

Internet appendix to

**Global economic growth and expected returns
around the world:**

The end-of-the-year effect

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Robustness tests

In this internet appendix, we show that our predictability results are robust. We mainly use the returns on the world market portfolio and regional portfolios to illustrate the results from the robustness tests.

Results are robust to taking into account publication lags. Data on industrial production are published with a lag. On, e.g., January 1, an investor does not know the level of industrial production in December. We check whether industrial production forecasts returns starting one quarter ahead. For instance, we investigate whether EOY growth in global industrial production predicts returns from April 1 through March 31 next year. The results are similar to those presented in Table 2: EOY global growth predicts returns strongly, whereas returns do not systematically respond to growth during the rest of the year. The results are in Table A1.

Results are robust towards using monthly growth rates instead of quarterly. Industrial production is available at a monthly frequency. Within the fourth quarter, we find global December growth (growth in global industrial production from November to December) to predict excess returns on the world portfolio stronger than November and October growth: t -statistic of -3.6 versus -2.4 and -2.6 , respectively, and R^2 s of 10.1% for December growth versus 8.8% and 7.9% for November and October growth. In addition, only one other monthly growth rate (February) predicts the return on the world market portfolio. The results are in Table A2.

The results using monthly economic growth also reveal that economic growth during the last quarter of the year provides more precise information about expected returns than growth during October, November, and December on their own, i.e. the t -statistics and R^2 s are lower from the monthly regressions compared to those from the quarterly regressions in Table 2. Another way to see this is by using October, November, and December growth in a multiple predictive regression. In this case, we get R^2 s like those in Table 2. Hence, information about expected returns is stronger in December than in November or October, but the combined information contained by economic growth during the final quarter of the year is even stronger. This is also a reason why we focus on quarterly growth rates in this paper.

Results are robust to predicting the same one-year ahead returns. In Table 2, we predict calendar-year returns when we use Q4 global economic growth, October 1-September 30 (next year) returns when using Q3 growth, etc. We do a robustness check where we predict the same returns, i.e. predict calendar year returns using Q1, Q2, Q3, and Q4 growth, April 1-March 30 (next year) returns using Q1, Q2, Q3, and Q4 growth, etc. The returns we predict here are the returns on the MSCI world market portfolio; predicting regional portfolios give similar results. The results are in Table A3 and show that EOY global growth is a significant predictor of calendar year returns, whereas economic activity at other times of the year generally does not predict returns. In addition, EOY global growth predicts Q1Q1 returns. Economic activity during Q1, Q2, or Q3 does not predict returns at all.

Results are robust to using value and growth portfolios instead of market indexes. EOY economic growth forecasts returns on other stock market portfolios than aggregate market portfolios. To verify this, we download global value and growth MSCI portfolios, available since 1974. We find that EOY growth is a strong predictor of both value and growth portfolios. For instance, the calendar year return on the MSCI world market value portfolio is predicted with a t -statistic of -4.7 ($R^2 = 11.7\%$) and the growth portfolio with a t -statistic of -5.4 ($R^2 = 12.1\%$). Global economic activity at other points in time does not affect returns. Detailed results are in Table A4.

IP^4 and IP^1 as predictors. There are some cases where IP^1 is a significant predictor in Table 3. We use the part of IP^1 that is uncorrelated with IP^4 to predict returns in those countries where IP^1 on its own is significant. We do as follows. For those countries where IP^1 is significant in Table 3, we run the regression:

$$IP_t^1 = \alpha + \beta IP_{t-1}^4 + IP_t^1 \perp. \quad (1)$$

We then use the residual $IP_t^1 \perp$ to forecast one-year ahead returns. We notice that the residual contains the part of information in global economic growth during the first quarter of the year that is independent of last year's EOY economic growth. The results are in Table A5. We find that there is no single case where $IP_t^1 \perp$ significantly predicts returns. This means that significant predictability by IP^1 arises as a consequence of correlation with economic growth

at the end of the previous year.

