated that the rates were negative. As a result, companies for which this was true had to be dropped from the sample when correlations of realized with perceived past growth rates were made. When we dropped the companies whose past calculated growth rates were negative (in order to put the calculated and perceived growth rates on a similar basis), the correlation coefficients of the calculated with the realized growth rates were raised. For example, with this change the first row of Table 9 would read

.30 .53 .17 .42

which compares favorably with the data in Table 7. Similar improvements occurred using the other types of calculated growth rates.

The possibilities of obtaining useful forecasts from simple extrapolation were also examined by calculating growth rates over the four preceding years[20] for (1) earnings plus depreciation, (2) earnings before taxes, (3) sales, (4) assets, and (5) share prices. The correlations of these growth rates calculated to the end of 1962, both with 1962-1965 and 1963-1965 earnings growth and the growth rates of the same variables, are shown in the first five rows of Table 10. It will be noticed that both the levels and the variation of these correlation coefficients are quite similar to those found for the predictions and perceptions of past growth and the equivalently calculated past growth rates of earnings. There was also no marked tendency for the extrapolations to do better at predicting their own growth rates than the growth rates of normalized earnings, but they tended to be better at predicting their own rates than the growth of actual earnings.

The last two rows of Table 10 show the correlations of the price-earnings ratio and the price-to-normalized-earnings ratio with the actual future growth of earnings. As mentioned earlier, these ratios have implicit in them a forecast of the rate of growth anticipated by the market. We find that, in terms of correlation, the market-determined earnings multiples perform no differently from the other predictors we have considered.

A similar picture emerged when the predictions and perceptions of growth rates of earnings were used to predict the growth that would occur in these same variables through the end of 1965. With the exception of the growth of price, the performance of the predictions and perceptions were about the same in terms of correlation as those shown when they were used to forecast the growth of normalized earnings. The inequality coefficients were, if anything, slightly lower. For price growth, however, these forecasts had virtually

20. Other periods and methods of calculating growth rates were also used. The ones presented tended to be very slightly better than the others and are comparable to the most successful of the longer-term earnings extrapolations.

TABLE 10
EXTRAPOLATIONS FROM OTHER SERIES AS PREDICTORS OF EARNINGS AND OWN GROWTH RATES*
(CORRELATION COEFFICIENTS)

	Growth of Actual Earnings 1962-65	Growth of Normalized Earnings 1962-65	Growth of Actual Earnings 1963-65	Growth of Normalized Earnings 1963-65	Growth Rate of Corresponding Variable 1962-65	Growth Rate of Corresponding Variable 1963-65
g_{e1}	.11	.39	.05	.27	.28	.20
g_{e2}	.29	.21	.42	.30	.24	.38
g_{e3}	.23	.37	.15	.29	.39	.31
g_{e4}	.29	.46	.47	.60	.63	.27
g_{e5}	.04	.34	—.03	.20	—.06	.05
P/E	.21	.25	.13	.18	—	—
P/NE	.14	.35	.08	.21	—	—

* g_{e1} is growth of earnings plus depreciation
g_{e2} is growth of earnings plus taxes
g_{e3} is growth of sales
g_{e4} is growth of assets
g_{e5} is growth of price of stock
P/E is price-earnings ratio at end of 1962
P/NE is price-normalized earnings ratio at end of 1962
The period used for the calculations of the growth rates was 1958-62 and the rates were calculated as

$$g = \sqrt[4]{V_{62} / V_{58}}$$ where V_{62} and V_{58} are the values of the variables.

no merit, with even poorer performance than they had for the growth of actual earnings.

V. CONCLUSION

In this paper, we have examined the characteristics of a small sample of security analysts' predictions of the long-run earnings growth of corporations. The extent of agreement among the different predictors was considered and their forecasting abilities assessed. Evidence has recently accumulated [7] that earnings growth in past periods is not a useful predictor of future earnings growth. The remarkable conclusion of the present study is that the careful estimates of the security analysts participating in our survey, the bases of which are not limited to public information, perform little better than these past growth rates. Moreover, the market price-earnings ratios themselves were not better than either the analysts' forecasts or the past growth rates in forecasting future earnings growth.

We must be cautious, however, in overgeneralizing these results. We did not have data to investigate directly whether the performance of the predictions of growth in the period considered were atypical of the usual forecasting abilities of such forecasts. The question is important, however, since it can be argued that the peculiarities of the expansion that occurred after the date of the forecasts made the period especially difficult to forecast. Moreover, our work is hampered by the fact that only a few firms were able to participate in our survey. It may also be that shorter-term earnings predictions are considerably more successful relative to naive forecasting methods. Fortunately, we are presently collecting additional data that will help shed light on these conjectures and permit a study of the generation of earnings forecasts and their usefulness in security evaluation.

REFERENCES

1. John W. Buckman. *The Reliability of Earnings Forecasts,* prepared for the Trust Investment Committee of the Continental Illinois Bank (Chicago: September 13, 1963), mimeographed.
2. John M. Culbertson. "The Term Structure of Interest Rates," *Quarterly Journal of Economics,* November, 1957, 485-517.
3. Benjamin Graham, David L. Dodd and Sidney Cottle. *Security Analysis, Principles and Technique,* 4th ed. (New York: McGraw-Hill, 1962).
4. Myron J. Gordon. *The Investment, Financing, and Valuation of the Corporation* (Homewood: Richard D. Irwin, 1962).
5. C. C. Holt. "The Influence of Growth Duration on Share Prices," *Journal of Finance,* September, 1962, 465-75.
6. Reuben Kessel. *The Cyclical Behavior of the Term Structure of Interest Rates* (New York: National Bureau of Economic Research, 1962).
7. I. M. D. Little. "Higgledy Piggledy Growth," *Oxford Institute of Statistics Bulletin,* November, 1962, 387-412.
8. Burton G. Malkiel. "Equity Yields, Growth, and the Structure of Share Prices," *American Economic Review,* December, 1963, 1004-31.
9. David Meiselman. *The Term Structure of Interest Rates* (Englewood Cliffs: Prentice-Hall, 1962).
10. Franco Modigliani and Richard Sutch. "Innovations in Interest Rate Policy," *American Economic Review: Papers and Proceedings,* May 1966, 178-197.
11. Henry Scheffé. *The Analysis of Variance* (New York: John Wiley & Sons, 1959).
12. *Short-Term Economic Forecasting.* Studies in Income and Wealth (Princeton: Princeton University Press for NBER, 1955).
13. *The Quality and Economic Significance of Anticipations Data* (Princeton: Princeton University Press for NBER, 1960).
14. Henri Theil. *Applied Economic Forecasting* (Chicago: Rand McNally, 1966).
15. J. B. Williams. *The Theory of Investment Value* (Cambridge: Harvard University Press, 1938).
16. Victor Zarnowitz. *An Appraisal of Short-Term Economic Forecasts* (New York: National Bureau of Economic Research, 1967).

Credit
Suisse
Research
Institute

CREDIT SUISSE

Credit Suisse Global Investment Returns Yearbook 2023 Summary Edition

Leading perspectives to navigate the future

Elroy Dimson, Paul Marsh, Mike Staunton

Summary Edition

Extracts from the Credit Suisse Global Investment Returns Yearbook 2023

Important information

This report contains extracts from the full 272-page Credit Suisse Global Investment Returns Yearbook 2023, which is available in hardcopy upon request – for details, see page 47.

Coverage of 2023 Summary Edition

This Summary Edition contains four extracts from the full Credit Suisse Global Investment Returns Yearbook 2023. The first extract explains the Yearbook's purpose. It describes the DMS Database, which lies at its core and covers all the main asset categories in 35 countries. Most of these markets, as well as the 90-country world index, have 123 years of data since 1900.

The second extract explains why a long-term perspective is needed to understand risk and return in stocks and bonds, and summarizes the long-run evidence on equity returns. The third extract provides projections of the return on stocks and bonds that the next generation can expect. The fourth extract reproduces in full the Yearbook's new focus chapter on commodities and inflation. Finally, there are a selected number of sample "country pages" from the detailed statistical section of the full Yearbook.

The text and charts in the Summary Edition are extracted directly from full Yearbook. The table and chart numbers in the Summary Edition are not therefore consecutive but reflect the numbering in the full report.

Coverage of the full Yearbook

In the full hardcopy 272-page Yearbook, renowned financial historians Professor Elroy Dimson, Professor Paul Marsh and Dr. Mike Staunton assess the returns and risks from investing in equities, bonds, cash, currencies and factors in 35 countries and in five different composite indexes since 1900. The Yearbook has nine chapters.

Chapter 1 explains its purpose and coverage. It provides historical perspective on the evolution of equity and bond markets over the last 123 years, and the accompanying industrial transformation.

Chapter 2 summarizes the long-run returns on stocks, bonds, bills, and inflation since 1900. It shows that higher levels of inflation have been associated with lower performance from stocks and bonds. It also documents the impact of interest rate hiking and easing cycles on stocks, bonds and risk premiums.

Chapter 3 focuses on currencies, long-run exchange rate changes, purchasing power parity and the case for hedging.

Chapter 4 looks at risk. It examines extreme periods of history, equity and bond drawdowns, and time-to-recovery. It provides evidence on the power of diversifying across stocks, countries and asset classes. It presents worldwide data on the historical equity risk premium.

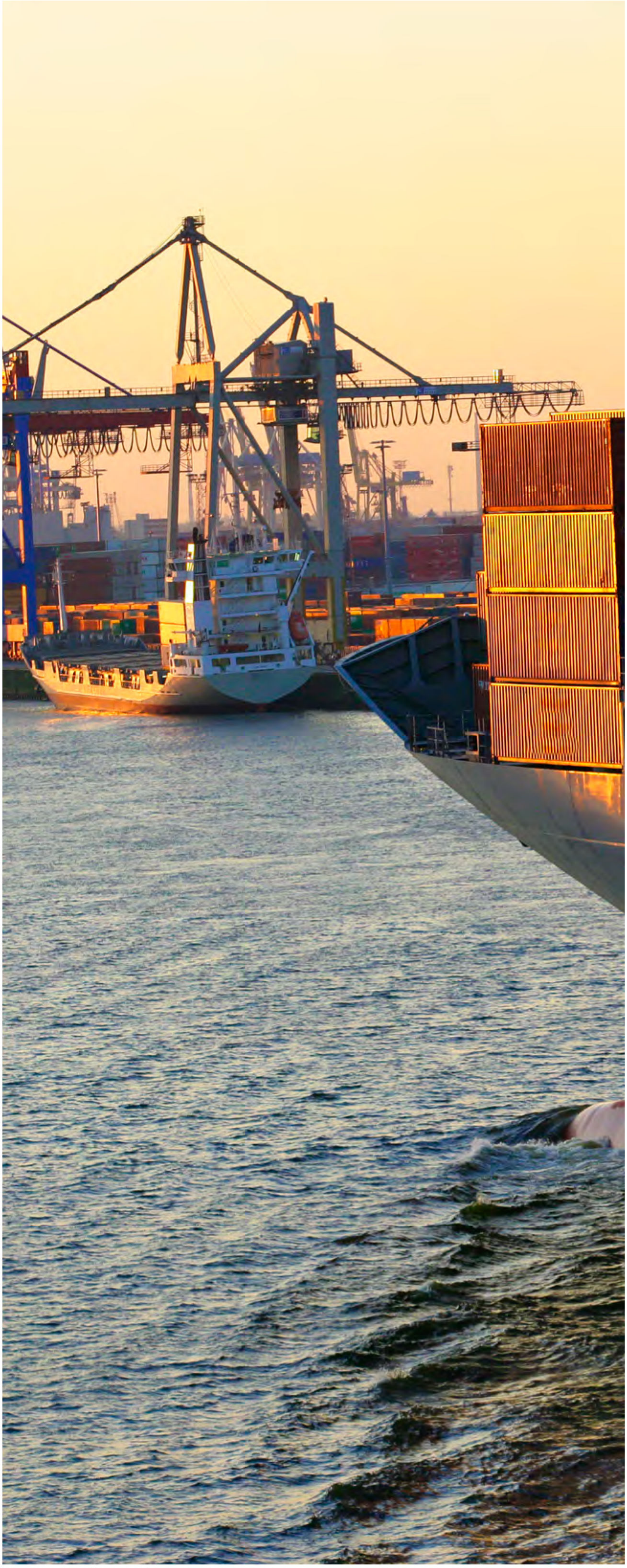
Chapter 5 moves from historical to prospective returns. It shows how returns vary with the real interest rate and estimates the prospective equity premium. It provides estimates of expected stock and bond returns, comparing these with returns over recent decades.

Chapter 6 presents evidence on factor investing around the world. It documents the historical premiums from size, value, income, momentum, volatility and multifactor models.

Chapter 7 addresses prospective factor premiums. It reviews the evidence and theoretical basis for premiums and discusses whether they will persist.

Chapter 8 focuses on commodities and inflation and is the special focus topic for the 2023 Yearbook. It shows that balanced portfolios of commodity futures have provided attractive risk-adjusted long-run returns, albeit with some large and lengthy drawdowns. They have also provided a hedge against inflation – in contrast to stocks, bonds and real estate. The chapter also documents the impact of stagflation on equity, bond and commodity returns. Chapter 8 is reproduced in full in this 2023 Summary Edition.

Finally, Chapter 9 presents a detailed historical statistical analysis of the performance of each of the 35 Yearbook countries and five composite indexes, providing three pages of charts, tables and statistics for each country and index. It also documents the data sources and provides references.



Extracted from:
Credit Suisse Global Investment Returns Yearbook 2022:
Elroy Dimson, Paul Marsh, Mike Staunton
emails: edimson@london.edu, pmarsh@london.edu, and mstaunton@london.edu

ISBN for full Yearbook ISBN 978-3-033-09700-1

For more information, contact:
Richard Kersley
Executive Director of EMEA Securities Research and Head of Global Product Management, Credit Suisse
richard.kersley@credit-suisse.com

Nannette Hechler-Fayd'herbe
CIO International Wealth Management and Global Head of Economics & Research, Credit Suisse
nannette.hechler-fayd'herbe@credit-suisse.com

See page 47 for copyright and acknowledgement instructions, guidance on how to gain access to the underlying data, and for more extensive contact details.

Cover photo by Gettys Images, Tim Martin
Photo left: Gettys Images, Staadtstudios

Editorial

I am delighted to present the 15th edition of the Credit Suisse Global Investment Returns Yearbook. Our long-standing collaboration with Professor Paul Marsh and Dr. Mike Staunton of London Business School and Professor Elroy Dimson of Cambridge University on the Yearbook project is one we are immensely proud of. The body of work that has been assembled over the years has established the study as the definitive source for the analysis of the long-term performance of global financial assets.

With last year's geopolitical and economic developments leading many market participants into uncharted territory, particularly with the re-emergence of inflation, the historical perspective has been crucial. With expectations seemingly conditioned by the more recent past, many investors have been reminded the hard way in 2022 of a few of the Yearbook's basic long-term learnings, not least the laws of risk and reward. The 2023 edition again spells out some of the basic tenets of financial asset performance that warrant revisiting amid today's changed economic environment.

New to this year's study is a deep dive into the role commodities can play in investors' asset allocations, both from a hedging and diversification perspective. The backdrop of a more inflationary environment makes this focus highly topical. To achieve this, the authors bring to the table unique long-term data to conduct their analysis. Providing guidance to our clients through proprietary data and insights is the mission of the Credit Suisse Research Institute. This new work is a case in point.

We trust you will find this year's edition of the Global Investment Returns Yearbook as thought-provoking as those that have preceded it and that it helps you navigate through the investment challenges that 2023 presents.

Axel P. Lehmann
Chairman of the Board of Directors
Credit Suisse Group AG

Executive summary

With the depth and breadth of the financial database that underpins it, the Credit Suisse Global Investment Returns Yearbook has established itself as the unrivalled authority on long-term investment returns. We now present a historical record of the real returns from equities, bonds, cash and currencies for 35 countries, spanning developed and emerging markets, and stretching back to 1900.

Many investors and analysts have typically relied on the template of US financial market history to provide parameters for valuation and return projections. However, our global body of work makes for a more informed investment discussion, revealing the USA to be the exception and not the rule where historical returns are concerned. Amid the wealth of historical data and analysis the Yearbook provides, we would particularly highlight three aspects in this edition for their topicality.

First, while something of a truism, a long-term perspective matters and with it an appreciation of the laws of risk and return. The long-run history of returns laid out in Chapter 2 shows how equities have outperformed bonds and bills in every country since 1900, reflecting such basic principles. After four decades, beginning in the 1980s, of bonds providing equity-like returns, it was tempting to have forgotten this basic identity. However, in 2022, with its inflation shock, real bond returns were the worst on record for many countries, including the USA, UK, Switzerland and for developed markets overall. We have also been served up the reminder that inflation is far from helpful for equities. While equities have enjoyed excellent long-run returns, they are not and never have been the hedge against inflation that many observers have suggested.

Second, and in keeping with the above, a historical risk premium in equity and bond returns relative to bills exists for a reason, that being a necessary payment for the risk of volatility and drawdown. A prolonged period of high and stable real returns had perhaps dimmed the focus of many here. Chapter 4 documents the periods of stress over time for bonds and equities. We have actually experienced four equity bear markets in the last two decades and investors need to be paid for such risk. The Yearbook has shown how portfolio diversification can mitigate such risks. However, reaping the benefits of diversification is also a long-term concept and can let you down in the short term. The recent fortunes of 60/40 equity/bond strategies are a painful example of this, having trusted too heavily in the recent negative correlations between the two assets rather than properly consulting the history books.

Third, this year's focus chapter (Chapter 8) looks further at the pernicious influence of inflation on returns from bonds and equities, but also the role of commodities within the mix. A look at the highly topical subject of stagflation rather than just inflation provides added reason for investor concern. There is also troubling news for the growing consensus that conditions will return to normal with low inflation re-established. A keener look at history would highlight how rare this actually is or a "best quintile" outcome in the words of academics Arnott and Shakernia with the "worst quintile" being inflation persistence for a decade, something by no means in the markets' prevailing psyche.

Rising commodity prices, particularly energy-related, have of course been a key driver of the steep rise in inflation we have witnessed in 2022. However, we explore the role that commodities play as an asset class. Do they offer the hedge against inflation that equities do not? To do so, we explore unique and rarely accessible historic data sets to analyze their role. We find investing in individual commodities have themselves yielded very low long returns. However, thanks to the power of diversification, portfolios of futures have provided attractive risk-adjusted long-term returns, yielding a premium over bills in excess of 3%. There can admittedly be large, lengthy periods of drawdowns, although no more than equity and bond investors have on occasion endured.

A key conclusion to take away, and highly pertinent today as 60/40 equity/bond strategies have let investors down, is that commodity futures do prove a "diversifier" from an asset-allocation perspective, being negatively correlated with bonds, lowly correlated with equities and also statistically a hedge against inflation itself. The problem is that the limited size of the asset class cannot solve all the asset allocator's prevailing inflation-induced dilemmas.

Richard Kersley
Executive Director of EMEA Securities Research and Head of Global Product Management, Credit Suisse

Introduction and historical perspective

The following is an extract from Chapter 1 of the Credit Suisse Global Investment Returns Yearbook 2023.

This extract explains the purpose of the Yearbook – learning from financial history – and using it to shed light on issues facing investors today, such as rising inflation and rising interest rates. It describes the coverage of the Yearbook – now expanded to 35 countries – and its underlying database. It provides historical perspective on the evolution of equity markets since 1900.

Photo: Getty Images, Claus Cramer / 500px

Introduction

The Credit Suisse Global Investment Returns Yearbook documents long-run asset returns over more than a century since 1900. It aims not just to document the past, but also to interpret it, analyze it and help investors learn from it. As William Wordsworth put it, "Let us learn from the past to profit by the present." Or, if you prefer Machiavelli to an English romantic poet, "Whoever wishes to foresee the future must consult the past." Or, switching continents, Theodore Roosevelt said, "The more you know about the past, the better prepared you are for the future."

Each year represents history in the making and provides the Yearbook with an additional year of data and experience. For investors, every year brings its own surprises, rewards, setbacks and, inevitably, new opportunities and concerns.

The purpose of the Yearbook
A key purpose of the Yearbook is to help investors understand today's markets through the lens of financial history. This is well illustrated by the events of 2022. In last year's Yearbook, we noted that "the winds of change are blowing, indeed gusting." At that time, investors faced an uptick in volatility, rising inflation, the prospect of hiking cycles to cure this, and hence rising real and nominal interest rates.

Events turned out worse than expected. The Russia-Ukraine war led to an energy crisis and higher food prices, further fueling inflation. Inflation hit a 41-year high in the USA, UK and Japan, and a 71-year high in Germany. Central banks raised rates aggressively. Stocks and bonds fell heavily. In real, inflation-adjusted terms, bonds had their worst year ever in the USA, Switzerland, the UK and across developed markets.

Most finance professionals are too young to remember high inflation, bond bear markets and years when stocks and bonds declined sharply together. The strength of the Yearbook is its long-term memory thanks to its comprehensive database. The lengthy period that it spans saw two world wars, civil wars, revolutions, pandemics, crises, slumps, the Great Depression, bear markets, periods of inflation and deflation, and hiking cycles. It also saw times of recovery, growth, and booms; easing cycles and times of looser money; and extended periods of peace, prosperity, and technological advance.

The Yearbook provides the long-run analysis needed to place the events of 2022 in context. It offers three explanations for the poor performance of both stocks and bonds. First, both Chapter 2 and the new Chapter 8 provide extensive evidence that stocks, as well as bonds, tend to perform poorly when inflation is higher. Stocks are not, as is often claimed, a hedge against inflation. Second, Chapter 2 shows that both stocks and bonds perform worse during hiking cycles. Third, as we discuss in Chapter 5, rises in longer-run real interest rates means that cash flows from both corporations and from bonds are discounted at a higher rate, thereby lowering valuations.