Results are robust to calculating global economic growth in different ways. In Table 2, we use global growth calculated as the equal-weighted average of growth in industrial production in the individual countries. Our results do not depend on this way of constructing global growth. We redo the regressions but with global growth calculated as the GDP-weighted industrial production growth rates or as the first principal component from the twelve individual-country industrial production growth rates. Results are in Table A6.

As mentioned in Section 2, we calculate quarterly growth rates using end-of-quarter values, i.e. end-of-the-year (fourth-quarter) growth is calculated as $IP^4 = IP^{Dec}/IP^{Sep}$ where IP^{Dec} is the level of global industrial production in December and IP^{Sep} is the level in September. To check robustness, we also used the average level of industrial production during a quarter, such that EOY growth in industrial production is calculated as $IP^4 = (IP^{Dec} + IP^{Nov} + IP^{Oct})/(IP^{Sep} + IP^{Aug} + IP^{July})$ where IP^{Dec} is the level of industrial production in December, IP^{Nov} the level in November, etc. Results are robust.

We calculate growth at the end of the year as either the quarterly growth rate from the third to the fourth quarter (Q3-Q4) or as the monthly growth rate from November to December. Jagannathan and Wang (2007) use annual fourth-quarter to fourth-quarter growth (Q4-Q4) as their end-of-the-year growth in their examination of the consumption CAPM on US data. Møller and Rangvid (2015) conduct a detailed examination of the difference in results that arise when predicting US returns using respectively Q3-Q4 and Q4-Q4 US economic growth. Møller and Rangvid (2015) find that Q3-Q4 US economic growth contains more predictive power for US returns. We check whether results are similar for international returns in Table A7 where we compare the results of this paper using Q3-Q4 global economic growth to results obtained if using Q4-Q4 global economic growth or December-December global economic growth. Similar to results in Møller and Rangvid (2015) for the US, we find that the Q3-Q4 global economic growth rate contains a considerably higher amount of predictive power.

We check what happens if we use GDP instead of industrial production. The results are in Table A8 for real returns; we find similar results for nominal and excess returns. We find strong predictability by GDP growth at the end of the year and no predictability by GDP growth during the second and the third quarter. In some contrast to predicting with industrial

production, we find GDP growth during the first quarter to be significant. However, like in Table A5, when we use the part of GDP growth during the first quarter than is independent of GDP growth during the last quarter of the previous year, we find that predictability by GDP ¹ becomes insignificant.

Results are robust during subsamples. We estimated our basic regression over different subsamples, such as splitting the sample in two equally large parts. EOY global economic growth forecasts returns in different subsamples. These results are available upon request.

Results are robust in both expansions and recessions. Recent literature has shown that return predictability by traditional forecasting variables tend to be concentrated to periods surrounding recessions; see, e.g., Henkel, Martin, and Nardari (2011) and Rapach, Strauss, and Zhou (2010). We checked whether EOY predictability is concentrated to recessions. We use US recessions. During our sample period, NBER recessions (by the end of the year) occurred in 1970, 1973, 1974, 1981, 1982, 1990, 2001, 2007, and 2008. We run a fixed-effects panel forecasting regression for excess returns on the world market portfolio and let the slope coefficient differ in the two regimes (recessions and expansions):

$$R_{i,t+1} = \alpha_i + \beta_r \Upsilon_t IP_t^4 + \beta_e (1 - \Upsilon_t) IP_t^4 + u_{i,t+1} \quad (2)$$

where Υ_t is an indicator variable picking out years where the economy is in recession at the end of the year, α_i is the country fixed effect for country i , and β_r and β_e measure the response of returns to EOY global economic growth in recessions and expansions, respectively. We estimate the beta in expansions to be $\hat{\beta}_e = -4.00$ with a t -statistic of -2.1 , while the beta in recessions is estimated at $\hat{\beta}_r = -3.40$ with a t -statistic of -3.5 (two-way clustered). So, contrary to Henkel, Martin, and Nardari (2011) and Rapach, Strauss, and Zhou (2010), we find strong predictability results both in expansions and recessions. It is reassuring that the predictability results we have found are not limited to a few recession years but is generally present in both expansions and recessions.¹

¹For robustness, we also estimated an alternative version of the regression: $R_{i,t+1} = \alpha_i + (\beta_r \Upsilon_t + \beta) IP_t^4 + u_{i,t+1}$ where β_r now measures the increase in beta during recessions. We obtain an estimate of β_r of 0.7 with a t -statistic of 0.3, i.e. the coefficient in recessions is not significantly different from the one in expansions.