Many investors were caught off balance by the simultaneous fall in stocks and bonds and the poor performance of a classic 60:40 equity-bond portfolio (see Chapter 4). Over the previous two decades, investors had grown used to stocks and bonds providing a hedge for each other. However, we cautioned last year that this had been exceptional in the context of history. The negative correlation had been associated with a period of falling real interest rates, mostly accommodative monetary policy and generally low inflation, and we pointed out that "change was in the air."

What's new and old in the Yearbook?
As we write, the gloom of 2022 has been replaced by optimism about a soft landing. However, the prospect is nevertheless one of continuing (albeit falling) inflation combined with generally low economic growth. In a new chapter on inflation and commodities, we analyze how equities and bonds have performed in periods of stagflation.

We also examine investment in commodities. Since rising commodity prices, including oil and gas, contributed to the resurgence of inflation, we explore whether investing in commodities offers a hedge against inflation. We find that portfolios of futures have provided attractive risk-adjusted long-run returns, albeit with some large lengthy drawdowns. They also provide an inflation hedge in contrast to most other assets.

Each year, we update all the Yearbook statistics and findings on long-run asset returns. Bad years happen and, when they do, it is consoling to remind ourselves of the long-run record from global investing. For this, the Yearbook provides the authoritative source. For investors in risky assets, especially equities, the long-run record truly does represent the triumph of the optimists.

The Yearbook database

The core of the Credit Suisse Global Investment Returns Yearbook is the long-run DMS database (Dimson, Marsh, and Staunton, 2023). This provides annual returns on stocks, bonds, bills, inflation and currencies for 35 countries. We believe the unrivalled breadth and quality of its underlying data make the Yearbook the global authority on the long-run performance of stocks, bonds, bills, inflation and currencies. The Yearbook updates and greatly extends the key findings from our book "Triumph of the Optimists."

Of the 35 countries, 23 (the DMS 23) have 122-year histories from 1900 to 2022. The remaining 12 markets have start dates in the second half of the 20th century, with either close to, or more than 50 years of data. Together with the DMS 23, these make up the DMS 35. We feature these 35 individual markets in Chapter 9, where we present detailed information and historical performance statistics, and list our data sources.

In addition, we monitor 55 additional markets for which we have equity returns data for periods ranging from 12 to 47 years. We also have inflation, currency and market capitalization data, but not yet bond or bill returns. These 55 countries, taken together with the DMS 35, provide a total of 90 developed and emerging markets (the DMS 90), which we use for constructing our long-run equity indexes.

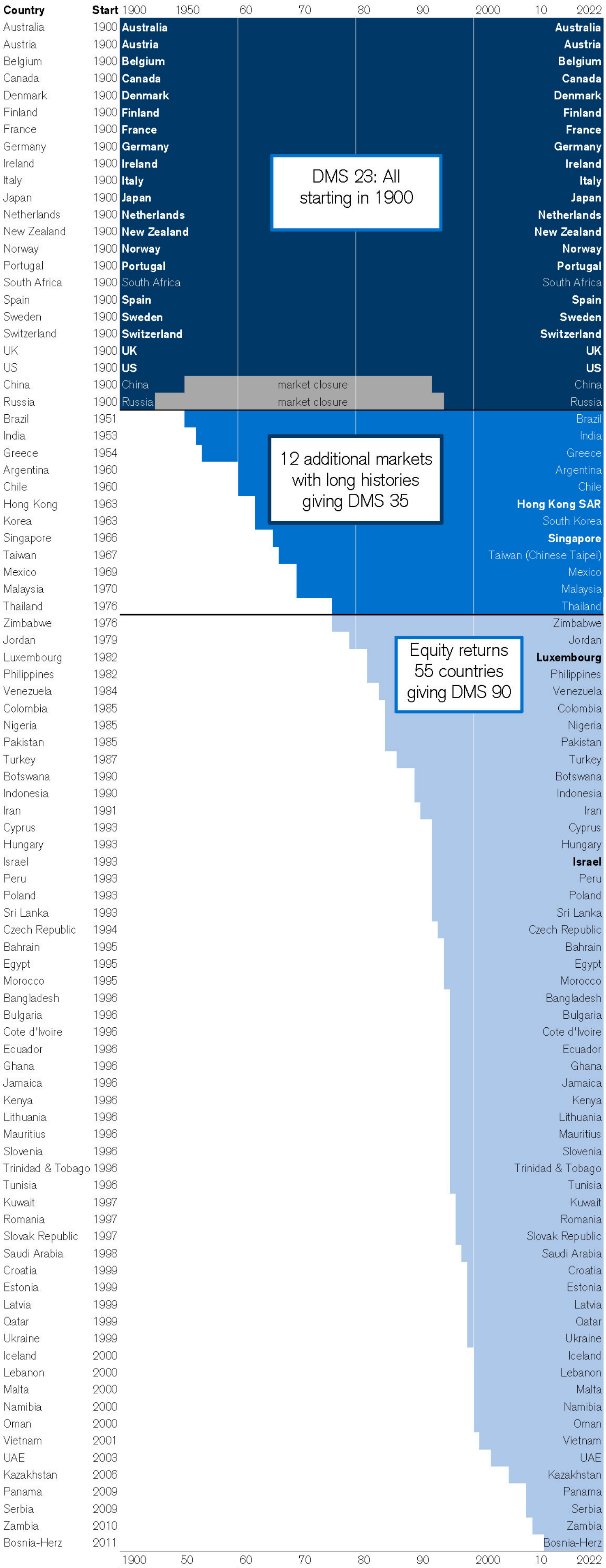
Figure 1 shows the consolidated dataset of 90 markets. The vertical axis lists the markets, ranked by the number of years for which we have data. We include markets only if we have at least a decade of returns. The horizontal axis runs from 1900 to 2022 inclusive. Prior to 1950, the units of time are demi-decades; from 1950 onward, time is measured in years.

The shading in the chart denotes three levels of coverage. The top panel shows the 23 Yearbook countries for which we have data for all asset classes starting in 1900. The DMS 23 comprise the United States and Canada, ten eurozone countries (Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal and Spain), six other European countries (Denmark, Norway, Russia, Sweden, Switzerland and the United Kingdom), four Asia-Pacific markets (Australia, China, Japan and New Zealand) and one African market (South Africa). All have continuous histories except China and Russia. Both had long market closures following total losses to investors after the communist revolutions. They resume when their markets reopened in the early 1990s.

The middle panel shows the 12 additional markets for which we have long histories, seven from Asia, four from Latin America and one from Europe. Unlike the DMS 23, these markets do not start in 1900, but in the second half of the 20th century. All 12 were emerging markets (EMs) at their start dates. However, both Hong Kong SAR and Singapore have now long been regarded as developed markets (DMs). In **Figure 1**, we show countries deemed to be DMs today in bold typeface. All the DMS 23 are currently DMs, except for China, Russia and South Africa.

Eight of the 12 markets in the middle panel have long-established stock exchanges dating back well over a century: Argentina (1854), Brazil (1890), Chile (1893), Greece (1876), Hong Kong SAR (1890), India (1875), Mexico (1894) and Singapore (1911). Unfortunately, we have

Figure 1: Markets in the DMS long-term dataset, 1900–2022



Source: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

been unable to obtain total returns data back to the origins of these exchanges. However, we have assembled 63 years of data for Argentina since1960, 72 years of data for Brazil since 1951, 63 years of data for Chile since 1960, 69 years for Greece since 1954, 60 years for Hong Kong SAR since 1963, 70 years for India since 1953, 54 years for Mexico since 1969 and 57 years for Singapore since 1966.

The other four markets have stock exchanges that were established after World War II, and we have total return series that span almost the entire period since they opened. Thus we have 53 years of data for Malaysia since 1970, 60 years of data for South Korea since 1963, 56 years for Taiwan (Chinese Taipei) from 1967 and 47 years for Thailand from 1976.

The bottom panel of **Figure 1** shows the 55 additional markets. Just two of these are today deemed developed, i.e. Luxembourg, where its exchange opened in 1928, but where our data starts more recently, and Israel, which was promoted to developed status by MSCI in 2010. The remaining 53 markets are all today classified as EMs or frontier markets.

The DMS database also includes five composite indexes for equities and bonds denominated in a common currency, here taken as US dollars. These cover the World, World ex-USA, Europe, Developed markets and Emerging markets. The equity indexes are based on the full DMS 90 universe and are weighted by each country's market capitalization. The bond indexes are based on the DMS 35 and are weighted by gross domestic product (GDP). The five composite indexes all have a full 123-year history starting in 1900.

Together, at the start of 2023, the DMS 35 markets made up 97.9% of the investable equity universe for a global investor, based on free-float market capitalizations. Our 90-country world equity index spans the entire investable universe. We are not aware of any other world index that covers as many as 90 countries.

Most of the DMS 35 and all the DMS 23 countries have experienced market closures at some point, mostly during wartime. In almost all cases, it is possible to bridge these closures and construct a returns history that reflects the experience of investors over the closure period. Russia and China are exceptions. Their markets were interrupted by revolutions, followed by long periods of communist rule. Markets were closed, not just temporarily, but with no intention of reopening, and assets were expropriated.

For 21 countries, we thus have a continuous 123-year history of investment returns. For Russia and China, we have returns for the pre-communist era, and for the period since these markets reopened in the early 1990s.

The expropriation of Russian assets after 1917 and Chinese assets after 1949 could be seen as wealth redistribution, rather than wealth loss. But investors at the time would not have warmed to this view. Shareholders in firms with substantial overseas assets may also have salvaged some equity value, e.g. Chinese companies with assets in Hong Kong (now Hong Kong SAR), and Formosa (now Taiwan (Chinese Taipei)). Despite this, when incorporating these countries into our composite indexes, we assume that shareholders and bondholders in Russia and China suffered total losses in 1917 and 1949. We then re-include these countries in the indexes after their markets re-opened in the early 1990s.

The DMS 23 series all commence in 1900, and this common start date aids international comparisons. Data availability and quality dictated this start date, which proved to be the earliest plausible date that allowed broad coverage with good quality data (see Dimson, Marsh, and Staunton, 2007).

Financial markets have changed and grown enormously since 1900. Meanwhile, over the last 123 years, the industrial landscape has changed almost beyond recognition. In the following sections, we look at the development of equity markets over time, including the split between DMs and EMs, how government debt for different countries has evolved, and at the Great Transformation that has occurred in industrial structure due to technological change.

The evolution of equity markets

Although stock markets in 1900 were rather different from today, they were not a new phenomenon. The Amsterdam exchange had already been in existence for nearly 300 years; the London Stock Exchange had been operating for over 200 years; and five other markets, including the New York Stock Exchange, had been in existence for 100 years or more.

Figure 2 (overleaf) shows the relative sizes of equity markets at the end of 1899 (left panel) and how this had changed by end-2022 (right panel). Today the US market dominates its closest rival and accounts for 58.4% of total world equity market value. Japan (6.3%) is in second place, the UK (4.1%) in third position, while China is ranked fourth (3.7%). France, Canada, Switzerland, Australia and Germany each represent between two and three percent of the global market, followed by, Taiwan (Chinese Taipei), India and South Korea, all with 1.3%–1.8% weightings.

In **Figure 2**, 12 of the DMS 35 countries – all those accounting for around 1.3% or more of world market capitalization – are shown separately, with the remaining 23 Yearbook markets grouped together as "Smaller DMS 35" with a combined weight of 8.5%. The remaining area of the right-hand pie chart labeled "Not in DMS 35" shows that the 35 Yearbook countries now cover all but 2.1% of total world market capitalization. This remaining 2.1% is captured within the DMS 90 and is made up almost entirely of emerging and frontier markets.

Note that the right-hand panel of **Figure 2** is based on the free-float market capitalizations of the countries in the FTSE All-World index, which spans the investable universe for a global investor. Emerging markets represent a higher proportion of the world total when measured using full-float weights or when investability criteria are relaxed (see Dimson, Marsh and Staunton (2021)).

The left panel of **Figure 2** shows the equivalent breakdown at the end of 1899. At the start of the 20th century, the UK equity market was the largest in the world, accounting for almost a quarter of world capitalization, and dominating the USA (15%). Germany (13%) ranked third, followed by France, Russia, and Austria-Hungary. Again, 11 Yearbook countries are shown separately, while the other 12 countries for which we have data for 1900 are aggregated and labeled "Smaller DMS 23" countries.

In total, the DMS database covered over 95% of the global equity market in 1900. The countries representing the missing 4.7% labeled as "Not in DMS 23" have been captured in later years by the 12 additional markets and the full DMS 90 database. However, we do not have returns data for these markets back in 1900.

Survivorship bias

A comparison of the left- and right-hand sides of **Figure 2** shows that countries had widely differing fortunes over the intervening 123 years. This raises two important questions. The first relates to survivorship bias. Investors in some countries were lucky, but others suffered financial disaster or very poor returns. If countries in the latter group are omitted, there is a danger of overstating worldwide equity returns.

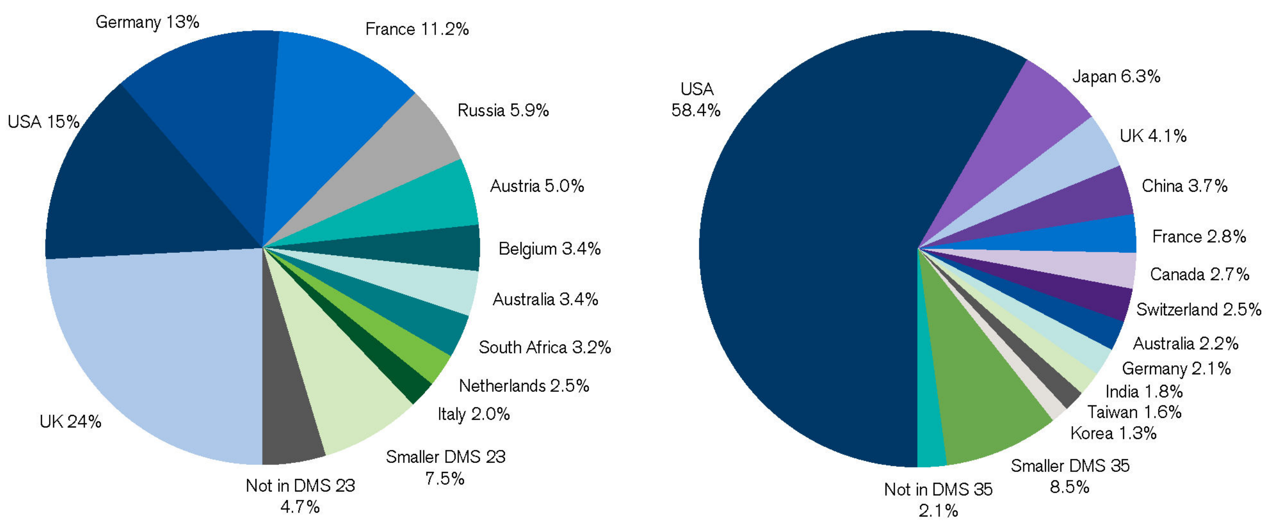
Austria and Russia are small markets today, accounting for just 0.06% and 0.26% of world capitalization. Similarly, China was a tiny market in 1900, accounting for 0.34% of world equities. In assembling the DMS database, it might have been tempting to ignore these countries, and to avoid the considerable effort required to assemble their returns data back to 1900. However, Russia and China are the two best-known cases of markets that failed to survive, and where investors lost everything. Furthermore, Russia was a large market in 1900, accounting for some 6% of world market capitalization. Austria-Hungary was also large in 1900 (5% of world capitalization) and, while it was not a total investment disaster, it was the worst-performing equity market and the second worst-performing bond market of our 21 countries with continuous investment histories.

Ensuring that the DMS database contained returns data for Austria, China, and Russia from 1900 onward was thus important in eliminating survivorship and "non-success" bias.

Success bias

The second and opposite source of bias, namely success bias, is even more serious. **Figure 3** provides insight on this by showing the evolution of equity market weightings for the entire world

Figure 2: Relative sizes of world stock markets, end-1899 (left) versus start-2023 (right)



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar; data for the right-hand chart from FTSE Russell All-World Index Series Monthly Review, December 2022. Not to be reproduced without express written permission from the authors.

equity market over the last 123 years. It shows the equity market share for 12 key countries, with other markets aggregated into the "Other" category. In this, and the charts that follow, countries are identified by their ISO 3166 alpha-3 country codes. Mostly, these three-character abbreviations map onto the country's name. For a full list of ISO codes, see page 254 of the full Yearbook.

Figure 3 shows that the US equity market overtook the UK early in the 20th century and has since been the world's dominant market, apart from a short interval at the end of the 1980s, when Japan briefly became the world's largest market. At its peak, at start-1989, Japan accounted for 40% of the world index, versus 29% for the USA. Subsequently, Japan's weighting has fallen to just 6%, reflecting its poor relative stock-market performance. The USA has regained its dominance and today comprises 58% of total world capitalization.

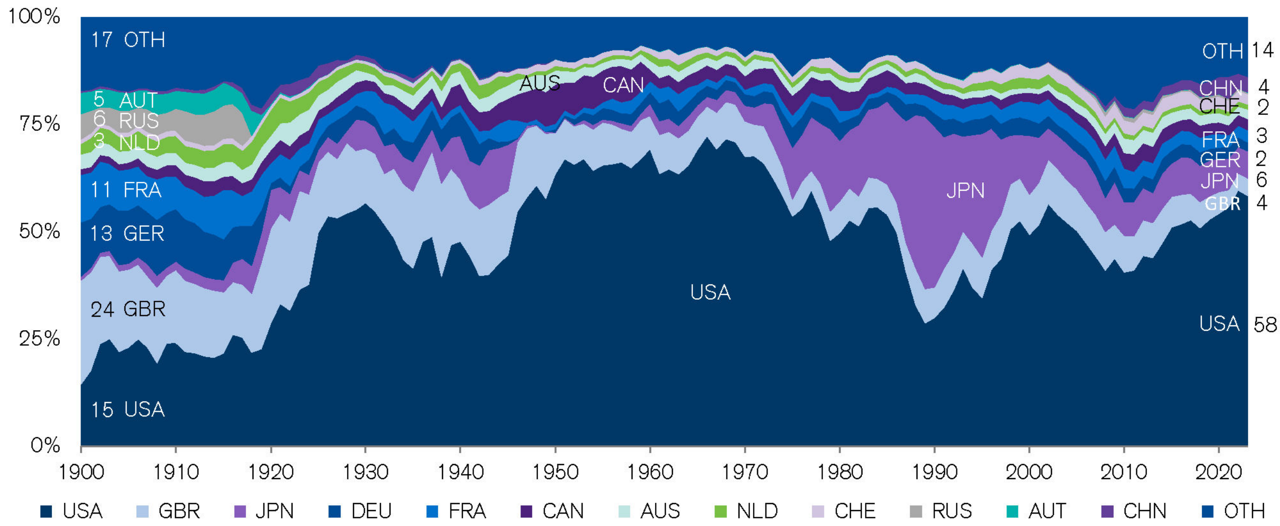
The USA is by far the world's best-documented capital market. Prior to assembly of the DMS database, the evidence cited on long-run asset returns was almost invariably taken from US markets and was typically treated as being universally applicable. Yet organized trading in marketable securities began in Amsterdam in 1602 and London in 1698, but did not commence in New York until 1792.

Since then, the US share of the global stock market has risen from zero to 58%. This reflects the superior performance of the US economy, the large volume of IPOs, and the substantial returns from US stocks. No other market can rival this long-term accomplishment. But this makes it dangerous to generalize from US asset returns since they exhibit "success bias." This is why the Yearbook focuses on global returns.

The remainder of Chapter 1

The remainder of Chapter 1 (in the full Yearbook) looks at the split between developed and emerging markets, how emerging markets are defined, and how they have evolved over time. It also examines the development of government bond markets over time, examining bond market weightings, and how these have changed since 1900. In addition, it compares industrial weightings in 1900 with those today, highlighting the industrial transformation that has taken place, and the emergence of new technologies. It concludes that, if anything, investors may have placed too high an initial value on new technologies, overvaluing the new and undervaluing the old.

Figure 3: The evolution of equity markets over time from end-1899 to start-2023



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar, and FTSE Russell All-World Index Series weights (recent years). Not to be reproduced without express written permission from the authors.

Long-run asset returns

This is an extract from Chapter 2 of the Credit Suisse Global Investment Returns Yearbook 2023

Many people consider the long term to be ten or 20 years. This extract from Chapter 2 of the Yearbook explains that much longer periods than 20 years are needed to understand risk and return in stocks and bonds because markets are so volatile. It shows the pattern of equity returns in both the USA and UK since 1900 in both nominal and real terms and provides long-run statistics on real equity returns around the world for the DMS 35 countries.

Photo: Getty Images: John W. Banagan

A long-term perspective is needed

To understand risk and return, we must examine long periods of history. This is because asset returns, and especially equity returns, are volatile. This is readily illustrated by recent history. The 21st century began with one of the most severe bear markets in history. The damage inflicted on global equities began in 2000 and, by March 2003, US stocks had fallen 45%, UK equity prices halved and German stocks fell by two-thirds. Markets then staged a remarkable recovery that reduced and, in many countries, eliminated the bear-market losses.

World markets hit new highs in October 2007, only to plunge again in another epic bear market fueled by the Global Financial Crisis. Markets bottomed in March 2009 and then staged an impressive recovery, although, in real terms, it took until 2013 for many of the world's largest markets to regain their start-2000 levels. Global equities then rose, with relatively few setbacks, for more than a decade. Meanwhile, volatility stayed remarkably low, albeit with occasional spikes. When markets are calm, we know there will be a return to volatility and more challenging times – we just cannot know when.

"When" proved to be in March 2020. The COVID-19 pandemic sent stocks reeling once again, falling by more than a third in many countries. Volatility skyrocketed to levels even higher than those seen during the Global Financial Crisis. The world experienced its third bear market in less than 20 years. Markets then staged a remarkable recovery and volatility fell once again. However, in 2022, volatility again rose, and both stocks and bonds fell sharply on inflation and rate hike worries and concerns over the Russia-Ukraine war. This was the fourth bear market since 2000.

The volatility of markets means that, even over long periods, we can still experience "unusual" returns. Consider, for example, an investor at the start of 2000 who looked back at the 10.5% real annualized return on global equities over the previous 20 years and regarded this as "long-run" history, and hence providing guidance for the future. But, over the next decade, our investor would have earned a negative real return on world stocks of –0.6% per annum.

The demons of chance are meant to be more generous. Investors who hold equities require a reward for taking risk. At the end of 1999, investors cannot have expected, let alone required, a negative real return from equities; otherwise, they would have avoided them. Looking in isolation at the returns over the first 23 years of the 21st century tells us little about the future expected risk premium. In the first decade, investors were unlucky and equity returns were attenuated by two deep bear markets. This was a brutal reminder that the very nature of the risk for which they sought a reward means that events can turn out poorly, even over multiple years. In the second decade, investors were lucky; markets recovered quickly from the Global Financial Crisis, which was followed by more than a decade of strong returns. They then recovered rapidly from the initial falls during the COVID-19 pandemic, only to fall again in 2022.

At the same time, the returns over the last two decades of the 20th century also revealed nothing very useful when taken in isolation. These returns must surely have exceeded investors' prior expectations and thus provided too rosy a picture of the future. The 1980s and 1990s were a golden age. Inflation fell from its highs in the 1970s and early 1980s, which lowered interest rates and bond yields. Profit growth accelerated and world trade and economic growth expanded. This led to strong performance from both equities and bonds.

Long periods of history are also needed to understand bond returns. Over the 40 years until end-2021, the world bond index provided an annualized real return of 6.3%, not far below the 7.4% from world equities. Extrapolating bond returns of this magnitude into the future would have been foolish. Those 40 years were a golden age for bonds, just as the 1980s and 1990s were a golden age for equities. In fact, the real return on world bonds in 2022 was –27%.

Golden ages, by definition, are exceptions. To understand risk and return in capital markets – a key objective of the Yearbook – we must examine periods much longer than 20 or even 40 years. This is because stocks and bonds are volatile, with major variation in year-to-year returns. We need very long time series to support inferences about investment returns.

Since 1900, there have been several golden ages, as well as many bear markets; periods of great prosperity as well as recessions, financial crises and the Great Depression; periods of peace and episodes of war. Very long histories are required to hopefully balance out the good luck with the bad luck, so that we obtain a realistic understanding of what long-run returns can tell us about the future.

In the remainder of this chapter, we document the long-run history of stocks, bonds, bills, and inflation since 1900 based on the DMS 35 countries and five composite indexes. Throughout the chapter, we distinguish between the 21 countries where we have full 123-year financial histories starting in 1900; the two other countries with 1900 start dates, but which have broken histories, Russia and China; and the DMS 12 countries which have start dates in the second half of the 21st century.

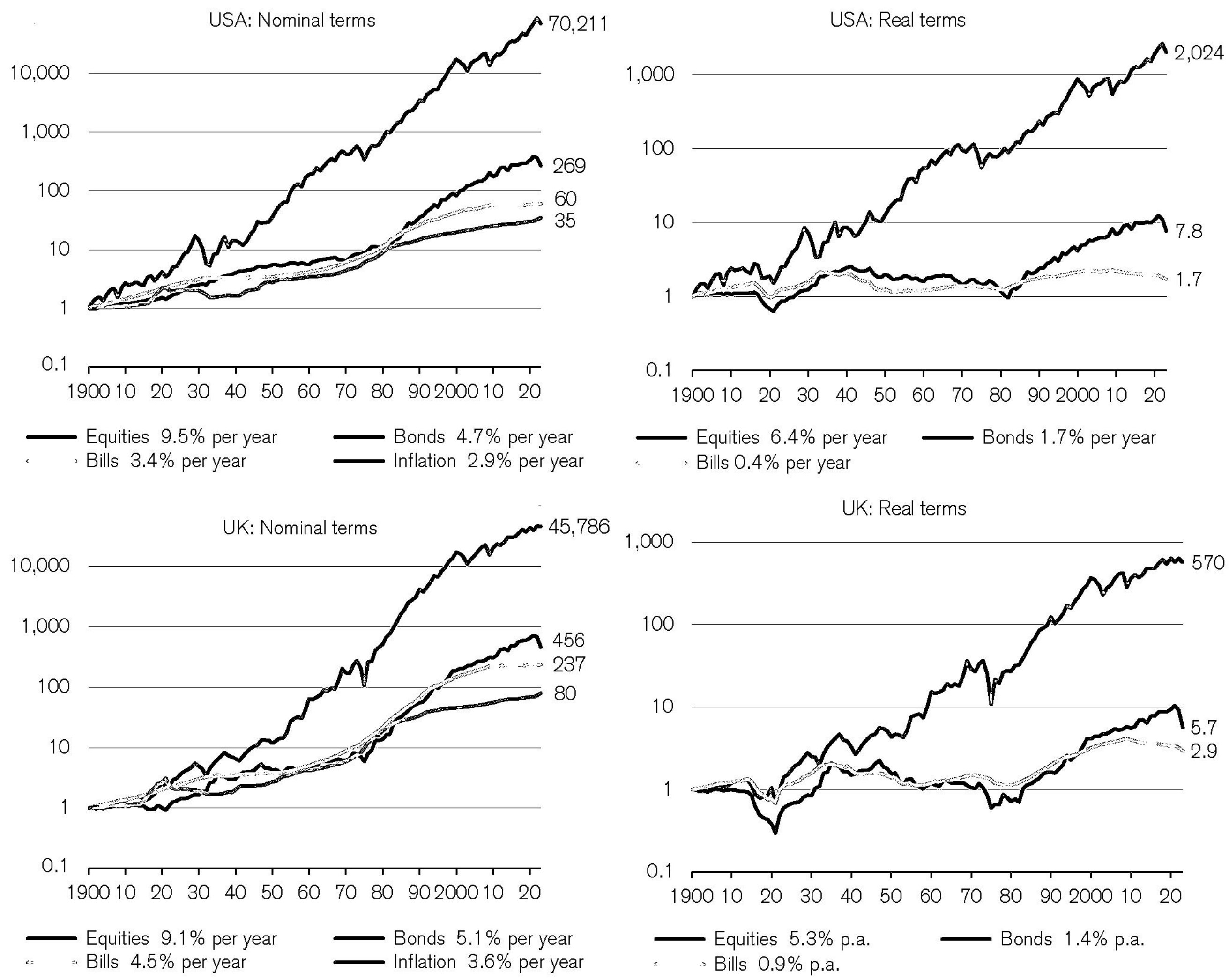
Equity returns since 1900

The top left panel of **Figure 10** shows the cumulative total return from stocks, bonds, bills and inflation from 1900 to 2022 in the world's leading capital market, the United States. Equities performed best. An initial investment of USD 1 grew to USD 70,211 in nominal terms by end-2022. Long bonds and Treasury bills gave lower returns, although they beat inflation. Their respective index levels at the end of 2022 are USD 269 and USD 60, with the inflation index ending at USD 35. The chart legend shows the annualized returns. Equities returned 9.5% per year versus 4.7% on bonds, 3.4% on bills and inflation of 2.9% per year.

Since US prices rose 35-fold over this period, it is more helpful to compare returns in real terms. The top right panel of **Figure 10** shows the real returns on US equities, bonds and bills. Over the 123 years, an initial investment of USD 1, with dividends reinvested, would have grown in purchasing power by 2,024 times. The corresponding multiples for bonds and bills are 7.8 and 1.7 times the initial investment, respectively. As the legend to the chart shows, these terminal wealth figures correspond to annualized real returns of 6.4% on equities, 1.7% on bonds, and 0.4% on bills.

The chart shows that US equities totally dominated bonds and bills. There were severe setbacks of course, most notably during World War I; the Wall Street Crash and its aftermath, including the Great Depression; the OPEC oil shock of the 1970s after the 1973 October War in the Middle East; and four bear markets so far during the 21st century. Each shock was severe at the time. At the depths of the Wall Street Crash, US equities had fallen by 80% in real terms. Many investors were ruined, especially those who bought stocks with borrowed money. The crash lived on in the memories of investors for at least a generation, and many subsequently chose to shun equities.

Figure 10: Cumulative returns on US and UK asset classes in nominal terms (left); real terms (right), 1900–2022



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express permission from the authors.

The top two panels of **Figure 10** set the Wall Street Crash in its long-run context by showing that equities eventually recovered and gained new highs. Other dramatic episodes, such as the October 1987 crash, hardly register; the COVID-19 crisis does not register at all since the plot is of annual data, and the market recovered and hit new highs by year-end; the bursting of the technology bubble in 2000, the Global Financial Crisis of 2007–09 and the 2022 bear market show on the chart but are barely perceptible. The chart sets the bear markets of the past in perspective. Events that were traumatic at the time now just appear as setbacks within a longer-term secular rise.

We cautioned above about generalizing from the USA, which, over the 20th century, rapidly emerged as the world's foremost political, military and economic power. By focusing on the world's most successful economy, investors could gain a misleading impression of equity returns elsewhere or of future returns for the USA.

The bottom two panels of **Figure 10** show the corresponding charts for the UK. The right-hand chart shows that, although the real return on UK equities was negative over the first 20 years of the 20th century, the story thereafter was one of steady growth broken by periodic setbacks. Unlike the USA, the worst setback was not during the Wall Street Crash period, but instead in 1973–74, the period of the first OPEC oil squeeze following the 1973 October War in the Middle East. UK bonds also suffered in the mid-1970s due to inflation peaking at 25% in 1975.

The chart shows that investors who kept faith with UK equities and bonds were eventually vindicated. Over the full 123 years, the annualized real return on UK equities was 5.3%, versus 1.4% on bonds. As in the USA, equities greatly outperformed bonds, which in turn gave higher returns than bills. These returns are high, although below those for the USA. However, for a more complete view, we need to look at investment returns across all countries.

Long-run returns around the world

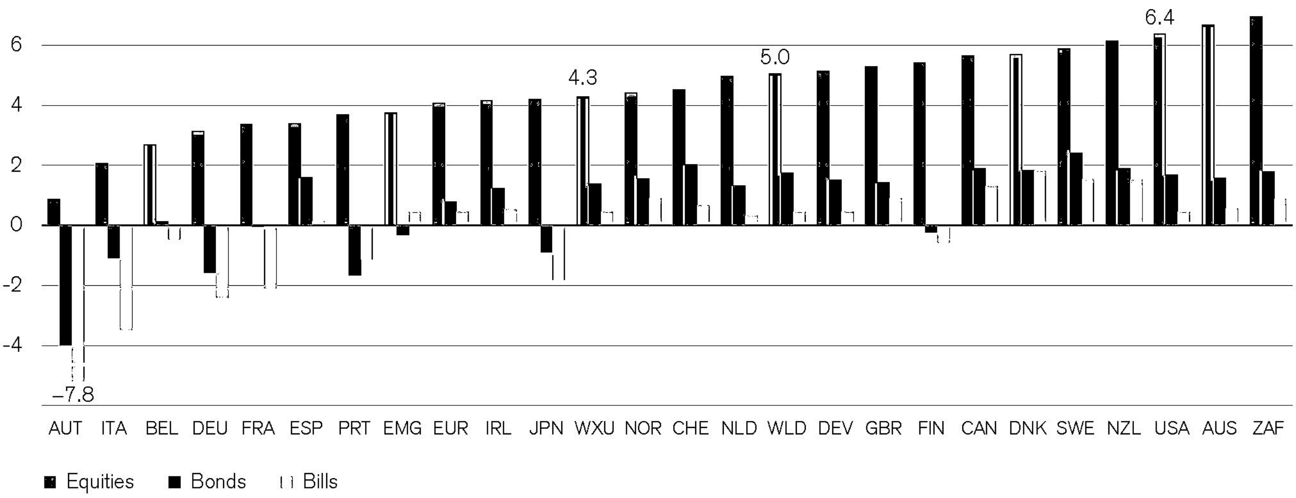
Figure 11 shows annualized real equity, bond and bill returns over the last 123 years for the 21 Yearbook countries with continuous investment histories plus the five composite indexes, namely, the World index (WLD), the World ex-USA index (WXU), the Europe index (EUR), the developed markets index (DEV) and the emerging markets index (EMG) ranked in ascending order of equity market performance. The real equity return was positive everywhere, typically around 3% to 6% per year.

Equities were the best-performing asset class everywhere. Furthermore, bonds outperformed bills in every country except Portugal. This overall pattern, of equities outperforming bonds and bonds beating bills, is what we would expect over the long haul since equities are riskier than bonds, while bonds are riskier than cash.

Figure 11 shows that, while most countries experienced positive real bond returns, six had negative returns. Mostly, countries with poor bond returns were also among the worst equity performers. Their poor performance arose during the first half of the 20th century. These were the countries that suffered most from the ravages of war and from periods of high or hyperinflation associated with the wars and their aftermath.

Figure 11 shows that the USA performed well, ranking third for equity performance (6.4% per year) and seventh for bonds (1.7% per year).

Figure 11: Real annualized returns (%) on equities versus bonds and bills internationally, 1900–2022



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

However, these are local currency real returns. As we show in Chapter 3, in common currency terms, US equities ranked second in the world (after Australia), while US bonds ranked fifth. This confirms our earlier conjecture that US returns would be high as the US economy has been such an obvious success story, making it unwise for investors around the world to base future projections solely on US evidence.

The 6.4% annualized real return on US equities contrasts with the 4.3% real USD return on the World-ex USA index. This difference of 2.1%, when compounded over 123 years, leads to a large difference in terminal wealth. A dollar invested in US equities in 1900 resulted in a terminal value of USD 2,024 in terms of real purchasing power (see **Figure 10**). The same investment in stocks from the rest of the world gave a terminal value of USD 176, less than a tenth of the US value.

A common factor among the best-performing equity markets over the last 123 years is that they tended to be resource-rich and/or New World countries. The worst-performing markets were afflicted by international or civil wars.

Long-run real equity returns

Table 1 provides statistics on long-run real equity returns. The top panel shows the 21 countries and five composite indexes for which we have continuous histories from 1900 to 2022. The geometric means in the third column show the 123-year annualized returns and these are the

Table 1: Real (inflation-adjusted) equity returns around the world, 1900–2022

Country	Start year	Geometric mean (%)	Arithmetic mean (%)	Standard error (%)	Standard deviation (%)	Minimum return (%)	Minimum year	Maximum return (%)	Maximum year
Countries and indexes with continuous histories since 1900									
Australia	1900	6.7	8.2	1.6	17.4	–42.5	2008	51.5	1983
Austria	1900	0.9	5.0	2.7	30.4	–59.6	1924	132.7	1921
Belgium	1900	2.7	5.3	2.1	23.5	–48.9	2008	105.1	1919
Canada	1900	5.7	7.0	1.5	16.8	–33.8	2008	55.2	1933
Denmark	1900	5.7	7.5	1.9	20.7	–49.2	2008	107.8	1983
Finland	1900	5.4	9.2	2.6	29.3	–61.5	1918	161.7	1999
France	1900	3.4	5.8	2.1	22.8	–41.5	2008	66.1	1954
Germany	1900	3.1	7.8	2.8	31.1	–90.8	1948	154.6	1949
Ireland	1900	4.2	6.7	2.1	22.7	–65.4	2008	68.4	1977
Italy	1900	2.1	5.9	2.5	28.1	–72.9	1945	120.7	1946
Japan	1900	4.2	8.6	2.6	28.9	–85.5	1946	121.1	1952
The Netherlands	1900	5.0	7.0	1.9	21.1	–50.4	2008	101.6	1940
New Zealand	1900	6.1	7.8	1.7	19.2	–54.7	1987	105.3	1983
Norway	1900	4.4	7.2	2.4	26.2	–53.6	2008	166.9	1979
Portugal	1900	3.7	8.4	3.0	33.5	–76.6	1978	151.8	1986
South Africa	1900	7.0	9.0	1.9	21.4	–52.2	1920	101.2	1933
Spain	1900	3.4	5.5	1.9	21.5	–43.3	1977	99.4	1986
Sweden	1900	5.9	8.0	1.9	21.2	–42.5	1918	67.5	1999
Switzerland	1900	4.53	6.3	1.7	19.3	–37.8	1974	59.4	1922
United Kingdom	1900	5.3	7.1	1.8	19.5	–56.6	1974	99.3	1975
United States	1900	6.38	8.3	1.8	19.9	–38.6	1931	55.8	1933
Europe	1900	4.1	5.9	1.8	19.7	–48.0	2008	75.2	1933
World ex-US	1900	4.3	6.0	1.7	18.8	–46.0	2008	79.6	1933
World	1900	5.0	6.5	1.6	17.4	–42.9	2008	67.6	1933
Developed markets	1900	5.1	6.7	1.6	17.6	–41.3	2008	65.1	1933
Emerging markets	1900	3.8	6.4	2.0	22.6	–63.0	1945	91.4	1933
Countries/markets with later start dates or discontinuous histories and hence later re-start dates (China and Russia)									
Argentina	1960	3.1	21.3	11.7	93.0	–78.5	1990	538.1	1976
Brazil	1951	6.2	16.1	6.3	53.3	–70.1	1990	224.8	1983
Chile	1960	11.8	18.6	6.0	47.6	–43.9	1965	282.7	1973
China	1993	3.3	8.4	6.2	34.2	–55.8	2008	99.5	2003
Greece	1954	4.6	13.1	5.9	48.7	–64.1	2008	236.1	1972
Hong Kong SAR	1963	8.5	15.0	5.0	38.4	–62.2	1974	129.5	1972
India	1953	6.6	9.7	3.1	26.0	–60.8	2008	88.2	1999
Malaysia	1970	6.3	12.0	5.3	38.3	–56.3	1997	157.1	1972
Mexico	1969	8.5	13.9	5.0	36.7	–60.8	1982	115.8	1983
Russia	1995	4.9	21.4	12.4	65.8	–75.5	1998	235.9	1999
Singapore	1966	5.4	9.6	4.0	30.5	–53.9	2008	108.8	1972
South Korea	1963	8.5	13.7	4.5	35.0	–51.4	2000	130.7	1972
Taiwan (Chinese Taipei)	1967	9.5	16.2	5.3	39.3	–68.0	1974	123.8	1987
Thailand	1976	7.0	13.7	5.9	40.4	–56.4	1997	122.3	2003

Sources: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar.

figures that were plotted in **Figure 11**. The arithmetic means in the fourth column show the average of the 123 annual returns for each country/composite index.

The arithmetic mean of a sequence of different returns is always larger than the geometric mean. For example, if stocks double one year (+100%) and halve the next (–50%), the investor is back where he/she started, and the annualized or geometric mean return is zero. However, the arithmetic mean is one-half of +100 – 50, which is +25%. The more volatile the returns, the greater the amount by which the arithmetic mean exceeds the geometric mean. This is verified by the sixth column of **Table 1**, which shows the standard deviation of each market's returns.

The USA's standard deviation of 19.9% places it among the lower risk markets since 1900, ranking sixth after Canada (16.8%), Australia (17.4%), New Zealand (19.2%), Switzerland (19.3%) and the UK (19.5%). The average standard deviation for the 21 countries in the top panel is 23.5%, while the World index has a standard deviation of just 17.4%, showing the risk reduction from global diversification.

The most volatile markets were Portugal (33.5%), Germany (31.1%), Austria (30.4%), Finland (29.3%), Japan (28.9%) and Italy (28.1%). These were the countries most seriously affected by the depredations of war, civil strife and inflation, and, in Finland's case, reflecting its concentrated stock market during more recent periods. **Table 1** shows that, as one would expect, the countries with the highest standard deviations experienced the greatest range of returns; in other words, they had the lowest minima and the highest maxima.

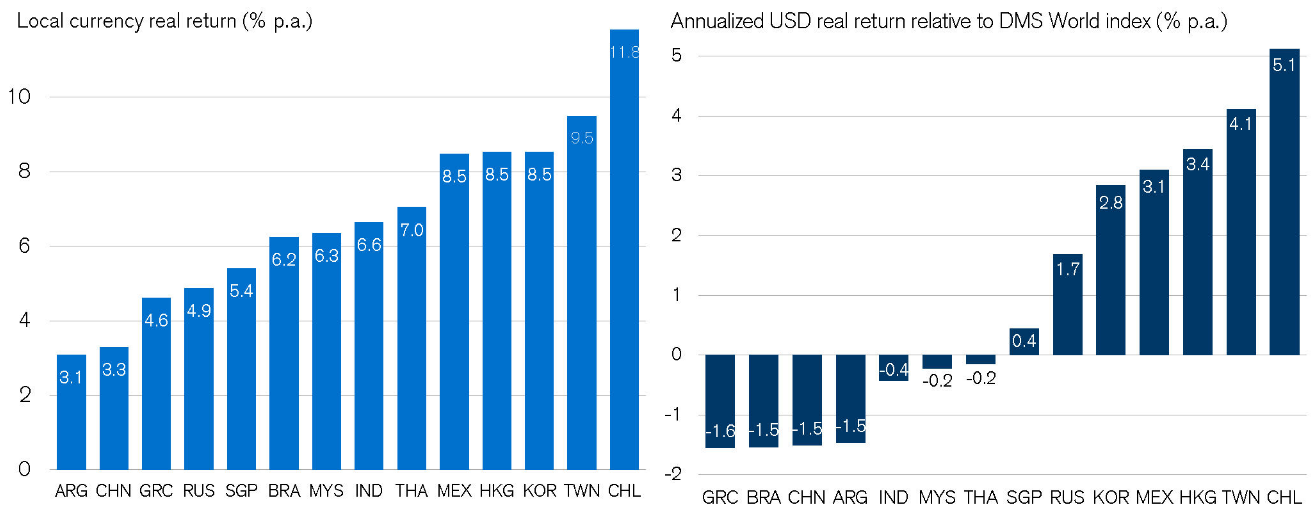
Bear markets underline the risk of equities. Even in a lower volatility market such as the USA, losses can be huge. **Table 1** shows that the worst calendar year for US equities was 1931 with a real return of –39%. However, during the 1929–31 Wall Street Crash period, US equities fell from peak to trough by 80% in real terms. The worst period for UK equities was the 1973–74 bear market, when stocks fell 70% in real terms and by 57% in a single year, 1974. For nearly half of the 21 countries, 2008 was the worst year on record. As we show in Chapter 4, over intervals of more than a year, even more extreme returns have occurred in many countries, both on the downside and the upside.