Accounting for potential small-sample bias does not affect main findings. We have a relatively low number of observations in our regressions; with annual 1970-2013 data, there are 43 observations in each regression.² Based on the classical results in Goetzmann and Jorion (1993), Nelson and Kim (1993), and Kothari and Shanken (1997) regarding potential small-sample biases in estimated slope coefficients in predictive regressions, one might wonder whether our results are affected by such biases. They are not.

We do a bootstrap analysis to show this. We bootstrap under the null of no predictability and assume an AR(1) data-generating process for EOY global economic growth:

$$R_{t+1} = \alpha + \varepsilon_{R,t+1} \quad (3)$$

$$IP_{t+1}^4 = \gamma_0 + \gamma_1 IP_t^4 + \varepsilon_{IP^4,t+1} \quad (4)$$

For each return series (world, Europe, EAFA, pacific; nominal, real, excess), we estimate the system in Eqs. (3) and (4) and save the estimated coefficients and residuals. We save the residuals in tandem, $\varepsilon_{t+1} = [\varepsilon_{R,t+1} \ \varepsilon_{IP^4,t+1}]'$, in order to preserve the contemporaneous correlation between returns and global economic growth. We simulate 10,000 bootstrap samples. For each bootstrap sample, we start out setting R_1 and IP_1^4 equal to their averages from the original sample. We then draw a tandem shock, ε_2 , by randomly selecting (with replacement) from the residuals such that we can calculate R_2 and IP_2^4 . We randomly draw another tandem shock, ε_3 , and calculate R_3 and IP_3^4 . We continue this procedure until we have a sample of $T + 200$ observations where $T = 43$ refers to the number of observations in our original sample. We throw away the first 200 observations to avoid any effects from using the sample averages as starting values.

For each bootstrap sample, we estimate the predictive regression. We calculate the slope coefficient, β , the corresponding t -value (Newey-West), and the R^2 statistic. We repeat this procedure 10,000 times, such that we generate 10,000 artificial slope coefficients, t -statistics, and R^2 statistics. On average, the artificial β values should equal 0 as they have been generated under the null of no predictability.

Table A9 shows the results from the bootstrap procedure. We report the mean values of the artificial β , t , and R^2 statistics. We also report the empirical p -value for each statistic,

²In panel regressions, we use 516 observations, see the "All" row in Table 3.

calculated as the fraction of artificial statistics that are larger (in numerical value) than the observed statistic. We find that the means of the simulated β -values are close to zero, i.e. the bias in the slope coefficients tends to be small. Accordingly, the artificial t -statistics are also close to zero. The mean value of the simulated R^2 statistics is typically around 2%. Most importantly, basically all the p -values are smaller than 5%. This indicates that our result that global returns are predicted by EOY economic growth is not due to a small-sample bias in the estimated coefficients.

The residual-based bootstrap that we use to generate the results in Table A9 is the standard in the literature. To be on the safe side, we also conducted a parametric bootstrap. Here, we draw ε_R and ε_{IP^4} from a multivariate normal distribution $N(0, \Sigma)$ where Σ is the covariance matrix of ε_R and ε_{IP^4} . We did this for excess returns from the world-market portfolio. We find that the mean values of the artificial β , t , and R^2 statistics from this bootstrap are basically the same as those we find with the residual-based bootstrap: -0.1 , -0.1 , and 2.3% , respectively. The p -values for each statistics are also quite similar: 0.014 , 0.000 , and 0.001 .

Finally, we have tried including higher-order lags in (4). This does not change the results either.