The lower panel of **Table 1** shows the remaining 14 markets in the DMS 35. Russia and China both start in1900, but equity investors lost everything in the 1917 and 1949 revolutions. Markets were then closed for many years, re-opening in the 1990s. China and Russia are thus included in **Table 1** from 1993 and 1995. For the other 12 countries, **Table 1** tracks their returns from the earliest date for which data is available.

The left-hand panel of **Figure 12** shows the annualized local real equity returns from the countries in the bottom section of **Table 1** (the geometric means from the third column). However, comparisons are difficult because of their different start dates. In the right-hand panel, we therefore show each country's real USD return relative to the return on the DMS World index over the same period.

Figure 12 shows that the annualized local currency real returns range from Argentina's 3.1% to Chile's 11.8%. The right-hand panel shows that Chile was also the best relative performer, beating the World index by 5.1% per annum since its 1960 start

Figure 12: Annualized real equity returns; absolute (left); versus DMS World index over matching periods (right)



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

date. The worst performer was Greece, which, since its 1954 start date, underperformed the World index by 1.6% per year.

Taiwan (Chinese Taipei), Hong Kong SAR, Mexico and South Korea also outperformed strongly. China underperformed by 1.5% per annum, despite unprecedented growth in real GDP since 1990 of 9% per annum versus 2% for the USA. This is a reminder of the lack of a relationship between long-term GDP growth and stock price performance (see Dimson Marsh and Staunton (2002, 2014)).

Returning to **Table 1**, the markets in the bottom panel have an average volatility (standard deviation) of just under 45%, nearly double that of the average of 23.5% for those in the top panel. Every market in the bottom panel had a volatility above 30% except for India (26%). Argentina (93%), Russia (66%), Brazil (53%), Greece (49%) and Chile (48%) were especially volatile, reflecting their historical hyperinflationary periods.

Every country in the top panel is today classified as a DM, except for South Africa. Twelve of the 14 markets in the bottom panel are EMs. The other two, Hong Kong SAR and Singapore, are DMs, but were EMs when their return series started. In the 2021 Yearbook, we showed that although individual EMs have typically been more volatile than DMs, the average EM volatility has declined sharply over the last 20 years. Over the most recent five-year period, the gap between the average EM and DM has fallen to just 5%.

The remainder of Chapter 2

The remainder of Chapter 2 (in the full Yearbook) records the long-run returns on bonds, bills and inflation over the last 123 years for the 35 DMS countries. It compares the performance of equities and bonds in emerging and developed markets since 1900. It shows that higher levels of inflation have been associated with lower performance from stocks and bonds Finally, it shows the impact of interest rate hiking cycles and easing cycles on stocks, bonds and risk premiums.

Projected returns

This is an extract from Chapter 5 of the Credit Suisse Global Investment Returns Yearbook 2023.

This extract focuses on projected returns. It shows how returns on stocks and bonds vary with the real interest rate. It documents how the real interest rate has changed over the 21st century, and discusses the impact that falling, and then rising real rates have had on stock and bond returns. It concludes with projections of the returns on stocks and bonds that the next generation can expect, comparing these with the returns that previous generations have enjoyed.

Photo: Getty Images, Krisikorn Tanrattanakunl / EyeEm

Chapter 5 of the Yearbook

Chapter 5 (of the full Yearbook) examines the components of long-run equity returns, how they vary over time, and how they can be used to project future risk premiums. After adjusting for non-repeatable factors that favored equities in the past, it infers that global investors can expect an equity premium (relative to bills) of around 3½% on a geometric mean basis and, by implication, an arithmetic mean premium of approximately 5%. It also analyzes how risk, and the risk premium vary over time.

The chapter also examines risk premiums for fixed-income investing – both the maturity premium and (in less detail) the credit premium. The maturity premium, which we measure as the geometric difference between the return on long government bonds and the return on Treasury bills, is the reward for duration. The credit premium is the premium for default risk relative to risk-free government bonds. The chapter concludes with a section on future projections for stock and bond returns, which we reproduce in the following extract.

Return expectations

We conclude this chapter by estimating the returns we can project into the future and comparing these with returns achieved in the past.

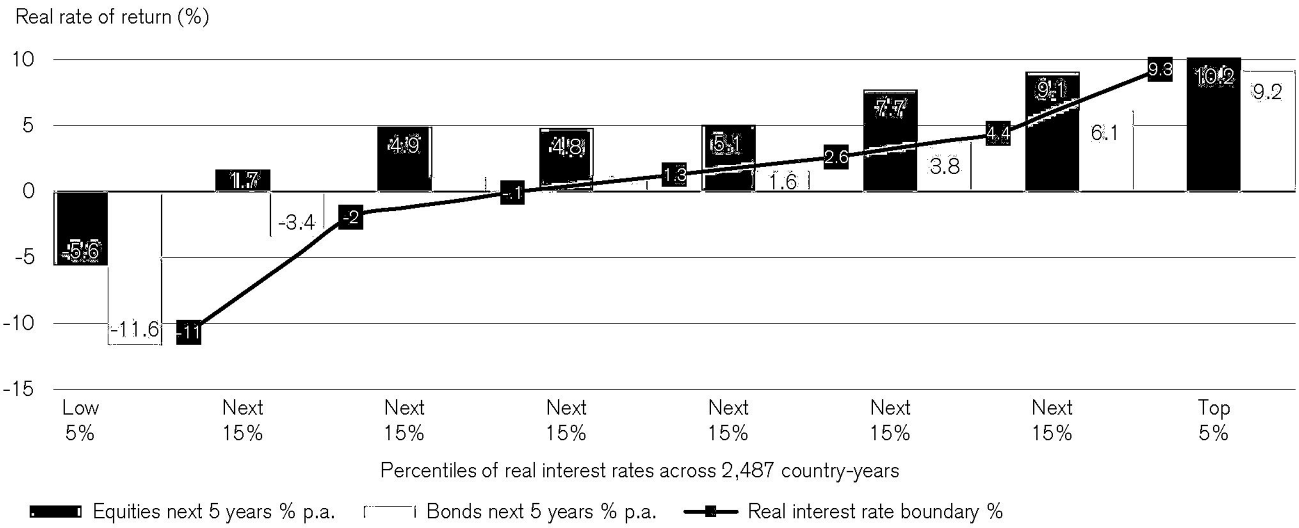
The real interest rate on Treasury bills represents the inflation-adjusted return on an asset that is essentially risk-free. The expected return on equities needs to be higher than this as investors require some compensation for their higher risk exposure. If real equity returns are equal to the real risk-free rate plus a risk premium, it follows that when the real interest rate is low, subsequent real equity returns will also be low. This applies not only to equities but also to bonds.

Interest rates and financial returns
Does history bear out this relationship between lower real equity returns and lower real interest rates? **Figure 50** provides evidence based on the full range of markets for which we have a complete history since 1900. We compare the real interest rate in a particular year with the real return from an investment in equities and bonds over the immediately following five years. After excluding periods that span the German and Austrian hyperinflations, we have a total of 2,487 observations of (overlapping) 5-year periods. We rank country-years by their real interest rates and allocate the sample to bands containing the 5% lowest and highest rates, with 15% bands in between. The line plot shows the boundaries between each band.

The bars are the average real returns on bonds and equities, including reinvested income, over the next five years. For example, the first pair of bars shows that, during years in which a country had a real interest rate below −11%, the average annualized real return over the next five years was −5.6% for equities and −11.6% for bonds.

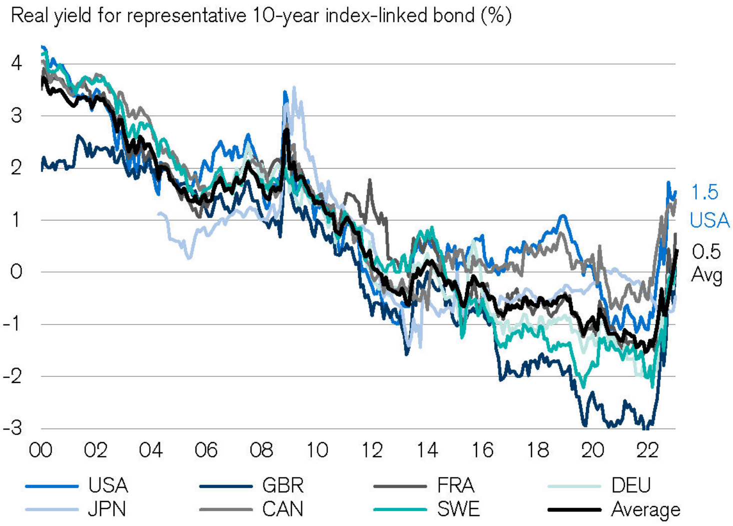
The first three bands comprise 35% of all observations and relate to real interest rates below zero. Negative real interest rates were experienced in around one-third of all country-years. These low real rates often arose in inflationary times.

Figure 50: Real asset returns versus real interest rates, 1900–2022



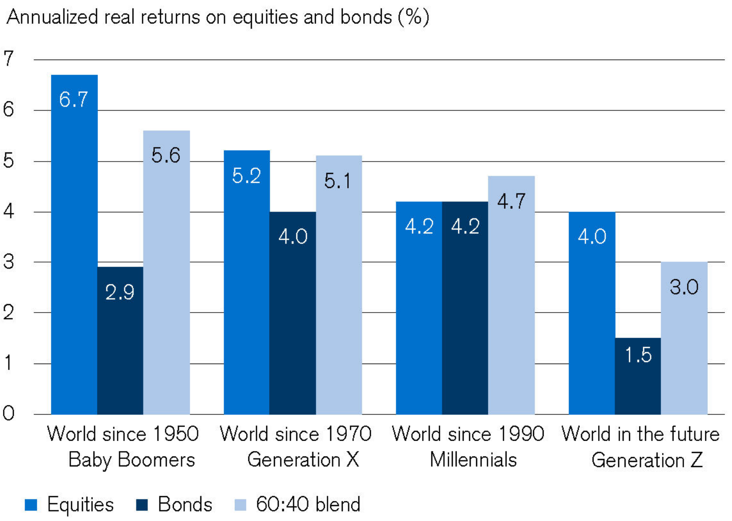
Source: Elroy Dimson, Paul Marsh, and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

Figure 51: Real yields on inflation-linked bonds, 2000–2022



Source: Elroy Dimson, Paul Marsh, and Mike Staunton using underlying bond level data from Refinitiv. Not to be reproduced without express written permission from the authors.

Figure 52: Return experiences across generations



Source: Elroy Dimson, Paul Marsh, and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

There is a clear relationship between the current real interest rate and subsequent real returns for both equities and bonds. Regression analysis of real interest rates on real equity and bond returns confirms this, yielding highly significant coefficients. Note also that in every band depicted in **Figure 50**, equities provided a higher return than bonds.

When real interest rates are low, expected future risky-asset returns are also lower. However, during periods when real interest rates fall unexpectedly, this will tend to provide an immediate boost to asset prices and hence returns, even though prospective returns will have been lowered. These patterns were prevalent during much of the 21st century until 2021.

The impact of changing real interest rates

Figure 51 plots the real yields on inflation-linked bonds (ILBs) with a maturity of ten years. These securities are the equivalent in other countries to the Treasury Inflation-Protected Security (TIPS) issued by the United States. **Figure 51** shows the real yields at which ILBs traded in seven countries that issue such securities.

The black line in **Figure 51** is the average of the ILB yields for the individual countries. In 2000, the average real yield was almost 4% (it was fully 4% if the UK is ignored). Within just over two decades, the average yield on these linkers had collapsed by some five percentage points to –1.5% by the end of 2021.

This large fall in real interest rates provided a significant boost to asset prices. It also had a big impact on capital market projections because as asset prices rose, future expected returns fell. This is because real interest rates provide the baseline (to which we add a risk premium) for estimating future expected returns. That is why many refer to the 21st century up to 2021, especially the period after the Global Financial Crisis, as the "low-return world."

However, **Figure 51** shows that real 10-year yields rose sharply in 2022 with the average across countries, shown by the heavier black line, rising by two percentage points to +0.5% by end-2022. In the USA, they rose even more from –1.1% to +1.5% by end-2022, with 20-year real yields rising from –0.5% to +1.8%. This had the reverse effect of the fall in real rates over the previous years. In 2022, asset prices fell substantially, while future expected returns rose.

Return experiences across generations

Investors' views of the future are conditioned by past experience. These past experiences differ across generational cohorts that are loosely defined by birth year, not by current age. Baby boomers (born 1946–64) were the post-war generation; Generation X (born 1965–80) and Millennials (born 1981–96) followed. Demographers and social scientists report major differences in the tastes, habits and expectations of each cohort. However, their capital market experiences have been broadly similar.

In the first three blocks of **Figure 52,** we report the returns they may have observed. In each block, we show the investment performance of world equities, world bonds, and a balanced portfolio (a 60:40 blend of the two). All three generations enjoyed good returns from equities, especially the Baby boomers. The bond returns, particularly since 1970 and 1990, are very high, reflecting the excellent returns during the "golden age" of bonds.

Generation Z (born 1997–2012) faces a different future. The block on the right of the chart uses current long bond yields to indicate future real bond returns and adds our estimated equity premium to make a projection of real equity returns for the next generation.

Expected equity returns are lower, although not very different from those enjoyed by Millennials. Prospective bond returns are much lower. Finally, the balanced portfolio now offers a risky return of around 3% in real terms – appreciably lower than the real return enjoyed by the previous three generations.

The sharp-eyed regular reader of the Yearbook will notice that **Figure 52** differs in two important respects from the equivalent chart presented last year. First, the past has become less rosy. Although we have added just one year to the long-run historical returns, 2022 was a very poor year for both world equities and bonds. Second, the returns projected for Generation Z have increased since last year.

Since this chart is meant to represent long-run expectations for the next generation, one might ask whether the estimates provided in last year's chart were misjudged and overly pessimistic? A year ago, we were still living in a low-return world. Now the transition from last year's projections to this year's needs to be judged after taking into account the *very* low returns on world stocks and bonds that investors experienced in 2022.

A low-return world, where interest rates are already exceptionally low, can develop in two ways. First, it can remain a low-expected-returns world by (on average) continuing to deliver low returns year after year. Alternatively, the low returns can come early in the form of a very bad year for asset prices. The lower asset prices then imply higher expected returns. This is obvious in the bond market where lower prices lead to higher yields. It is equally true in the equity market, with the higher bond yields forming the baseline for future equity, and indeed all asset returns. We have thus moved from a low-return world to a somewhat higher-return world thanks to the very poor returns in 2022.

Concluding remarks

This chapter has built on our estimates of the equity risk premium in order to look to the future. We use a building block approach to decompose past returns. After adjusting for non-repeatable factors that favored equities in the past, we infer that investors can expect an equity premium (relative to bills) of around 3½% on a geometric mean basis and, by implication, an arithmetic mean premium of approximately 5%. We have also examined risk premiums for fixed-income investing – both the maturity premium and (in less detail) the credit premium.

We have examined the historical record to gain insights into the financial market risks that should command a return premium. We have shown how expected returns can be inferred from current yields and have estimated the portfolio returns that, at the current time, can be anticipated in the future. In the next two chapters we build on these findings by studying the rewards for exposure to a wider range of risk factors.

Chapter 8: Commodities and inflation

This extract from the Credit Suisse Global Investment Returns Yearbook 2023 reproduces the whole of Chapter 8 on Commodities and Inflation, the new focus topic for this year.

Inflation is once again a major issue, negatively impacting the real value of assets. Since rising commodity prices, including oil and gas, have contributed to this, we investigate whether investing in commodities offers an effective hedge against inflation. We find that individual commodities have, on average, generated low long-run returns. However, balanced portfolios of futures have provided attractive risk-adjusted long-run returns, albeit with some large, lengthy drawdowns. They have also provided an effective hedge against inflation. We show that commodity futures are almost unique in this respect, compared with other assets.

Photo: Getty Images, Wan Fahmy Redzuan Wan Muhammad / EyeEm

Inflation: The beast that's never slain

Throughout history, there have been periods when inflation has flared up. The left-hand chart below illustrates this, showing inflation peaking in times of wars and energy crises. Both factors are present in the latest burst of inflation in 2021–22.

There have also been long intervals when inflation seemed conquered. The right-hand chart shows that, for the first 21 years of the 21st century, average inflation in developed countries was just 1.5%. It never exceeded 4%, and during the Global Financial Crisis, turned negative. When emerging markets are included, the average rises to 2.2% (excluding hyperinflationary Argentina).

Periods of low inflation can breed complacency. When inflation picked up in 2021, the so-called "team transitory" argued that this was temporary, caused by the rapid pickup in demand and supply chain bottlenecks after the COVID lockdown. Thinking this would normalize, the US Federal Reserve waited until March 2022 to raise interest rates.

By then, US inflation had risen from 0.3% to 7%. Russia was at war with Ukraine, which led to an energy crisis and higher food prices. It was also now accepted that inflation had been fueled by ultra-loose monetary and fiscal policy aimed at easing the impact of COVID. By end-2022, average inflation across the countries in the DMS database (left-hand chart below) was 8.0%, 19 times higher than at end-2020. US and UK inflation hit 41-year highs in 2022, while German inflation reached its highest level in 71 years. As in many previous episodes, inflation had rapidly accelerated. It became a major issue for citizens, central banks, politicians and investors.

The persistence of inflation

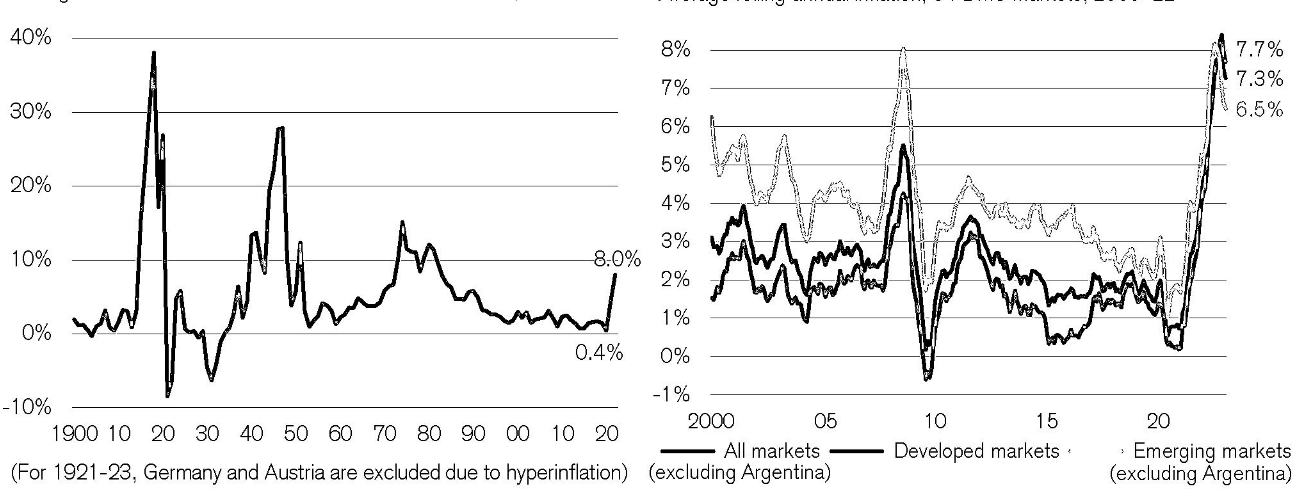
By end-2022, there were signs that inflation had peaked. US inflation was 6.5%, down from its June high of 9.1%. The DMS average of 8.0% shown in the left-hand chart below had fallen from its October peak of 8.3%. By October 2022, International Monetary Fund (IMF) forecasts showed inflation in advanced economies peaking in 2022, cooling in 2023 to 4.4% and dropping to 2%–3% in 2024.

Arnott and Shakernia (2023) argue that these forecasts are optimistic in the light of history. They studied inflation persistence in 14 developed economies from 1970 to 2022. They found that, "Reverting to 3% inflation … is easy from 4%, hard from 6% and very hard from 8% or more. Above 8%, reverting to 3% usually takes six to 20 years, with a median of over ten years."

They conclude that, "Those who expect inflation to fall rapidly in the coming year may well be correct. But, history suggests that's a "best quintile" outcome. Few acknowledge the "worst quintile" possibility, in which inflation remains elevated for a decade." To support their position, they cite Havranek and Ruskan (2013) who analyzed 67 published studies on global inflation and monetary policy in developed economies. They found that, across 198 policy rate hikes of 1% or more, the average lag until a 1% fall in inflation was achieved was between two and four years.

Arnott and Shakernia's (2023) analysis is influenced by "event clustering" during the inflationary experience of the 1970s and early 1980s. Hopefully, central banks have learnt from this and today's actions will lead to faster falls. However, it is important to be reminded just how persistent inflation has proved historically.

Figure 69: Average inflation rates across DMS database countries over time



Source: Elroy Dimson, Paul Marsh, and Mike Staunton using data from Refinitiv. Not to be reproduced without express written permission of the authors.

Inflation's negative impact

Inflation makes citizens poorer through the reduction in their purchasing power. Workers seek higher pay to compensate. This potentially leads to inflationary spirals, both wage-price and price-price, as firms seek to pass on their higher raw materials and labor costs. Inflation hits the poorest hardest as a higher proportion of their consumption is on basics such as food and energy. However, it also hits the wealthy by negatively impacting the real value of their assets – stocks, bonds and real estate – as we will see below.

Central banks seek to control and reduce inflation through an interest-rate-hiking cycle. The mechanisms and rationale for this are explained in Chapter 2. The hiking cycle and consequent higher interest rates exacerbate the already negative impact of inflation on asset prices. We focus in the next two sections specifically on the impact of inflation on bond and equity returns. Later, we look at the correlation between inflation and other asset classes.

Inflation and equity and bond returns

The recent strong uptick in inflation has reminded investors about the likely impact of inflation on asset returns. For bonds, the impact is clear. Conventional fixed income bonds have cash flows that are contractually fixed in nominal terms. When inflation rises, interest rates will also tend to rise. Fixed income securities thus have unchanged cash flows, but these will be discounted at a higher rate. Their prices will fall.

Figure 16 in Chapter 2 showed that the average real return from bonds varied inversely with contemporaneous inflation. As an asset class, bonds suffer in periods of inflation, but provide a hedge against deflation. **Figure 28** in Chapter 4 shows that during the disinflationary (declining inflation) period from 1982 to 2014, dubbed the "golden age of bonds," the world bond index experienced a remarkably high annualized real return of 7.4%.

It is often claimed that equities are a hedge against inflation. **Figure 16** showed this is incorrect. Equities performed especially well in real terms when inflation was low. High inflation impaired performance and deflation led to lower returns than on government bonds. The correlation between real equity returns and inflation was negative, i.e. equities were a poor hedge against inflation. There is an extensive literature to back this up. Fama and Schwert (2077), Fama (1981), and Boudoukh and Richardson (1993) are three classic papers, and Tatom (2011) is a useful review article.

Despite this, it is widely believed that stocks must be a good hedge against inflation to the extent that they have had long-run returns that were ahead of inflation. However, their high ex-post return is better explained as a large equity risk premium (see Chapters 4 and 5). It is important to distinguish between beating inflation and hedging against inflation.

Stagflation

Many investors today are currently concerned not just about inflation, but "stagflation." This term was first used by British politician Iain Macleod in 1965. He referred to the UK suffering "the worst of both worlds – not just inflation on the one side or stagnation [stagnating economic growth] on the other, but both of them together." At the time of writing, the IMF forecasts continuing (albeit falling) inflation combined with generally low economic growth. The IMF (2022) says, "For many people 2023 will feel like a recession."

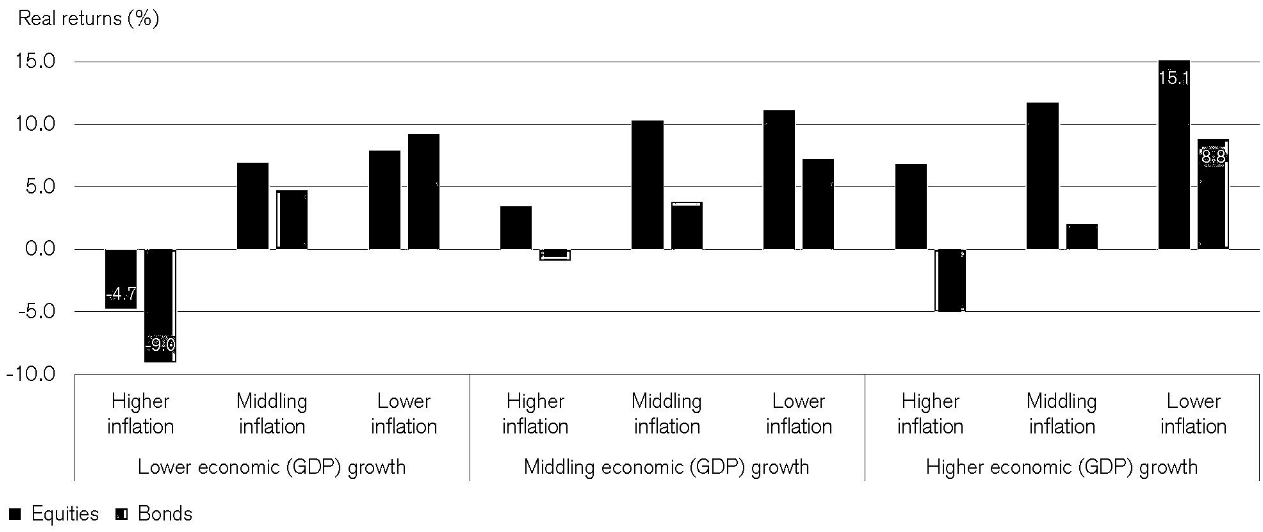
To examine the impact of stagflation on equity and bond returns, we employ a similar methodology to that used to produce **Figure 16**, but add a further variable, real GDP growth. **Figure 70** (overleaf) compares real equity and bond returns with both inflation and real GDP growth in the same year for the full range of 21 countries for which we have a complete 123-year history. We exclude the hyperinflationary years of 1922–23 for Germany and 1921–22 for Austria.

We sort all the country-year observations by economic growth and divide the sample into three equal groupings representing lower, middling and higher growth. Within each group, we then sort by inflation, dividing each growth category into three equal subsamples of lower, middling and higher inflation. For each of these nine subsamples, we compute the average real return from equities and bonds. In the chart, the nine categories are ranked from stagflation on the left – lower growth and higher inflation – through to the opposite of stagflation on the right. We refer to this as stable growth, namely higher growth and lower inflation.

The chart shows that, for equities and bonds, real returns tend to be higher when economic growth is higher and inflation is lower. Within each growth category, equity and bond returns increase with decreasing inflation. In times of stagflation, real equity returns averaged –4.7% while the average real bond return was –9.0%. In the opposite case of stable growth, the average real returns were +15.1% for equities and +8.8% for bonds.

These results reinforce the fact that inflation is bad for both stocks and bonds. They also show why investors are right to fear stagflation.

Figure 70: Real equity and bond returns versus inflation rates and real economic (GDP) growth, 1900–2022



Source: Elroy Dimson, Paul Marsh, and Mike Staunton, DMS Database 2023, Morningstar. GDP data is from Barro (2010), Maddison (1995), Mitchell (2007) and IMF (2022).

Commodities: An alternative asset?

The year 2022 was characterized by higher inflation, hiking cycles and rising nominal and real interest rates throughout much of the world. Not surprisingly, and in conformity with historical experience and financial theory, the real returns from bonds and equities were negative. At times like these, investors naturally cast around for alternative investments that might offer a positive return and which could provide a hedge against inflation.

Rising commodity prices, including oil and gas, have contributed to the wave of inflation. So could investment in commodities provide the alternative asset class that investors are seeking?

We document and analyze the long-run record of commodity investment, looking first at investment in physical (or spot) commodities and then at investment in commodity futures.

Investing in physical commodities

Table 15 shows the returns from investing in 29 physical (also known as spot or cash) commodities since 1900. For each commodity, the data span the full period from 1900 through to 2022. **Table 15** shows the arithmetic mean (AM) and geometric mean (GM) real returns and the standard deviation of real returns. The commodity prices are in US dollars, so returns are deflated by US inflation. To facilitate later comparisons with futures returns, the final column shows the GM of excess returns, i.e. the return after (geometrically) deducting the US treasury bill rate.

The AM annual real return over the 123 years was positive for all but one commodity. However, the GM real returns – the annualized returns over 123 years – were much lower and were negative for 21 of the 29 commodities. The best performer, nickel, gave an annualized return of 1.20%. The penultimate row of the table shows the average mean return and standard deviation of returns for the 29 commodities. The average GM real return, i.e. the long-run annualized return from selecting a commodity at random, was –0.49%. This is consistent with the long-established contention that commodity prices have not kept pace with inflation (see Gorton and Rouwenhorst (2006)).

The GM is always lower than the AM. As a rough approximation, it is lower by half the variance of returns, i.e. half the standard deviation (or volatility) squared. This is known as the variance drain or volatility drag.

The table shows that the average 123-year standard deviation of real returns for the 29 commodities was 27.6%, similar to the average volatility for individual stocks. This implies that, on average, the GM for individual commodities should be around 3.8% lower than the AM. The penultimate row of the table shows that the actual difference of 2.74% (average AM) less –0.49% (average GM) equals 3.2%, which is close.

Table 15: Spot commodity returns (%), 1900–2022

	Real (inflation adjusted) returns			Excess returns
Commodity	**Geometric mean (%)**	**Arithmetic mean (%)**	**Standard deviation (%)**	**Geometric mean (%)**
Aluminum	–1.88	0.49	25.47	–2.31
Cattle	0.06	0.99	13.85	–0.39
Coal	0.91	2.71	21.18	0.46
Cocoa	–1.20	3.01	31.68	–1.64
Coffee	–0.54	3.59	31.36	–0.99
Copper	–0.46	2.57	27.13	–0.91
Corn	–0.33	3.79	30.83	–0.77
Cotton	–0.23	3.55	28.45	–0.68
Eggs	–0.93	1.85	24.73	–1.37
Gold	0.76	1.98	17.18	0.31
Hogs	–0.49	3.33	30.27	–0.93
Iron ore	–0.05	2.41	24.73	–0.50
Lard	–0.67	3.66	30.85	–1.11
Lead	–0.05	2.81	25.61	–0.49
Lumber	–0.92	1.00	21.14	–1.36
Nickel	1.20	5.53	37.05	0.74
Oats	–0.70	3.35	30.96	–1.14
Oil	0.27	3.66	28.38	–0.18
Palm oil	–0.95	2.51	27.66	–1.39
Platinum	0.41	2.69	22.44	–0.04
Rice	–1.39	0.68	23.46	–1.83
Rubber	–3.21	4.22	46.76	–3.64
Silver	0.10	3.68	34.96	–0.35
Sugar	–1.48	4.50	37.22	–1.92
Tea	–1.68	–0.66	17.20	–2.12
Tin	0.24	3.27	26.89	–0.21
Tobacco	–0.14	1.32	17.21	–0.59
Wheat	–0.79	2.00	25.46	–1.23
Zinc	–0.05	5.06	38.94	–0.50
Average	**–0.49**	**2.74**	**27.55**	**–0.93**
Equally Weighted Portfolio	**2.04**	**2.74**	**12.47**	**1.58**

Sources: Analysis by Elroy Dimson, Paul Marsh and Mike Staunton using commodity price data (in USD) from Global Financial Data and US risk free interest rates and inflation from the DMS Database 2023, Morningstar. Note that the penultimate row labeled "Average" shows the averages of the previous 29 rows for the individual commodities. Not to be reproduced without express written permission of the authors.

Figure 71 (overleaf) shows the cumulative real returns over 123 years for a representative commodity from each commodity group – gold from precious metals, copper from industrial metals, oil from energy, corn from grains, sugar from soft commodities, cattle from animal products and cotton from other agricultural products. Prices are rebased to start at USD 1.

Rolling, long-run investments in sugar, copper, corn and cotton all gave a real terminal value after 123 years that was less than the initial investment, i.e. they failed to keep pace with inflation. Cattle resulted in a seven US cents profit on the initial dollar investment after 123 years. Oil and gold performed somewhat better with terminal values of USD 1.4 and USD 2.5.

Gold: A special case

Gold is not just a commodity, but also a financial and cautionary investment. Some would argue it is also a currency – it certainly has a legacy from the gold standard days. Gold bugs – those who expound the virtues of gold – still see it as the ultimate anchor of value, warning against fiat currencies (government supported paper money). Investopedia (2023a) says they believe "its price will perpetually increase."

The evidence from **Table 15** and **Figure 71** contradicts this. Since 1900, the annualized real return on gold was just 0.76%. In **Table 15**, the last column shows that gold has outperformed Treasury bills (cash) by 0.3% per annum. However, it has been far more volatile, with a standard deviation of 17% per annum, similar to the world equity index. The chart shows that an initial investment in gold of USD 1 in 1900 yielded a real terminal value of USD 2.5 by end-2022. This compares poorly with US bonds and stocks, which gave terminal values of USD 7.8 and USD 2,024 (see Chapter 2).

While the long-term returns on gold have been unexciting, gold is prized for other reasons. In many countries, it is an important part of society and culture. Gold is also a cautionary asset. Throughout history, investors in less-secure parts of the world have focused on gold because it is highly portable, easily realizable, a store of value and anonymous.

For investors who do not prize gold for these reasons, it should be viewed as an asset that has generated a volatile and low real rate of return over the long haul. It is thus less suited to long-term institutional investment. It does, however, as we will see below, have a role as an inflation hedge.

Portfolios of physical commodities

A recurring theme of the Yearbook is the power of diversification. Nowhere is this better illustrated than in the case of investing in commodity portfolios. The final row in **Table 15** shows the mean returns and standard deviation for an annually rebalanced, equally weighted portfolio of the 29 commodities shown in the table. The AM for this index is, by definition, the same as the average AM for the 29 individual commodities.

However, the final row of the table shows that the GM real return of 2.0% is much higher than the average GM of the individual commodities. This is because a portfolio of commodities has much lower volatility – down to 12.5% – and this has reduced the volatility drag to just 0.8%. Diversification is especially effective within commodity portfolios as the average correlation between commodities is very low at just 0.20.

Thus, while individual commodities on average gave a negative annualized real return, an equally weighted portfolio of those same commodities gave a positive return. Booth and Fama (1992) call this the "diversification return," while Erb and Harvey (2006), hereafter EH (2006), as we refer to this article frequently) describe this as "turning water into wine." **Figure 71** shows the impact. The equally weighted portfolio gave a terminal value after 123 years of USD 12, compared with an average terminal value for the 29 individual commodities of just USD 0.90.

Avoiding physical commodities

Investors tend to avoid physical commodities as dealing in them is burdensome. Investing directly in a commodity involves buying and storing it. Selling entails finding a buyer and handling delivery logistics and costs. This might be feasible in the case of precious or even industrial metals, but livestock, bushels of corn, frozen orange juice and barrels of crude oil are more complicated. Storage and insurance costs can be large. There are also interest rate/carry considerations which we discuss below. All this requires management time and, even if delegated to third parties, it adds a further layer of costs. Managing a multi-commodity portfolio is even more complex.

The annualized returns (GMs) shown in **Table 15** would therefore not have been achievable, because they ignore all these costs. At best, they are a pre-costs upper bound.

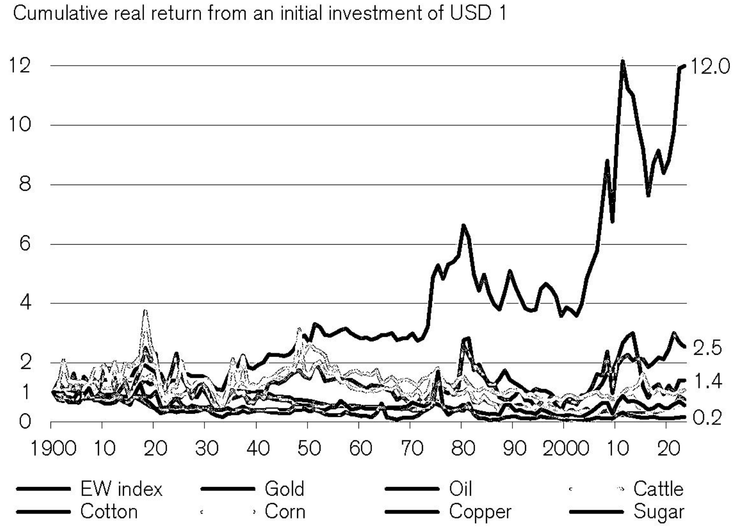
For institutional investors, commodity futures are a far simpler way of investing. Futures contracts are usually rolled over when the maturity date approaches to avoid taking delivery. Not only are commodity futures more convenient, with lower transaction costs, but, as we will see, they are also a more rewarding alternative.

Futures – the crock of gold?

In an influential study published in 2006, Gorton and Rouwenhorst (hereafter GR) found that, from 1959 to 2004, a fully collateralized portfolio of commodity futures provided a similar return and risk premium to US equities, a lower volatility, and hence a somewhat higher Sharpe ratio. Furthermore, commodity futures returns were negatively correlated with equity and bond returns, and positively correlated with inflation. Overall, they appeared to be the perfect asset class, especially for inflationary times.

However, as has often proved the case, post-publication returns failed to match the promise of the back history. Was this just bad luck? We examine the evidence below based on data for a much longer period from the 1870s to the present day. First, however, we highlight the

Figure 71: Real returns, selected commodities, 1900–2022



Sources: Analysis by Elroy Dimson, Paul Marsh and Mike Staunton using commodity price data (in USD) from Global Financial Data and US inflation from DMS Database 2023, Morningstar. Not to be reproduced without express written permission of the authors.

differences between investing in physical commodities versus futures. We explain why investing in commodity futures could generate a risk premium, while investing in physical commodities has failed to do so after costs.

Investing in commodity futures

A commodity futures contract is an agreement to buy or sell a specified quantity of a standardized commodity on a fixed maturity date at a price agreed at the contract date. In setting the price, the parties to the contract will assess the likely future spot price at maturity, considering market expectations, and any trends and seasonality.

Thus, in contrast to investment in physical commodities, market-expected movements in the spot price are not a source of return to futures investors. Long investors will gain (lose) only if the spot price at maturity turns out to be higher (lower) than was expected. To generate abnormal returns, futures investors need to be smarter than the market at forecasting spot prices.

For those with no forecasting skills, investing in futures still makes sense if there is a risk premium. If today's futures price is set below the expected future spot price, a buyer of futures will expect to earn a risk premium. Similarly, a seller of futures will expect to earn a risk premium if the futures price is set above the expected future spot price. The main theory explaining why there should be a risk premium that accrues mostly to buyers is the theory of normal backwardation (Keynes (1930) and Hicks (1939)).

Normal backwardation postulates a world in which the producers of commodities wish to fix the price of their output for future delivery, for example, at harvest time in the case of agricultural crops. To obtain this insurance against future spot price movements, the producers hedge by selling futures to buyers (speculators or investors), who demand a risk premium for providing this insurance. They do this by setting the futures price below the expected future spot price.

Normal backwardation is clearly a simplification. Consumers may also want to hedge, e.g. airlines and aviation fuel. However, a common assumption is that consumers' hedging needs are overshadowed by producers' hedging requirements. Whether long investors in futures earn a risk premium over the long run is an empirical question, which we address below.

There are two other key differences between investing in futures versus spot commodities. First, long futures investors very seldom take delivery at maturity. Instead, they sell their contract, or roll it over into a contract for later delivery to avoid the costs involved in taking delivery. Second, when a futures contract is taken out, no cash changes hands between the buyer and seller. In this sense, the value of the contract is zero. In practice, both the buyer and seller need to post collateral. The amount of collateral will vary over time to ensure that it is adequate to settle gains and losses that accrue on the contract.

The collateral, however, is typically small relative to the futures price, implying considerable leverage. Since we wish to make comparisons with other asset classes such as bonds and stocks, we need to adjust for this leverage when computing futures returns. The standard approach is to assume that the contract is fully collateralized. This means that if the contract price is, say, USD 100, we assume that the investor simultaneously invests USD 100 in Treasury bills.

The total return from investing in a futures contract is thus the change in the futures price plus the return from Treasury bills. In the analysis below, we will mostly report excess returns, which are the returns after deducting the Treasury bill return, i.e. just the change in the futures price. Over the long run, we can interpret this as the ex-post risk premium relative to bills, just as we do for equities.

Commodity futures data

The data we use for individual commodity futures was originally assembled and used by Levine, Ooi, Richardson and Sasseville (2018) (hereafter LORS). Three of these authors worked for AQR Capital Management, and AQR has generously provided us with the data – we are especially grateful to Dr. Antti Ilmanen. Commodity Systems Inc. provided AQR with a sizable part of this data and we are also grateful to them, especially Rudolph Cabral, for permission to use their data.

The dataset, which provides monthly returns for 30 futures contracts, starts in 1877, soon after futures trading began on organized exchanges in the USA and UK. Returns were computed assuming that in each month the investor held the nearest of the contracts whose delivery month was at least two months away. The return on the contracts held were spliced together on the roll dates. In 1877, the database covered just five agricultural products. The number and variety grew as futures trading became more popular especially from the 1960s onward. By 2022 there were 26 futures in the database, four having by then been discontinued.

The dataset provides a helpful decomposition of the change in the futures prices into the excess spot return (the spot return deflated by the Treasury bill return) plus the interest-rate-adjusted carry. The carry (or roll) return is the return, positive or negative, from rolling over contracts. It is sometimes referred to as the income return, where income can be negative. This decomposition allows us to make direct comparisons of the excess return on futures investment (i.e. the change in the futures price) and the excess spot return.

Commodity futures returns

Table 16 (overleaf) shows the long-run USD returns from (rolled) investing in the 30 individual commodity futures. The table shows excess returns – returns after (geometrically) deducting the US bill rate. The table relates to the 146 years since 1877, although only five of the futures contracts date back to 1877.

The last row of **Table 16** shows the excess returns for an equally weighted portfolio of futures. As we saw in the case of physical commodities in **Table 15**, diversification again "turns water into wine." The GM of excess returns on the equally weighted portfolio is 3.28% per annum, much higher than the average GM (0.99%) of the individual, component futures. This is because a portfolio of futures has a much lower volatility of 17.6%, thanks to the very low average correlation between individual futures of just 0.22. This has reduced the volatility drag to 1.5%.

The historical risk premium

The excess return on the equally weighted futures portfolio can be interpreted as a risk premium – the futures return relative to bills. **Figure 72** shows its evolution since 1877. An initial investment of USD 1 grew to USD 110 by 2022, an annualized premium of 3.28%. This was much higher than the excess spot return, where the terminal value was USD 3.3, an annualized return of 0.82%.

The excess futures return was not always ahead of the excess spot return. For the first 30 years until late 1906, the cumulative excess spot return was ahead of the excess futures return. Over this period, there was a negative adjusted carry or income from futures and both spot and futures returns underperformed Treasury bills. Futures proved a poor investment during the late 19th and very early 20th centuries. The futures roll returns have also been net negative over the last two decades and we explore this further below.

Figure 72 also shows real futures and spot returns, where returns are deflated by the inflation rate rather than the Treasury bill return. Since Treasury bills provided a positive real return, the real returns from commodities lie above the excess returns. Clearly, collateralized commodity futures portfolios have greatly outperformed spot portfolios, Treasury bills and inflation.