Country-returns in USD. In Table 3 in the paper, we investigate real returns from a large number of individual countries. The returns are in local currencies. The international returns we otherwise consider in the paper – returns from international portfolios (world, European, etc.), commodity returns, FX returns, etc. – are in USD. In Table A10 we report results for country excess returns in USD, i.e. we convert country returns in local currencies to USD, subtract the US risk-free rate, and run the predictive regressions. We find that EOY global economic growth predicts returns whereas global economic growth at other times of the year does not.

In total, we conclude that our results are robust and statistically strong.

Table A1. Taking into account publication lags.

| Return | IP^1 | | | IP^2 | | | IP^3 | | | IP^4 | | |
|----------------------------------|---------|-----|-------|---------|------|-------|---------|------|-------|---------|-------------|-------|
| | β | t | R^2 | β | t | R^2 | β | t | R^2 | β | t | R^2 |
| World | | | | | | | | | | | | |
| Nominal | 1.7 | 1.2 | 2.1% | -2.8 | -1.0 | 2.4% | -2.0 | -0.7 | 1.3% | -4.1 | -4.6 | 16.6% |
| Excess | 1.4 | 0.9 | 1.5% | -2.6 | -0.8 | 2.1% | -2.1 | -0.7 | 1.5% | -4.6 | -4.6 | 20.4% |
| Real | 1.5 | 1.0 | 1.6% | -3.2 | -1.0 | 3.1% | -2.2 | -0.8 | 1.6% | -4.3 | -4.5 | 18.7% |
| Europe | | | | | | | | | | | | |
| Nominal | 2.6 | 1.7 | 3.2% | 0.3 | 0.1 | 0.0% | -1.3 | -0.3 | 0.4% | -3.9 | -3.0 | 10.0% |
| Excess | 2.3 | 1.4 | 2.5% | 0.4 | 0.1 | 0.0% | -1.4 | -0.4 | 0.5% | -4.4 | -3.1 | 12.5% |
| Real | 2.3 | 1.5 | 2.7% | -0.4 | -0.1 | 0.0% | -1.5 | -0.4 | 0.6% | -4.1 | -3.0 | 11.4% |
| Europe, Australasia and Far East | | | | | | | | | | | | |
| Nominal | 2.7 | 1.7 | 3.7% | -1.9 | -0.6 | 0.8% | -2.7 | -0.9 | 1.7% | -4.6 | -3.4 | 13.7% |
| Excess | 2.4 | 1.5 | 3.0% | -1.7 | -0.5 | 0.6% | -2.9 | -0.9 | 1.8% | -5.1 | -3.5 | 16.4% |
| Real | 2.5 | 1.5 | 3.2% | -2.4 | -0.7 | 1.3% | -2.9 | -1.0 | 1.9% | -4.8 | -3.4 | 15.4% |
| Pacific | | | | | | | | | | | | |
| Nominal | 2.7 | 1.5 | 2.3% | -4.0 | -1.3 | 2.0% | -3.7 | -1.3 | 1.7% | -5.5 | -3.2 | 11.9% |
| Excess | 2.4 | 1.3 | 1.9% | -3.9 | -1.1 | 1.8% | -3.9 | -1.3 | 1.8% | -6.0 | -3.3 | 13.9% |
| Real | 2.5 | 1.4 | 2.0% | -4.4 | -1.3 | 2.5% | -3.8 | -1.3 | 1.9% | -5.6 | -3.2 | 13.5% |

The table is as Table 2, except from the fact that returns have been moved forward one quarter, i.e., for IP^4 , the one-year-ahead stock return is measured from the beginning of the second quarter to the end of the first quarter next year, for IP^3 , the one-year-ahead stock return is measured over the calendar year, for IP^2 , the one-year-ahead stock return is measured from the beginning of the fourth quarter to the end of the third quarter next year, and for IP^1 , the one-year-ahead stock return is measured from the beginning of the third quarter to the end of the second quarter next year. The sample period is 1970-2013.