In a critique of the influential Gorton and Rouwenhorst (GR) paper referred to above, EH (2006) argue that much of what appears to be a risk premium from futures could arise from the monthly rebalancing of the futures portfolio back to equal weights. They argue that this arises because rebalancing involves selling the commodity futures that have risen the most and buying those that have fallen most. However, Gorton and Rouwenhorst (2006, 2006a) show that less frequent rebalancing slightly increases returns, rather than vice versa. We can therefore reject the notion that the risk premium from futures is due to rebalancing.

Futures versus stocks and bonds

In the rest of this chapter, we focus on portfolios of commodity futures, not on spot commodities, nor on individual commodities. The data we have used on individual futures and spot returns was kindly provided by AQR. In terms of long-run futures portfolio returns, we have a second source of data, namely the equally weighted index constructed by Bhardwaj, Janardanan and Rouwenhorst (2019) (hereafter BJR EW index) and subsequently kept updated by SummerHaven Investment Management. This was generously provided to us by Geert Rouwenhorst.

Table 16: Commodity futures returns (%), 1877–2022

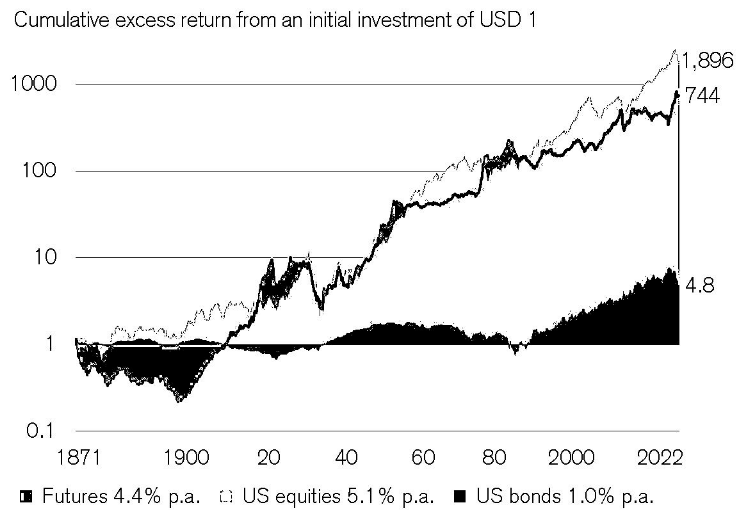
Futures	Start year	End year	Excess returns: Futures Geometric mean %	Arithmetic mean %	Standard deviation %	Spot Geometric mean %
Aluminum	1992	2022	-3.40	-1.63	19.13	-0.68
Brent oil	1988	2022	6.81	11.87	32.22	2.31
Cattle	1964	2022	2.80	4.08	16.20	-1.22
Cocoa	1966	2022	0.03	4.51	30.37	-1.57
Coffee	1972	2022	-1.14	4.99	36.08	-1.50
Copper	1993	2022	5.84	8.68	24.34	2.51
Corn	1877	2022	-0.51	2.51	25.02	-1.62
Cotton	1925	2022	0.61	3.52	24.29	-2.32
Crude oil	1983	2022	2.72	9.27	36.44	-0.88
Feeder cattle	1971	2022	1.34	2.74	16.65	-1.22
Gas oil	1981	2022	4.33	9.04	31.06	-0.83
Gold	1975	2022	-0.07	1.63	18.59	0.49
Heating oil	1978	2022	5.08	10.03	32.31	0.43
Hogs	1966	2022	-0.79	2.60	26.01	-2.96
Kansas wheat	1966	2022	-1.67	1.52	25.68	-1.29
Lard	1877	1951	-4.33	-1.60	23.93	-3.74
Lead	1995	2022	1.99	5.63	27.07	1.64
Natural gas	1990	2022	-15.98	-5.26	49.71	1.83
Nickel	1994	2022	3.74	9.45	34.20	1.98
Oats	1877	2015	-1.21	2.56	28.26	-2.39
Pork	1877	1921	-0.77	3.48	29.43	-0.84
Short ribs	1885	1929	6.74	9.43	24.23	-1.84
Silver	1963	2022	-1.13	3.50	30.72	0.19
Soybeans	1937	2022	4.95	7.74	24.60	-1.29
Soybean meal	1951	2022	5.89	9.26	27.39	-1.24
Soybean oil	1950	2022	3.36	7.08	28.11	-1.69
Sugar	1966	2022	-3.03	4.45	40.09	-0.80
Unleaded	1985	2022	10.07	16.23	35.80	0.13
Wheat	1877	2022	-1.33	1.55	24.31	-2.12
Zinc	1992	2022	-1.31	1.79	24.79	0.43
Average			0.99	5.02	28.23	-0.67
Equally weighted portfolio	1877	2022	3.28	4.75	17.55	0.82

Sources: Elroy Dimson, Paul Marsh and Mike Staunton using futures data (in USD) from AQR and Commodity Systems Inc (see Levine, Ooi, Richardson and Sasseville (2018)) and US risk free interest rates and inflation from DMS Database 2023, Morningstar. Not to be reproduced without express written permission of the authors.

Figure 72: Futures vs. spot returns – equally weighted portfolio, 1877–2022

Sources: Analysis by Elroy Dimson, Paul Marsh and Mike Staunton using futures data (in USD) from AQR and Commodity Systems Inc (see Levine, Ooi, Richardson and Sasseville (2018)) and US risk free interest rates and inflation from DMS Database 2023, Morningstar. Not to be reproduced without express written permission of the authors.

Figure 73: Futures, stocks and bonds, 1871–2022



Sources: Analysis by Elroy Dimson, Paul Marsh and Mike Staunton using the equally weighted commodity futures index created by Bhardwaj, Janardanan and Rouwenhorst (2019) and updated by SummerHaven Investment Management, linking into the AQR equally weighted commodity futures index after November 2021. The US inflation rate and equity series are from DMS Database 2023, Morningstar. Not to be reproduced without express written permission of the authors.

This index starts in 1871, slightly earlier than the LORS/AQR index. It is much broader, embracing 230 futures contracts, rather than the 30 in the AQR index. Even in the 1880s, it covered over 30 futures contracts, compared with five for the AQR index. By 2021, it contained just under 50 contracts.

The AQR index covers US commodity futures traded on the Chicago Board of Trade. The BJR EW index includes contracts traded in 16 different US cities and 12 locations overseas. In addition to commodities traded in the USA, the index includes contracts from nine other countries. In the analysis that follows, we therefore use the more comprehensive BJR index as our long-run measure of the returns from a portfolio of collateralized futures. Note, however, that the broad findings from both datasets are very similar.

Figure 73 shows the cumulative excess returns from 1871–2022 from an initial investment of USD 1 in futures compared with US stocks and bonds. For equities, the series plotted is the US equity premium versus bills; for bonds, it is the risk premium of US bonds over bills, or the maturity premium; for futures, it is the commodity futures risk premium relative to bills from the BJR EW index.

For almost the entire 151 years, stocks were ahead of bonds. Futures started poorly, trailing bonds until 1908, then catching up with stocks in 1917. Futures then tracked stocks quite closely until 1984, after which equities stayed in the lead. The gap narrowed during the Global Financial Crisis, but stocks then pulled decisively ahead. The terminal value for the US equity risk premium was more than two and a half times that for the futures risk premium. Over this period, the annualized US equity risk premium versus bills was 5.1%, while the annualized risk premium from futures was 4.4%. The annual volatilities of the two excess return series were very similar – 19.5% for stocks and 20.0% for futures.

Comparing futures with US equities is setting a tough hurdle. Since 1900, US stocks have outperformed those from every other country except Australia when measured in common currency (see Chapter 2). Although futures have underperformed US stocks since 1871, it seems possible – as we will explore in the next section – that futures will outperform stocks in an international setting.

Commodity futures internationally

Although most of the commodity futures in the BJR EW index were/are traded on US exchanges, some 20% were traded on foreign exchanges. However, wherever the exchange is located, these are internationally traded goods and the US commodity exchanges (and those in other countries) are open to and frequented by foreign investors and traders. Prices are set globally while also being subject to important local factors, delivery locations and conditions. So far, we have compared futures investing with investment in US stocks and bonds, but how does the equivalent comparison appear to investors from overseas?

Our global DMS database starts in 1900 and, except for the USA, we do not have global equity and bond data of the same high quality going back to 1871. Our international comparisons shown in **Figure 74** (overleaf) therefore cover the period from 1900 to 2022. They show the excess returns on futures, stocks and bonds from the perspective of investors in different countries, using the same period for each country.

The later start date of 1900 means that the figures for the USA are different from those shown in **Figure 73**, where the start date was 1871. Since futures returns were low in the late 19th century, the excess return on futures was appreciably larger from the 1900 start date. Indeed, the bars for the USA in **Figure 74** show that, from 1900 onward, futures gave a higher return than US stocks. The annualized excess returns from 1900 to 2022 were 6.5% for futures, 5.9% for US stocks and 1.2% for US bonds. The bars for the world (WLD) show that, for a globally diversified US-based investor, futures beat world equities and bonds by an even greater margin.

The remaining five bars in **Figure 74** show the perspective for investors in five other major countries/markets, namely Germany, France, Japan, the UK and Switzerland. In each case, we convert commodity futures returns into the local currency (euros, Japanese yen, British pounds or Swiss francs). Excess returns are estimated relative to each country's Treasury bill rate. We then compare these with the excess returns from each country's stocks and bonds.

In every country, and for the world, the excess return on commodity futures dominates the excess return from both stocks and bonds. Non-American investors enjoyed an even more favorable relative return from futures than their American counterparts. These returns are, of course before costs. It is debatable whether futures transaction costs including rolls or equity transactions costs were higher over the long run.

Has the risk premium disappeared?

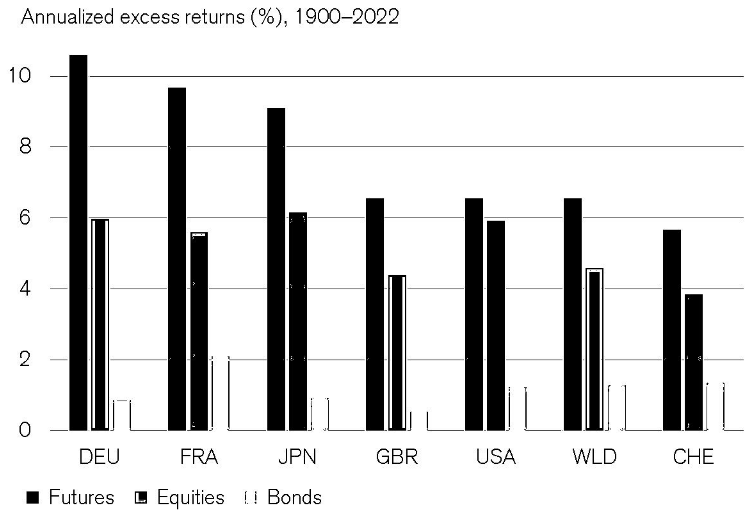
In their influential paper published in 2006, Gorton and Rouwenhorst (GR) documented an annualized risk premium of 4.2% from investing in an equally weighted index of commodity futures over the period from 1959 to 2004. Encouraged by the GR findings, in 2006 a number of exchange traded fund (ETF) providers introduced commodity futures ETFs which tracked indices such as the S&P GSCI index.

Soon after the publication of their paper, commodity futures suffered a deep and long drawdown. EH (2006) had cautioned that "naively extrapolating past performance [of futures] into the future is dangerous." Later, in EH (2016), they asked whether the ensuing performance of futures was because "a 'bad' investment strategy drove a bad outcome or a 'good' strategy experienced an unlucky outcome." Was the futures risk premium just historical good luck, and had it now disappeared?

To assess just how severe this drawdown was, we again use the BJR EW index subsequently updated by Summerhaven Investment Management. The post GR drawdown began in February 2008. It reached a nadir that was 42% lower in real terms by February 2009. The February 2008 high was not regained until September 2021, so the drawdown lasted for 13 years and seven months.

The ETFs fared far worse, especially those that tracked the S&P GSCI index. One of the larger ETFs provided a return from its 2006 launch to date of –58%.

Figure 74: Excess returns for investors in different countries



Sources: Analysis by Elroy Dimson, Paul Marsh and Mike Staunton using the equally weighted commodity futures index created by Bhardwaj, Janardanan and Rouwenhorst (2019) and updated by SummerHaven Investment Management, linking into the AQR equally weighted commodity futures index after November 2021. Stock, bond, bill and currency data are from DMS Database 2023, Morningstar. Not to be reproduced without express written permission of the authors.

The financialization of futures

One possibility is that GR's influential paper helped popularize commodity futures, and the consequent weight of money carried the seeds of its own destruction. Bhardwaj, Gorton and Rouwenhorst (2016) investigated this phenomenon known as "financialization." They focused on the decade starting in 2005 – the year after the GR research appeared in working paper form – when commodity investment gained popularity. Over this decade, institutional investors became an important source of new capital through largely passive long positions linked to indices of commodity futures.

They examine three possible impacts of financialization. First, inflows could have lowered the risk premium through the increased competition in the provision of insurance to hedgers. Second, because institutional investors hold portfolios of commodities and their allocation to commodities competes to some extent with that to other assets, their activities might increase the correlation between individual futures, and between futures and other asset classes. Finally, passive index investments might weaken the link between futures prices and fundamentals.

The authors conclude that, despite the high growth in commodity markets during this decade, the proportion of hedgers and speculators was broadly constant. Nor, in terms of risk and return, was this decade significantly different from the longer historical experience. Correlations between commodities rose, then fell again. The authors attribute this to the Global Financial Crisis, not financialization. As we noted in the 2022 Yearbook, correlations within many asset classes tend to rise sharply during periods of financial turmoil. Irwin and Sanders (2011) also review the evidence on financialization. They conclude that, "the weight of the evidence is not consistent with the argument that index funds created a bubble in commodity futures prices."

Drawdowns in commodity futures

The post GR drawdown was deep and prolonged, but was it unusual? To assess this, we show drawdown charts below of commodity futures (left-hand chart) and US equity returns (right-hand chart) from 1871 onward. They are shown in real terms for comparability with drawdown charts earlier in the Yearbook.

Drawdowns for commodity futures were clearly not unusual. Over the 152 years, they were frequent, with12 involving losses greater than 20% and nine lasting over five years. The post GR drawdown was the longest. After 37 months, it came within 0.7% of re-attaining its February 2008 high, only to plunge again, with the second phase of the drawdown lasting until September 2021. In terms of depth, it ranked fourth with its 42% drawdown. The deepest involved a 60% loss after the Wall Street Crash.

The right-hand chart shows that, over the same period, US equities experienced even more and deeper drawdowns. 15 drawdowns exceeded 20%, 9 were greater than 30%, 5 more than 40%, and 4 exceeded 50%. The largest loss was 79% following the Wall Street Crash. Five drawdowns exceeded five years, while two extended over more than 14 years.

Drawdowns in risky assets are commonplace and commodity futures are no exception. The proximate cause of the post Gorton and Rouwenhorst drawdown was the Global Financial Crisis, not financialization. Unlike stocks, however, commodity futures took longer to recover from the crisis. The disinflationary decade following the crisis was a very difficult time for commodities. Many institutions capitulated, reducing or removing their commodity positions – before they turned useful again in 2021/22. It is harder for investors to stay the course in commodities than equities amid a comparable drawdown, given that commodities are less "conventional." This can be a typical fate for a good diversifying asset.

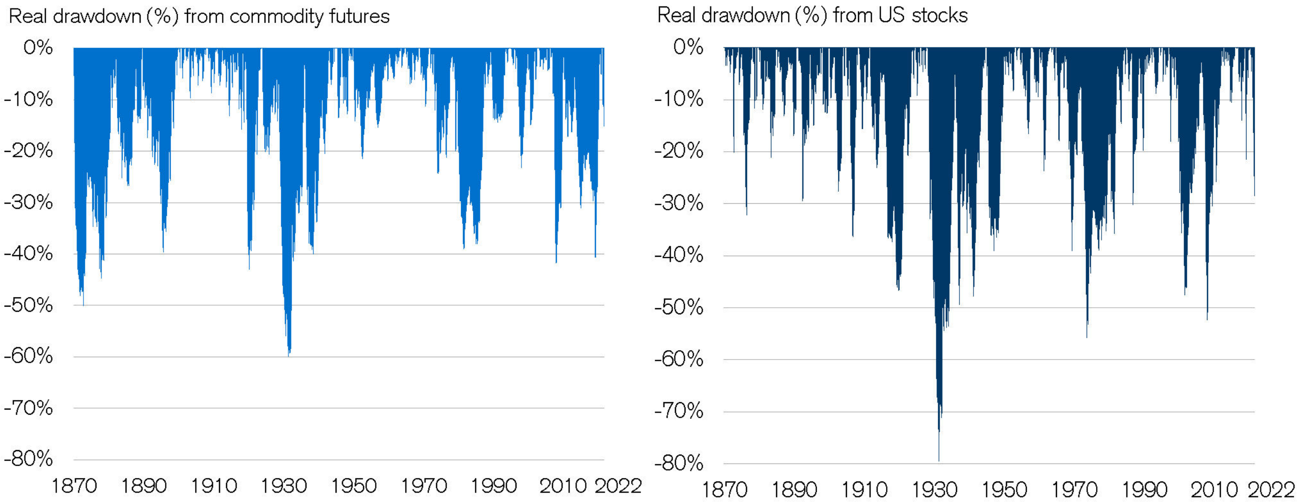
Weightings in futures indices

The deep and protracted drawdown in **Figure 75** that started in 2008 was over by 2021. So why did the iShares ETF, which passively tracks the S&P GSCI index, perform so poorly over the same period, remaining deeply underwater?

The explanation lies in index weightings. Rather than using equal weights, the S&P GSCI weights futures by their world production quantities, resulting in a heavy tilt toward energy. At the start of the drawdown in 2008, energy futures made up 70% of the index. They subsequently performed especially poorly.

To our knowledge, all long-term academic research studies on commodity futures utilize equally weighted indices. This is not simply for convenience, as it allows researchers to draw conclusions about how the average futures contract behaves within a portfolio. However, EH (2006) question the use of equally weighted indices. They point out that long-run stock market research focuses on capitalization

Figure 75: Drawdowns in commodity futures (left) and US equities (right), 1871–2022



Sources: Analysis by Elroy Dimson, Paul Marsh and Mike Staunton using the equally weighted commodity futures index created by Bhardwaj, Janardanan and Rouwenhorst (2019) and updated by SummerHaven Investment Management, linking into the AQR equally weighted commodity futures index after November 2021. Drawdowns are computed in USD. The US inflation and equity series are from DMS Database 2023, Morningstar. Not to be reproduced without express written permission of the authors.

weighted, not equally weighted indices, as the latter overweight small stocks. This is backed by theory, since, according to the Capital Asset Pricing Model, a capitalization weighted benchmark is the mean-variance efficient portfolio in the absence of stock selection skills. Nor are equally weighted equity portfolios "macro consistent" (Sharpe, 2010). It would be impossible for everyone to hold equally weighted portfolios, but all investors could hold capitalization weighted portfolios.

Commodity futures are different. The market capitalization of the stock market is equal to the outstanding value of stocks. However, when a futures contract is taken out, no cash changes hands, so the contract value is zero. Even were this not so, for every contract that an investor holds long, another investor is short. Long and short futures are exactly offsetting. The total capitalization of commodity futures is always zero (Black (1976)). So, weighting by the market value of futures makes no sense.

The first commercial, investible, composite commodity futures index was created by Goldman Sachs in 1991, sold to S&P in 2007, and is now the S&P GSCI. This was followed by the Dow Jones AIG Commodity Index in 1998, which in 2014 became the Bloomberg Commodity Index (BCOM). These remain the two most important composite indices of commodity futures. Both have futures traded on them, with the S&P GSCI being roughly three times larger in terms of open interest.

Neither of them is an equally weighted index. Both use production weights, with BCOM using a combination of liquidity (trading volume) and production weights in a 2:1 ratio, with some capping of the weights for individual commodities and sectors. S&P GSCI uses liquidity as an eligibility filter, but not for weightings. The justification for production weights is that they reflect the global economic significance of each commodity. Yet they have no theoretical basis.

When the Dow Jones index became the BCOM in 2014, Dow Jones set up its own commodity index, the DJCI. A spokesperson said they were now freed from production weights. "Today, we know if the goal of the index is to be well-diversified, we can simply equal-weight it, then adjust for liquidity." The DJCI, however, is not an equally weighted index. It equal weights the energy, agricultural and metals sectors, but, within these, individual futures are liquidity weighted, subject to floors and caps.

We are aware of just two commercial indices used by third parties as benchmarks that employ equal weighting, the Refinitiv Equal Weight Commodity Index (originally the Commodity Research Bureau (CRB) index), and the Summerhaven Dynamic Commodity index. The paucity of equally weighted indices is surprising, given that equal weighting produces highly diversified portfolios. If liquidity is a concern, filters could be used to screen eligibility.

Index weightings matter, as we saw from the post-2008 performance of the S&P GSCI. EH (2006) compared the performance of the S&P GSCI, BCOM and CRB indices over a 14-year period and found large differences in means and standard deviations. The average pairwise correlation was 0.79.

Futures: The expected risk premium

GR reported an annualized risk premium from commodity futures of 4.2% from 1959 to 2004. This was consistent with earlier studies on smaller samples over shorter, mostly overlapping periods by Bodie and Rosansky (1980), Greer (1978) and Fama and French (1987). But as we have seen, the subsequent performance of commodity futures was disappointing. EH (2006), having cautioned about this possibility, argued in their subsequent 2016 paper that investors should learn from their mistakes. The strong implication was that the risk premium had been illusory.

Ilmanen (2022) takes a different view. Despite the poor performance, he argues that the case for a positive risk premium strengthened over this period, thanks to two important new databases and research studies. The GR study spanned some 45 years. The new studies covered periods more than three times longer. Both reported substantial risk premiums from futures.

The annualized premium from 1877 to 2022 was 3.3% using the LORS (2018) database updated to 2022 by AQR. The even more comprehensive BJR database showed an annualized premium from 1871 to 2022 of 4.4%. This figure is close to the historical equity premium for global equities reported in Chapter 4. Commodity futures and stocks also had similar long-run volatilities. It is worth noting that these two new studies, as well as the GR research, all avoided survivorship bias by including non-surviving commodity futures.

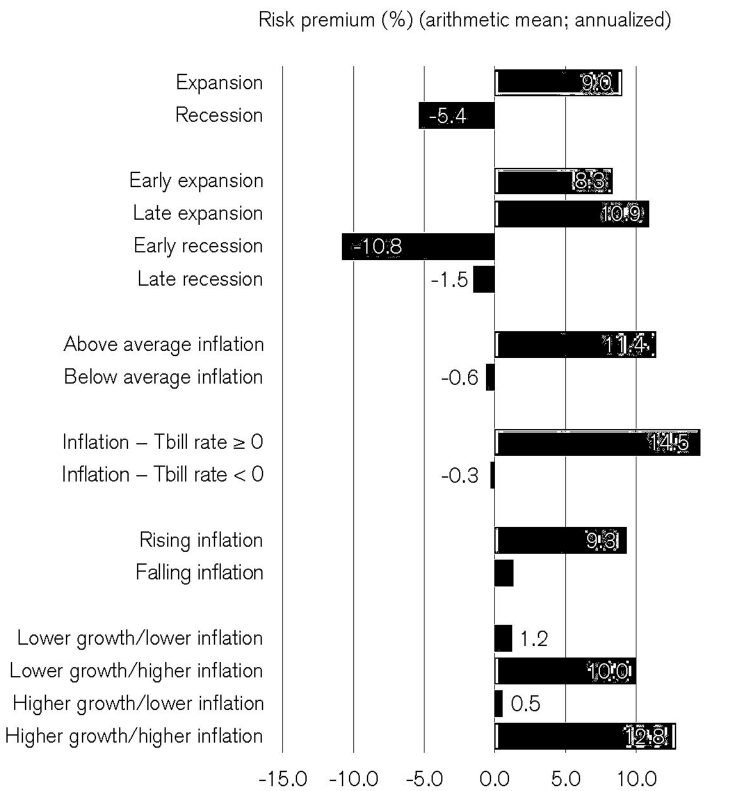
It would seem quite wrong, therefore, to conclude that the risk premium from futures had disappeared simply because of the Global Financial Crisis drawdown in commodity futures that followed the publication of GR's research. This was a disinflationary and low inflation period, and, as we will see below, these are challenging conditions for commodity futures. What risk premium should we expect from a long-run investment in a portfolio of collateralized futures? Ilmanen (2022) concludes that the best long-term, forward-looking estimate is the historical premium. He suggests that "a constant premium of some 3% over cash seems appropriate for a diversified commodity portfolio – though not for single commodities!"

The impact of economic conditions

BJR use their comprehensive dataset to provide insights into how commodities perform under different economic conditions. They looked at business cycles using the dates of expansions and recessions determined by the NBER Business Cycle Dating Committee. Over the period spanned by their study, 1871–2018, there were 30 recessions and expansions. The chart on the right shows that commodity futures were strongly pro-cyclical, with a mean excess return in expansions of 9.0% versus –5.4% in recessions. Returns tended to peak in the second half of the expansion and to trough in the first half of a recession.

Strategies based on the NBER dates are not implementable as the dates are determined four to 21 months after the turning point. In addition, the NBER Committee was established only in 1978, so the first 24 of the 30 economic cycles were dated retrospectively long afterward. BJR also looked at inflation. They compared the excess return in months when US inflation was above average and those when it was below average. The average excess return was high at 11.4% in the above-average inflation months compared with –0.6% in the below-average inflation months. While this provides insight, it is not implementable as the average inflation rate would not be known until the end of the period.

Figure 76: Excess returns and economic conditions



Source: Bhardwaj, Janardanan and Rouwenhorst (2019) covering the period 1871–2018; GDP growth and inflation analysis by Elroy Dimson, Paul Marsh and Mike Staunton using the BJR EW index and GDP growth and inflation data from DMS Database 2023, Morningstar.

They also examined a measure of unexpected inflation suggested by Fama and Schwert (1977), namely the inflation rate minus the Treasury bill rate. In months when this was positive (i.e. when the inflation rate exceeded the Treasury bill rate), the excess return averaged 14.5%. In negative months, it averaged –0.3%. They also compared months when inflation rose and those when it fell and found excess returns of 9.3% and 1.3%. Excess returns were thus high when inflation was high, unexpected inflation was high, and when inflation rose.

Finally, we conducted our own research to assess how the excess return from futures varies with GDP growth and inflation. This is akin to the analysis above for stocks and bonds exploring the impact of stagflation (see **Figure 70**).

To investigate this, we matched the annual excess returns on the BJR EW index from 1871–2022 with the corresponding real GDP growth and inflation figures for the USA. We sorted these annual observations by GDP growth and divided the years into two halves, representing lower and higher years for GDP growth. Within each of these two growth categories, we sorted again by inflation, dividing each growth band into two halves, representing lower and higher inflation. We then computed the average excess return on commodity futures for each of these four categories. While this provides useful insights, it is again not implementable as a trading strategy for the reasons given above. The results are shown in the final four rows of **Figure 76**.

The two bars representing lower inflationary conditions show similar, and very low average annual excess returns. Excess returns are very much higher for the two bars corresponding to higher inflationary conditions. In the stagflationary setting (lower growth and higher inflation), the annual excess return (risk premium) from futures was 10.0% – precisely the opposite of the negative relationship we found for stocks and bonds (again, see **Figure 70** above). The average annual risk premium was even greater at 12.8% for the higher growth/higher inflation years.

Correlations of commodity futures

In their influential paper, GR showed that, over the period from 1959 to 2004, a portfolio of commodity futures not only provided an equity-like risk premium, but was also an excellent diversifier, with a low correlation with stocks and bonds, while also providing a hedge against inflation.

We confirm this finding over the much longer period from 1871 to 2022 using the BJR EW index as extended by SummerHaven Investment Management. We use annual data to compute correlations as the use of monthly data makes no sense given that inflation is reported on a mid-month basis and is inevitably smoothed.

The first set of bars in **Figure 77** below shows that, from 1871 to 2022, US stock returns had a low correlation of 0.20 with commodity futures. Futures proved a hedge for US bonds, with a correlation of –0.21. The correlation with inflation was 0.26. This confirms the BJR findings from **Figure 76**, namely that futures tend to do well when inflation is high. As we show below, they are one of the few asset classes that provides an inflation hedge. This also means, of course, that they tend to perform poorly in disinflationary times such as the 2010s.

The second group of bars shows the same set of pairwise correlations, but for the period 1900–2022. This is to facilitate comparisons with the rest of the Yearbook by using a common start date of 1900. The correlations are very similar to those in the first panel, although the correlation between US bonds and futures is now –0.11, rather than –0.21, while the correlation between futures and inflation is a little lower at 0.21.

Finally, the third set of bars relates to a US investor holding global stocks and bonds as represented by the DMS World equity and bond indices over the period from 1900 to 2022. The correlation between commodity futures and inflation is obviously the same as it relates to US inflation. The correlation between futures and global equities is a little higher at 0.23, while the correlation between futures and global bonds is similar at –0.06. For a US-based global investor, commodity futures offer excellent diversification, while providing a hedge against inflation.

Commodity futures asset allocation

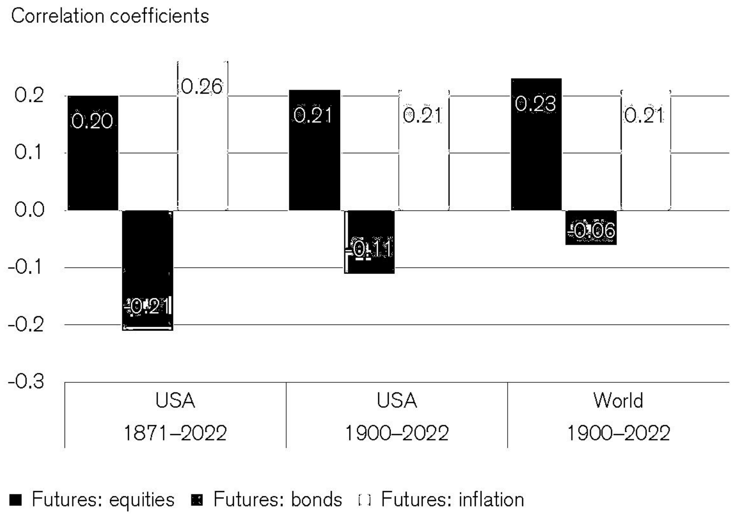
The diversification opportunities provided by portfolios of commodity futures can be illustrated with a simple example. The long-run correlation between real futures returns and real US stock returns was just 0.2. A portfolio split 50:50 between futures and US stocks would therefore have had an appreciably lower volatility (some 14% per annum) than either stocks (19%) or futures (18%) alone. This mixed portfolio would have been more efficient – i.e. with a higher reward to risk ratio – than a stand-alone stock portfolio unless the risk premium from futures was less than half that from stocks.

What then should be the optimal asset allocation to futures? EH (2006) provide an illustration. They project a prospective excess return of 5% for stocks, 3% for futures and 2% for bonds, while correlations and variances were assumed to be the same as in the past. The optimal allocation to futures depends on the investor's tolerance for risk. For an investor who was comfortable with the risk of a 60:40 equity: bond portfolio, they show that the optimal allocation would be 18% in commodity futures, 60% in stocks and 22% in bonds. Unsurprisingly, the optimal allocation to futures depended on the expected excess returns. With an expected excess return of 1%, the optimal allocation to futures fell to 3%.

Investopedia (2023b) states that "experts recommend around 5%–10% of a portfolio be allocated to a mix of commodities." However, this is far higher than the average amount actually allocated to futures. Finney and Gambera (2020) estimate that the average is around 0.2%. A survey by Mercer (2020) of European and UK funds suggested an even lower figure of around 0.1% – just 4% of funds had an allocation to futures.

While these figures seem low, investors may also gain exposure to commodities through their equity investments, e.g. in mining, energy and agriculture-related stocks. GR investigated this by comparing the performance of commodity futures with commodity company stocks. They concluded that the latter behaved more like other stocks than futures. They were not a close substitute.

Figure 77: Correlations of futures with stocks, bonds and inflation



Sources: Analysis by Elroy Dimson, Paul Marsh and Mike Staunton using the equally weighted commodity futures index created by Bhardwaj, Janardanan and Rouwenhorst (2019) and updated by SummerHaven Investment Management, linking into the AQR equally weighted commodity futures index after November 2021. The equity, bond and inflation data are from DMS Database 2023, Morningstar. Not to be reproduced without express written permission of the authors.

This raises the obvious question of whether investors are missing an opportunity and investing too little in futures. However, this takes us back to macro-consistency (Sharpe (2010)). We estimate that global investable assets have a total value of around USD 230 trillion. If commodity futures account for 0.2% of this, this is equivalent to less than USD 0.5 trillion. Ilmanen (2022) also estimates that the investable market is well under USD1 trillion, but points out that the total value of many commodities (oil in the ground, outstanding gold) is much larger. A 10% allocation to commodity futures would thus involve moving an additional amount of some USD 22.5 trillion into the asset class, which would be the financialization of commodities on a massive scale. It would be very hard to accomplish – and even if it were, the price impact would likely be self-defeating.

Thus, while individual investors or institutions might wish to consider increasing their exposure to commodity futures, very large increases would be difficult to achieve in the aggregate.

Asset class correlations with inflation

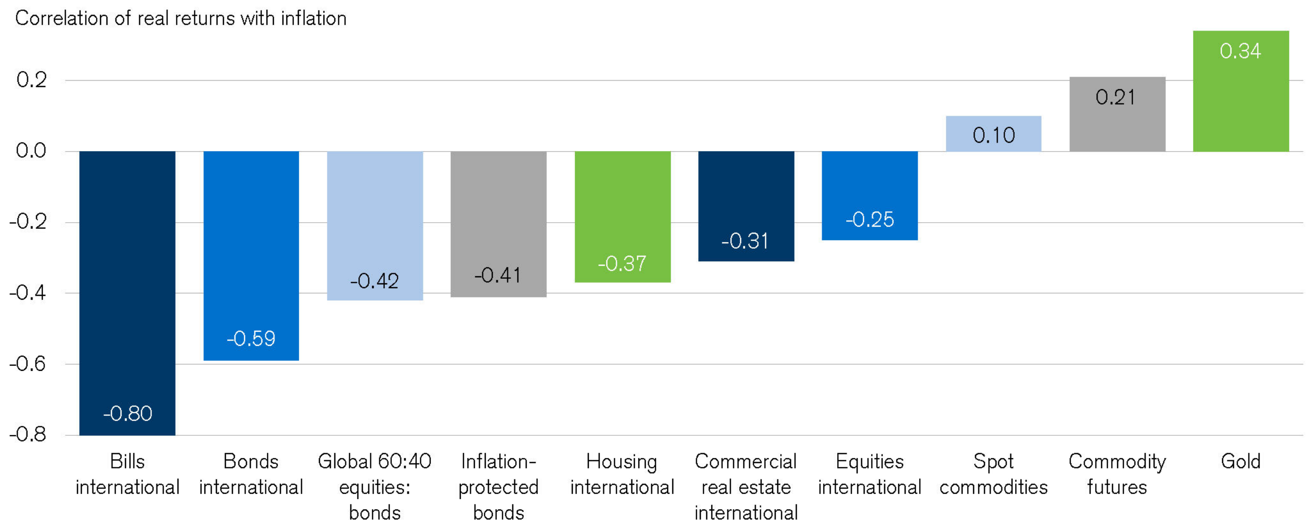
We have seen that bonds and stocks are adversely impacted by inflation, while a portfolio of futures provides a hedge. The chart below shows the correlation between annual inflation and real asset returns from 1900 to 2022, although inflation-protected bonds, commercial real estate and gold have later start dates.

Focusing first on bonds, the chart shows a correlation of –0.59. This is the average correlation between real local bond returns and local inflation across the 21 DMS countries with continuous histories since 1900. It confirms both theory and our earlier findings that bonds suffer greatly from rises in inflation. The same is true of bills, where the figure of –0.80 is also calculated as the average correlation across the 21 DMS countries since 1900.

Using the same approach, the chart shows that the average correlation between real equity returns and inflation across the 21 DMS countries was –0.25. While equities are less negatively impacted by inflation than bonds, real equity returns still tend to fall when inflation rises. Unsurprisingly, the correlation for a 60:40 portfolio – i.e. 60% in the DMS world equity index and 40% in the world bond index, rebalanced back to 60:40 annually – provides an intermediate correlation of –0.42.

The correlation of –0.41 for inflation-protected bonds is unexpected. A notional zero-coupon inflation-protected bond will, if held to maturity, produce a return that exactly matches inflation. The correlation of the nominal return with inflation would be 1.0, while the correlation of the real return would be zero. The chart shows the correlation for a different strategy, namely maintaining a constant maturity portfolio by always holding inflation-protected bonds with an average maturity of 20 years. The annual returns from this

Figure 78: Correlations between inflation and real asset returns for a range of asset classes, 1900–2022



Source: Analysis by Elroy Dimson, Paul Marsh, and Mike Staunton; the data is for the period 1900–2022 except for inflation-protected bonds, commercial real estate and gold. For equities, bonds, bills, inflation and the 60:40 global portfolio the data are from DMS Database 2022, Morningstar; the inflation-protected bond returns are for UK index-linked gilts from 1981–2022 computed by Elroy Dimson, Paul Marsh, and Mike Staunton; housing returns are the average correlation across 11 countries using updated series from Elroy Dimson, Paul Marsh, and Mike Staunton, Global Investment Returns Yearbook 2018 (for full sources, see Box 4, page 75 of that volume); commercial property data is for 17 countries, with the UK data taken from the MSCI (formerly IPD) UK Annual Property Index from 1971–2022, the USA data from the NCREIF indices (averaged across categories) for 1978–1988, linked into the FTSE EPRA NAREIT US index from 1989–2022, while the data for the other 15 countries are from the FTSE EPRA NAREIT indices, mostly starting in 1989; the spot commodities correlation relates to the equally weighted portfolio of spot commodities constructed from 29 individual commodities with the data taken mostly from Global Financial Data (see **Table 15** above); the correlation for commodity futures relates to the equally weighted index constructed by Bhardwaj, Janardanan and Rouwenhorst (2019) and updated by SummerHaven Investment Management as described above; the gold data is for spot gold over the post-Bretton Woods period from 1972–2022 and is from the World Gold Council.

approach are surprisingly vulnerable to inflation. The data used here are for UK index-linked gilts from 1981 to 2022. These have a much longer history than US TIPS, which were introduced only in 1997.

The chart also shows correlations for real estate, revealing that it is also vulnerable to inflation. For commercial/investment real estate – industrial premises, retail, offices, hotels and apartments – our data starts in 1971 for the UK, 1978 for the USA and 1989 for most of the other 15 countries represented. The average correlation with inflation was –0.31. For domestic housing, the correlation of –0.37 is the average for 11 countries for which we have long-term house price data (we have updated the data from Dimson, Marsh and Staunton (2018)). Real estate correlations lie between those on bonds and equities.

Bonds, bills, equities and real estate make up the vast bulk of the world's traded investment assets. The chart shows that all of these have negative correlations with inflation. To find positive correlations – assets which on average benefit from inflation – we need to move into the commodity world. The real return on an equally weighted portfolio of spot commodities (using the data from **Table 15** above) had a positive correlation of 0.10 with inflation. However, the long-run excess return has been low, and almost certainly negative on an after-costs basis. More promisingly, as we already saw above, the real return on an equally weighted portfolio of commodity futures has a correlation of 0.21 with inflation, while offering an acceptable long-run risk premium.

The final bar in the chart is for gold. Over the full period since 1900, the correlation between changes in the real price of gold and inflation was –0.04. This is misleading, however, as over much of the period prior to 1972, currencies were pegged to gold. Except for occasional devaluations, the nominal change in the price of gold was zero, while real changes were negatively correlated with inflation.

In the chart, we therefore show the correlation from 1972 to 2022, when changes in the gold price had a positive correlation of 0.34 with inflation. This figure is for spot gold. Gold futures trading began in 1974 and, from 1975 to 2022, the correlation between the real return on gold futures and inflation was lower at 0.21. However, while gold provided a potentially valuable hedge against inflation, it was volatile and had a low long-run return.

We have not included cryptocurrencies in the chart, as they have too short a history. However, the most cursory review of the recent past indicates that claims of cryptocurrencies providing a hedge against inflation are manifestly false.

Summary and concluding remarks

Recently, inflation has flared up as it has done periodically in the past. Inflation makes citizens poorer, reducing their purchasing power. It is also bad for investors, as the major asset classes – equities, bonds and real estate – tend to fall in value when inflation rises. Central banks are charged with controlling inflation and they respond with interest-rate hikes. The higher nominal and real interest rates are also harmful to most asset values, as we saw in 2022.

While we are hopefully entering a period of falling inflation, history warns that it may take longer than many would expect to lower inflation to acceptable levels. Central banks need to be sure the job is done, rather than relaxing too early. History also tells us that inflation will eventually flare up again – although it may lie dormant for years. Continual vigilance is required.

Since rising commodity prices, including energy prices, have been important contributors to the current bout of inflation, we investigated whether investing in commodities offers an effective hedge. Individual commodities have, on average, generated low long-run returns. However, portfolios of futures have provided attractive risk-adjusted long-run returns, albeit with some large, lengthy drawdowns. Based on historical returns, it seems reasonable to assume that a balanced portfolio of collateralized commodity futures is likely to provide an annualized long-run future risk premium of around 3%.

Historically, commodities have had a low correlation with equities and a negative correlation with bonds, making them effective diversifiers. They have also provided a hedge against inflation. Indeed, commodities are unique in this respect, compared with the other major asset classes. However, their inflation-hedging properties also mean that, in extended periods of disinflation, they tend to underperform.

Furthermore, as Ilmanen (2022) has argued, commodity futures portfolios provide the instruments needed to hedge against different types of inflation. Energy futures perform well during energy-driven cost-push inflation; industrial metals during demand-pull inflation; and precious metals, especially gold, perform well when central bank credibility is questioned.

There is a problem, however, with this otherwise attractive asset class. The investable market size is quite small. Thus, while individual investors or institutions may wish to consider increasing their exposure to commodity futures, large increases would be challenging if everyone sought to raise their allocations.

Selected individual markets

The following four pages are extracted from Chapter 9 of the Credit Suisse Global Investment Returns Yearbook 2023.

The Credit Suisse Global Investment Returns Yearbook covers 35 markets and five composite indexes, i.e. the world, the world ex-USA, Europe, developed markets and emerging markets. Twenty-three of the countries and all five composite indexes start in 1900. The other 12 markets start later but have substantial histories. In Chapter 9 of the full Yearbook, each country and index has three pages of descriptive data, charts, tables and statistics. We show here only the initial page for a small selection of three countries and one composite index.

Please note that historical performance indications and financial market scenarios are not reliable indicators of future performance.

Photo: Getty Images, DS70

Switzerland

For a small country with just 0.1% of the world's population and less than 0.01% of its land mass, Switzerland punches well above its weight financially and wins several "gold medals" when it comes to global financial performance.

The Swiss stock market traces its origins to exchanges in Geneva (1850), Zurich (1873), and Basel (1876). It is now the world's sixth-largest equity market, accounting for 2.5% of total world value. Since 1900, Swiss equities have achieved a real return of 4.5% (equal to the median across our countries).