Table A2. Using monthly growth rates to predict excess returns on the world market portfolio.

| | β | t | R^2 |
|-----------|---------|-------------|-------|
| December | -5.1 | -3.6 | 10.1% |
| November | -6.2 | -2.4 | 8.8% |
| October | -7.9 | -2.6 | 7.9% |
| September | 3.6 | 0.9 | 1.8% |
| August | -6.6 | -1.7 | 6.9% |
| July | 5.0 | 1.2 | 3.3% |
| June | -2.0 | -0.5 | 0.5% |
| May | -1.5 | -0.5 | 0.8% |
| April | -2.5 | -1.0 | 1.2% |
| March | -4.8 | -1.2 | 2.8% |
| February | -8.8 | -2.2 | 12.2% |
| January | 3.0 | 0.8 | 3.3% |

We regress one-year ahead excess returns on MSCI World index on monthly growth rates of global industrial production. The sample period is 1970-2013.

Table A3. Forecasting the same one-year ahead returns.

| Return | IP^1 | | | IP^2 | | | IP^3 | | | IP^4 | | |
|------------------------------------|---------|------|-------|---------|------|-------|---------|------|-------|---------|-------------|-------|
| | β | t | R^2 | β | t | R^2 | β | t | R^2 | β | t | R^2 |
| Q4Q4 world returns (calendar year) | | | | | | | | | | | | |
| Nominal | -0.3 | -0.2 | 0.5% | -2.5 | -0.9 | 2.2% | -2.0 | -0.7 | 1.3% | -3.1 | -4.3 | 11.3% |
| Excess | -0.7 | -0.5 | 0.3% | -2.3 | -0.7 | 1.9% | -2.1 | -0.7 | 1.5% | -3.6 | -5.3 | 14.5% |
| Real | -0.3 | -0.2 | 0.1% | -2.9 | -1.0 | 2.9% | -2.2 | -0.8 | 1.6% | -3.3 | -4.4 | 12.6% |
| Q3Q3 world returns | | | | | | | | | | | | |
| Nominal | 0.1 | 0.1 | 0.0% | -2.8 | -1.0 | 2.4% | -1.1 | -0.4 | 0.3% | -2.1 | -1.3 | 4.5% |
| Excess | -0.2 | -0.2 | 0.0% | -2.6 | -0.8 | 2.1% | -1.1 | -0.4 | 0.4% | -2.6 | -1.7 | 6.7% |
| Real | -0.0 | -0.0 | 0.0% | -3.2 | -1.0 | 3.1% | -1.3 | -0.5 | 0.5% | -2.4 | -1.5 | 5.9% |
| Q2Q2 world returns | | | | | | | | | | | | |
| Nominal | 1.7 | 1.2 | 2.1% | -1.1 | -0.5 | 0.5% | 2.4 | 1.1 | 2.2% | -1.1 | -1.1 | 1.7% |
| Excess | 1.4 | 0.9 | 1.5% | -1.0 | -0.5 | 0.4% | 2.2 | 0.9 | 1.8% | -1.7 | -1.6 | 3.7% |
| Real | 1.5 | 1.0 | 1.6% | -1.6 | -0.7 | 0.9% | 1.9 | 0.8 | 1.3% | -1.5 | -1.4 | 3.1% |
| Q1Q1 world returns | | | | | | | | | | | | |
| Nominal | -1.9 | -0.9 | 2.3% | -1.2 | -0.3 | 0.4% | -1.4 | -0.4 | 0.6% | -4.1 | -4.6 | 16.6% |
| Excess | -2.2 | -1.0 | 2.9% | -1.1 | -0.3 | 0.4% | -1.7 | -0.5 | 0.8% | -4.6 | -4.6 | 20.4% |
| Real | -1.9 | -0.9 | 2.2% | -1.6 | -0.5 | 0.8% | -1.8 | -0.5 | 0.9% | -4.3 | -4.5 | 18.7% |

We regress annual returns on lagged quarterly growth rates in industrial production. We predict calendar year returns (Q4Q4 returns) using IP^1 , IP^2 , IP^3 , and IP^4 , third-quarter to third-quarter (Q3Q3) returns using IP^1 , IP^2 , IP^3 , and IP^4 , etc. The sample period is 1970-2013.