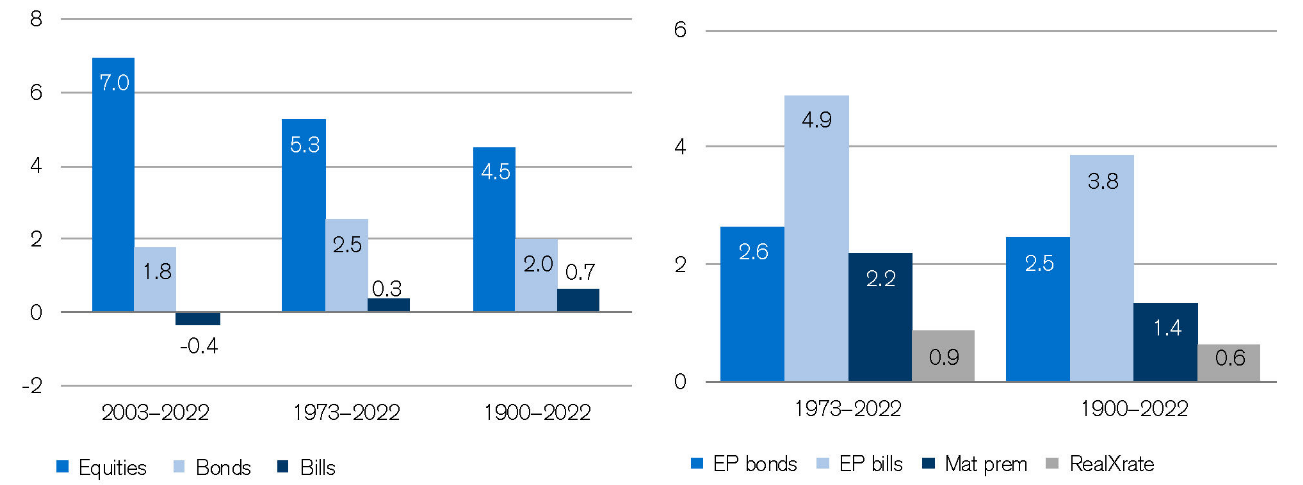
Meanwhile, Switzerland has been the world's best-performing government bond market, with an annualized real USD return of 2.7% (it ranks second in real local currency return terms, with an annualized return since 1900 of 2.0%). Switzerland has also had the world's lowest 123-year inflation rate of just 2.1%.

Switzerland is one of the world's most important banking centers, and private banking has been a major Swiss competence for over 300 years. Swiss neutrality, sound economic policy, low inflation and a strong currency have bolstered the country's reputation as a safe haven.

A large proportion of all cross-border private assets invested worldwide is still managed in Switzerland.

Switzerland's healthcare industry accounts for over a third (36%) of the value of the FTSE World Switzerland Index. Nestle (22%), Roche (16%), and Novartis (13%) together account for half of the index's value.

Figure 139: Annualized real returns and risk premiums (%) for Switzerland, 1900–2022



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

Source: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

United Kingdom

Organized stock trading in the United Kingdom dates from 1698, and the London Stock Exchange was formally established in 1801. By 1900, the UK equity market was the largest in the world, and London was the world's leading financial center, specializing in global and cross-border finance. Early in the 20th century, the US equity market overtook the UK and, nowadays, New York is a larger financial center than London. What continues to set London apart, and justifies its claim to being the world's leading international financial center, is the global, cross-border nature of much of its business.

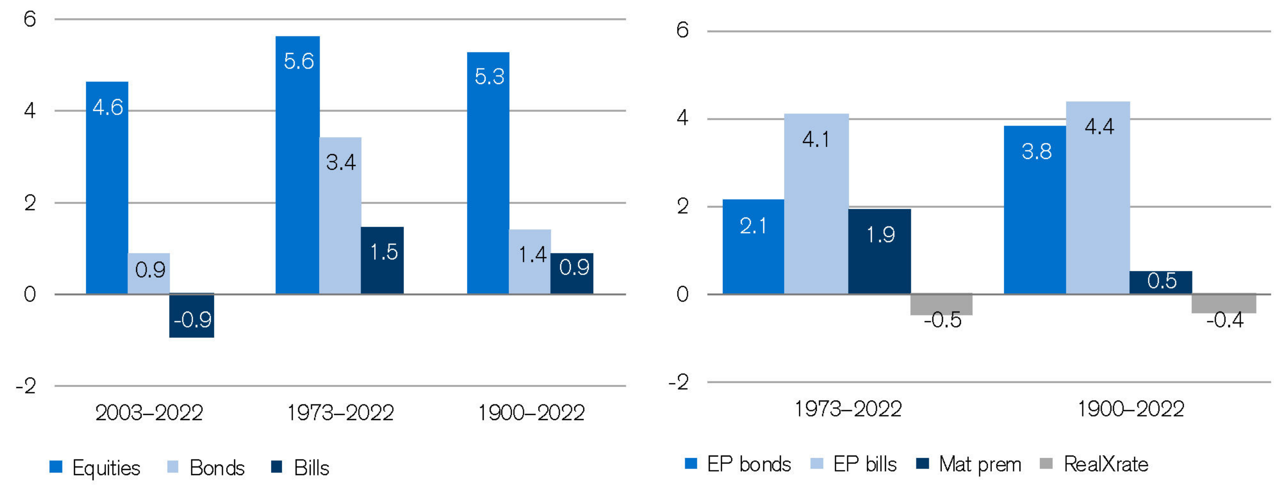
Today, London is ranked as the second most important financial center (after New York) in the Global Financial Centers Index. It is the world's banking center, with 550 international banks and 170 global securities firms having offices in London.

The UK's foreign exchange market is the biggest in the world, and Britain has the world's number-three stock market, number-three insurance market, and the fourth-largest bond market.

London is the world's largest fund management center, managing almost half of Europe's institutional equity capital and three-quarters of Europe's hedge fund assets. More than three-quarters of Eurobond deals are originated and executed there. More than a third of the world's swap transactions and more than a quarter of global foreign exchange transactions take place in London, which is also a major center for commodities trading, shipping and many other services.

AstraZeneca is the largest UK stock by market capitalization. Other major companies include Shell, Unilever, HSBC Holdings, BP, Diageo, and British American Tobacco.

Figure 145: Annualized real returns and risk premiums (%) for the UK, 1900–2022



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

Source: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

United States

In the 20th century, the United States rapidly became the world's foremost political, military, and economic power. After the fall of communism, it became the world's sole superpower. It is also the world's number one oil producer.

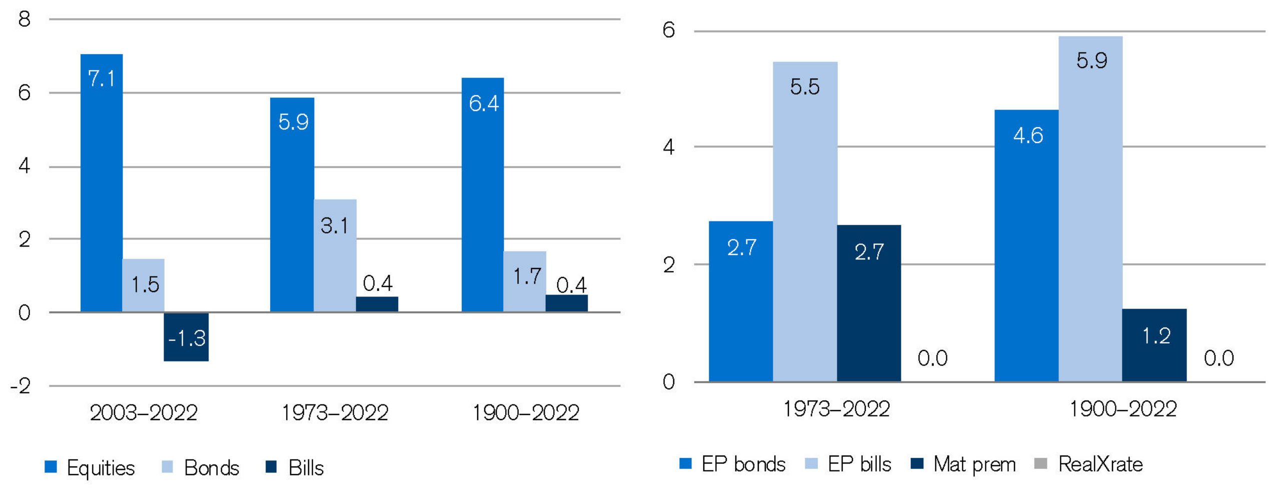
The USA is also a financial superpower. It has the world's largest economy, and the dollar is the world's reserve currency. Its stock market accounts for 58% of total world value (on a free-float, investible basis), which is over nine times as large as Japan, its closest rival. The USA also has the world's largest bond market.

US financial markets are by far the best-documented in the world and, until recently, most of the long-run evidence cited on historical investment performance drew almost exclusively on the US experience. Since 1900, the US equity market has generated an annualized real return of 6.4%, the second-highest common-currency return for a Yearbook country.

There is an obvious danger of placing too much reliance on the impressive long-run past performance of US stocks. The New York Stock Exchange traces its origins back to 1792. At that time, the Dutch and UK stock markets were already nearly 200 and 100 years old, respectively. Thus, in just a little over 200 years, the USA has gone from zero to a 58% weighting in the world's equity market.

Extrapolating from such a successful market can lead to "success" bias. Investors can gain a misleading view of equity returns elsewhere or of future equity returns for the USA itself. That is why this Yearbook focuses on global investment returns, rather than just US returns.

Figure 147: Annualized real returns and risk premiums (%) for the USA, 1900–2022



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

Source: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

World ex USA

In addition to the World indexes, we also construct World indexes that exclude the USA, using exactly the same principles. Although we are excluding just one country, the USA today accounts for 58% of the total stock market capitalization of the 90 countries included in the DMS World equity index. Our 89-country, World ex-USA equity index thus represents just 42% of today's value of the DMS World index.

The charts below show the returns for a US global investor. The indexes are expressed in US dollars, real returns are measured relative to US inflation, and the equity premium versus bills is relative to US Treasury bills.

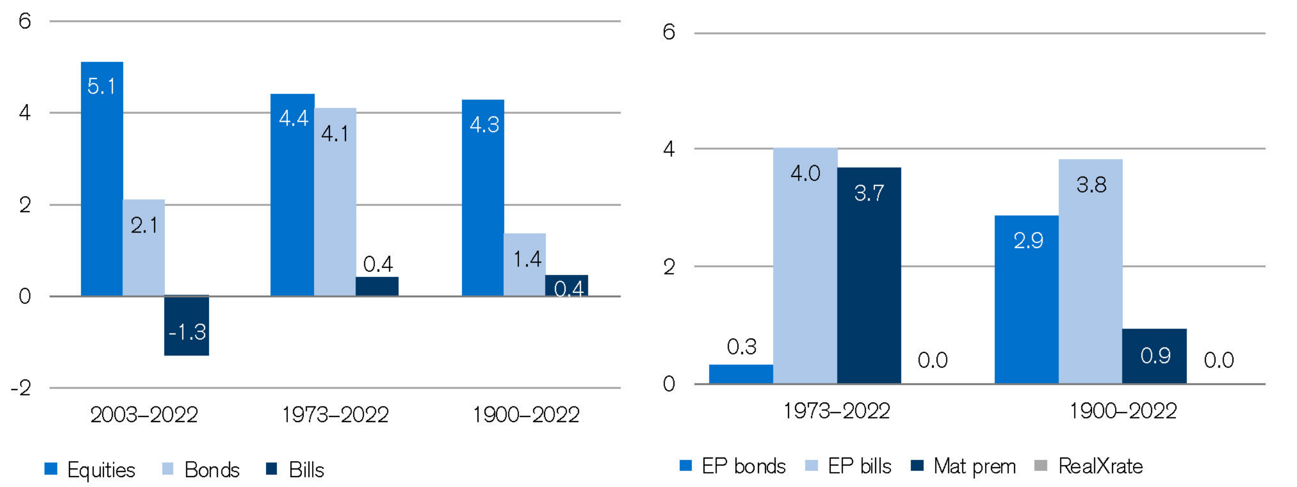
We noted in Chapter 1 that, until relatively recently, most of the long-run evidence cited on historical asset returns drew almost exclusively on the US experience. We argued that focusing on such a successful economy can lead to "success" bias. Investors can gain a misleading view of equity returns elsewhere or of future equity returns for the USA itself.

The chart below confirms this concern. It shows that, from the perspective of a US-based international investor, the real return on the World ex-USA equity index was 4.3% per year, which is 2.1% per year below that for the USA.

This differential of 2.1% per annum leads to very large differences in terminal wealth when compounded over 123 years. A US-based investor who invested solely in their domestic market would have enjoyed a terminal wealth more than ten times greater than from investing in the rest of the world, excluding their own country. This does not, however, take account of the risk reduction from diversification that they would have enjoyed from diversifying abroad.

Our World index ex-USA thus stresses the importance of looking at global returns, rather than focusing on, and generalizing from, the USA.

Figure 151: Annualized real USD returns and risk premiums (%) for the World ex-USA, 1900–2022



Note: The three asset classes are equities, long-term government bonds, and US Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to US bills; Mat prem denotes the maturity premium for bonds relative to US bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

Source: Elroy Dimson, Paul Marsh and Mike Staunton, DMS Database 2023, Morningstar. Not to be reproduced without express written permission from the authors.

References

Arnott, R. and Shakernia, O., 2022. History lessons: how transitory is inflation? Journal of Portfolio Management 49(3).

Bhardwaj, G., Gorton, G. and Rouwenhorst, G., 2016. Facts and fantasies about commodity futures returns ten years later. Yale ICF working paper No. 15–18.

Bhardwaj, G., Janardanan, R. and Rouwenhorst, G., 2019. The commodity futures risk premium 1871–2018. SSRN working paper.

Black, F., 1976. The pricing of commodity contracts. Journal of Financial Economics 3(1/2): 167–179.

Bodie, Z. and Rosansky, V., 1980. Risk and return in commodity futures. Financial Analysts Journal 36(3): 27–39.

Booth, D. and Fama, E., 1992. Diversification returns and asset contributions. Financial Analysts Journal 48(3): 26–32.

Boudoukh, J. and Richardson, M., 1993. Stock returns and inflation: a long-horizon perspective. American Economic Review 83(5): 1346–55.

Dimson, E., Marsh, P. and Staunton, M., 2002. Triumph of the optimists: 101 years of global investment returns. New Jersey: Princeton University Press.

Dimson, E., and Marsh, P., and Staunton, M., 2007. The worldwide equity premium: a smaller puzzle. In: Mehra, R. (ed.) The Handbook of the Equity Risk Premium. Amsterdam: Elsevier.

Dimson, E., Marsh, P. and Staunton, M., 2014. The growth puzzle. In: Global Investment Returns Yearbook 2014. Zurich: Credit Suisse Research Institute, 17–29.

Dimson, E., Marsh, P. and Staunton, M., 2018. Private wealth investments. In: Global Investment Returns Yearbook 2018. Zurich: Credit Suisse Research Institute, 64–82.

Dimson, E., Marsh, P. and Staunton, M., 2021. Chapter 8: Emerging markets. In: Global Investment Returns Yearbook 2018. Zurich: Credit Suisse Research Institute, 84–102.

Dimson, E., and Marsh, P., and Staunton, M., 2023. The Dimson-Marsh-Staunton Global Investment Returns Database 2023 (the "DMS Database"), Morningstar Inc.

Erb, C. and Harvey, C., 2006. The strategic and tactical value of commodity futures. Financial Analysts Journal 62(2): 69–97.

Erb, C. and Harvey, C., 2016. Conquering misperceptions about commodity investing. Financial Analysts Journal 72(2): 26–35.

Fama, E., 1981. Stock returns, real activities, inflation and money. American Economic Review 71(4): 545–565.

Fama, E. and Schwert, W., 1977. Asset returns and inflation. Journal of Financial Economic 5(2): 115–46.

Fama, E. and French, K., 1987. Commodity futures prices: some evidence on forecast power, premiums, and the theory of storage. Journal of Business 60: 55–73.

Finney, L. and Gambera, M., 2020. Alternative investments. December. UBS Asset Management.

Gorton, G. and Rouwenhorst, G., 2006. Facts and fantasies about commodity futures. Financial Analysts Journal 62(2): 47–68.

Gorton, G. and Rouwenhorst, G., 2006a. A note on Erb and Harvey (2005). Yale ICF Working Paper No. 06-02.

Gorton, G., Hayashi, F. and Rouwenhorst, G., 2013. The fundamentals of commodity futures returns. Review of Finance 17: 35–105.

Greer, R., 1978. Conservative commodities: A key inflation hedge. Journal of Portfolio Management 4(4): 26–29.

Havranek, T. and Ruskan, M., 2013. Transmission lags of monetary policy: a meta-analysis. International Journal of Central 9(4): 39–76.

Hicks, J., 1939. Value and capital. Oxford: Clarendon Press.

Ilmanen, A., 2022. Investing amid low expected returns. Hoboken, New Jersey: John Wiley & Sons Inc..

International Monetary Fund, 2022. World economic outlook: countering the cost-of-living crisis. October. Washington DC: International Monetary Fund.

Investopedia, 2023a. https://www.investopedia.com/terms/g/goldbug.asp#:~:text=A%20gold%20bug%20is%20an,and%20outspoken%20among%20these%20investors

Investopedia, 2023b. https://www.investopedia.com/terms/c/commodity.asp#:~:text=Experts%20recommend%20around%205%2D10,mutual%20funds%20to%20gain%20exposure

Irwin, S. and Sanders, D., 2011. Index Funds, financialization, and commodity futures markets. Applied Economic Perspectives and Policy 33(1): 1–31

Kaldor, N., 1939. Speculation and economic stability. Review of Economic Studies 7(1): 1–27.

Keynes, J., 1930. A Treatise on Money, vol. 2. London: Macmillan.

Levine, A., Ooi, Y., Richardson, M. and Sasseville, C., 2018. Financial Analysts Journal 74(2): 55–68.

Mercer, 2020. European asset allocation insights 2020. Mercer-MarshMcLennan.

Roll, R., 1984. A simple implicit measure of the effective bid-ask spread in an efficient market. Journal of Finance 39(4): 1127–39

Tatom, J., 2011. Inflation and asset prices. MPRA Paper 34606, networks Financial Institute at Indiana State University.

Sharpe, W., 2010. Adaptive asset allocation policies. Financial Analysts Journal 66(3): 45–59.

Working, H., 1949. The theory of the price of storage. American Economic Review 39, 1254–1262.

Authors

Elroy Dimson, Paul Marsh, and Mike Staunton jointly wrote the influential investment book, Triumph of the Optimists, published by Princeton University Press. They have authored the Global Investment Returns Yearbook annually since 2000. They distribute the Yearbook's underlying dataset through Morningstar Inc. The authors also edit and produce the Risk Measurement Service, which London Business School has published since 1979. They each hold a PhD in Finance from London Business School.

Elroy Dimson
Elroy Dimson is Chairman of the Centre for Endowment Asset Management at Cambridge Judge Business School, and Emeritus Professor of Finance at London Business School. He previously served London Business School in a variety of senior positions, FTSE Russell as Chairman of the Policy and Academic Advisory Boards, and the Norwegian Government Pension Fund Global as Chairman of the Strategy Council. He has published in Journal of Finance, Journal of Financial Economics, Review of Financial Studies, Journal of Business, Journal of Portfolio Management, Financial Analysts Journal, and other journals.

Paul Marsh
Paul Marsh is Emeritus Professor of Finance at London Business School. Within London Business School he has been Chair of the Finance area, Deputy Principal, Faculty Dean, an elected Governor and Dean of the Finance Programmes, including the Masters in Finance. He has advised on several public enquiries; was previously Chairman of Aberforth Smaller Companies Trust, and a non-executive director of M&G Group and Majedie Investments; and has acted as a consultant to a wide range of financial institutions and companies. Dr Marsh has published articles in Journal of Business, Journal of Finance, Journal of Financial Economics, Journal of Portfolio Management, Harvard Business Review, and other journals. With Elroy Dimson, he co-designed the FTSE 100-Share Index and the Numis Smaller Companies Index, produced since 1987 at London Business School.

Mike Staunton
Mike Staunton is Director of the London Share Price Database, a research resource of London Business School, where he produces the London Business School Risk Measurement Service. He has taught at universities in the United Kingdom, Hong Kong SAR and Switzerland. Dr. Staunton is co-author with Mary Jackson of Advanced Modelling in Finance Using Excel and VBA, published by Wiley and writes a regular column for Wilmott magazine. He has had articles published in Journal of Banking & Finance, Financial Analysts Journal, Journal of the Operations Research Society, Journal of Portfolio Management, and Quantitative Finance.

Please note that these individuals are not associated with/related to Credit Suisse and do not act for and on behalf of Credit Suisse. Please contact your Relationship Manager for further information.

Imprint

Publisher
Credit Suisse Research Institute
Paradeplatz 8
CH-8070 Zurich
Switzerland

Responsible authors
Elroy Dimson, edimson@london.edu
Paul Marsh, pmarsh@london.edu
Mike Staunton, mstaunton@london.edu

ISBN 978-3-033-09700-1

To purchase a copy of the Yearbook
The Credit Suisse Global Investment Returns Yearbook 2023 is distributed to Credit Suisse clients by the publisher. All others (e.g. governmental organizations, regulators, consultants and accounting firms) that would like to purchase a copy of the Yearbook should contact London Business School. Please address requests to Patricia Rowham, London Business School, Regents Park, London NW1 4SA, United Kingdom, e-mail: prowham@london.edu.

To gain access to the underlying data
The Dimson-Marsh-Staunton dataset is distributed by Morningstar Inc. Please ask for the DMS data module. Address requests to Ms Quan Domaleczny, email: quan.domaleczny@morningstar.com, tel. +1 312 696-6848. Further information on subscribing to the DMS dataset is available at www.tinyurl.com/DMSdata.

To quote from this publication
To obtain permission contact the authors with details of the required extracts, data, charts, tables or exhibits. At a minimum, each chart and table must carry the acknowledgement Copyright © 2023 Elroy Dimson, Paul Marsh and Mike Staunton. If granted permission, a copy of published materials must be sent to the authors at London Business School, Regents Park, London, NW1 4SA, United Kingdom.