Table A4. Value and growth stocks.

| | IP^1 | IP^2 | IP^3 | IP^4 | IP^1 | IP^2 | IP^3 | IP^4 |
|----------------------------------|--------|-------------|--------|-------------|--------|--------|--------|-------------|
| World | | | | | | | | |
| | Value | | | | Growth | | | |
| β | -2.4 | -0.1 | 0.8 | -3.1 | -2.0 | 0.3 | 1.6 | -3.4 |
| t | -0.9 | -0.0 | 0.3 | -4.7 | -0.8 | 0.1 | 0.6 | -5.4 |
| R^2 | 3.2% | 0.0% | 0.2% | 11.7% | 2.0% | 0.0% | 0.6% | 12.1% |
| Europe | | | | | | | | |
| | Value | | | | Growth | | | |
| β | -1.6 | 4.8 | 2.9 | -4.4 | -1.0 | 5.3 | 4.3 | -3.7 |
| t | -0.4 | 1.7 | 0.9 | -6.7 | -0.3 | 1.9 | 1.6 | -4.8 |
| R^2 | 0.9% | 5.2% | 1.8% | 14.1% | 0.4% | 6.4% | 4.5% | 11.0% |
| Europe, Australasia and Far East | | | | | | | | |
| | Value | | | | Growth | | | |
| β | -1.0 | 0.3 | -0.4 | -4.4 | -0.3 | 1.6 | 1.0 | -3.9 |
| t | -0.3 | 0.1 | -0.1 | -5.3 | -0.1 | 0.7 | 0.3 | -4.6 |
| R^2 | 0.3% | 0.0% | 0.0% | 14.9% | 0.0% | 0.7% | 0.2% | 11.9% |
| Pacific | | | | | | | | |
| | Value | | | | Growth | | | |
| β | -0.2 | -5.3 | -4.8 | -4.2 | 0.6 | -2.6 | -3.7 | -3.9 |
| t | -0.0 | -2.0 | -1.5 | -3.0 | 0.1 | -0.9 | -0.9 | -2.5 |
| R^2 | 0.0% | 4.4% | 2.6% | 10.1% | 0.1% | 1.1% | 1.5% | 7.4% |

We regress one-year ahead excess returns on MSCI value and growth indexes on the lag of global industrial production growth. The returns are in US dollars and in excess of a short US T-bill rate. The sample period is 1974-2013.

Table A5. Conditioning IP^1 growth on IP^4 .

| | Sample begins | IP^1 | | | $IP^1 \perp$ | | |
|-------------------------------------|------------------|---------|-------------|-------|--------------|------|-------|
| | | β | t | R^2 | β | t | R^2 |
| <u>Panel A: Developed countries</u> | | | | | | | |
| Australia | 1970 | -3.1 | -2.7 | 5.9% | -0.1 | -0.0 | 0.0% |
| Netherl. | 1970 | -4.9 | -2.3 | 7.8% | -0.2 | -0.1 | 0.0% |
| UK | 1970 | -3.5 | -2.5 | 7.9% | -0.4 | -0.1 | 0.0% |
| <u>Panel B: Emerging countries</u> | | | | | | | |
| <u>Asia</u> | | | | | | | |
| India | 1993 | -5.2 | -2.1 | 7.0% | 5.3 | 0.9 | 3.4% |
| Philippin. | 1988 | -5.3 | -4.2 | 8.7% | -3.9 | -1.2 | 2.4% |
| Thailand | 1988 | -7.3 | -3.1 | 12.6% | -1.7 | -0.4 | 0.4% |
| <u>Eastern Europe</u> | | | | | | | |
| Hungary | 1995 | -11.9 | -3.1 | 21.8% | 0.6 | 0.1 | 0.0% |
| Russia | 1995 | -5.9 | -2.3 | 1.9% | 9.0 | 0.9 | 1.8% |
| <u>Latin America</u> | | | | | | | |
| Brazil | 1994 | -4.5 | -2.4 | 7.5% | -1.6 | -0.3 | 0.4% |
| Mexico | 1994 | -5.9 | -3.6 | 14.2% | -1.9 | -0.4 | 0.6% |
| Peru | 1994 | -4.0 | -2.3 | 4.4% | -1.1 | -0.2 | 0.2% |

We use the part of IP^1 that is orthogonal to IP^4 to predict one-year ahead returns in those countries where IP^1 on its own is statistically significant. Results in IP^1 columns are repeated from Table 3 to ease comparison with results in $IP^1 \perp$ columns.

Table A6. Three alternative measures of global economic growth.

| | IP^1 | IP^2 | IP^3 | IP^4 | IP^1 | IP^2 | IP^3 | IP^4 | IP^1 | IP^2 | IP^3 | IP^4 |
|----------------------------------|-----------------------|--------|--------|-------------|---------------|--------|--------|-------------|----------------------|--------|--------|-------------|
| World | | | | | | | | | | | | |
| | Cross-country average | | | | Common factor | | | | GDP-weighted average | | | |
| β | -2.2 | -1.0 | -1.1 | -3.6 | -0.03 | -0.01 | -0.01 | -0.07 | -2.3 | -1.6 | -0.8 | -3.0 |
| t | -1.0 | -0.5 | -0.4 | -5.3 | 1.2 | -0.5 | -0.3 | -5.1 | -1.0 | -0.7 | -0.4 | -4.4 |
| R^2 | 2.9% | 0.4% | 0.4% | 14.5% | 3.7% | 0.6% | 0.1% | 12.3% | 2.8% | 1.3% | 0.2% | 9.7% |
| Europe | | | | | | | | | | | | |
| | Cross-country average | | | | Common factor | | | | GDP-weighted average | | | |
| β | -2.0 | 3.6 | 0.5 | -4.2 | -0.03 | 0.04 | 0.01 | -0.07 | -2.2 | 2.8 | -0.3 | -3.5 |
| t | -1.0 | 1.3 | 0.2 | -6.5 | 0.7 | 1.5 | 0.3 | -5.8 | -0.9 | 1.1 | -0.1 | -4.5 |
| R^2 | 2.9% | 3.1% | 0.1% | 13.7% | 1.4% | 3.8% | 0.1% | 11.4% | 1.8% | 2.5% | 0.0% | 9.3% |
| Europe, Australasia and Far East | | | | | | | | | | | | |
| | Cross-country average | | | | Common factor | | | | GDP-weighted average | | | |
| β | -1.1 | 0.5 | -1.2 | -4.4 | -0.02 | 0.00 | -0.01 | -0.08 | -1.1 | -0.1 | -1.1 | -3.2 |
| t | -0.4 | 0.2 | -0.4 | -5.1 | 0.3 | 0.1 | -0.3 | -5.1 | -0.4 | -0.1 | -0.6 | -4.5 |
| R^2 | 0.5% | 0.1% | 0.3% | 14.8% | 0.4% | 0.0% | 0.1% | 11.9% | 0.4% | 0.0% | 0.3% | 7.6% |
| Pacific | | | | | | | | | | | | |
| | Cross-country average | | | | Common factor | | | | GDP-weighted average | | | |
| β | 0.4 | -2.8 | -3.0 | -4.6 | 0.01 | -0.04 | -0.02 | -0.08 | 0.9 | -2.8 | -1.7 | -2.7 |
| t | 0.1 | -1.0 | -1.0 | -2.8 | -0.2 | -1.1 | -0.7 | -2.7 | 0.2 | -1.1 | -0.7 | -2.5 |
| R^2 | 0.0% | 1.2% | 1.1% | 8.9% | 0.1% | 1.8% | 0.5% | 6.8% | 0.2% | 1.6% | 0.4% | 3.0% |

We regress one-year ahead excess returns on the lag of quarterly growth rates in global industrial production. We use three alternative measures of growth in global industrial production: 1) A simple equal-weighted cross-country average, 2) The first principal component of the growth rates in industrial production across countries, and 3) A GDP-weighted cross-country average. The timing of returns is as in Table 2. The sample period is 1970-2013.

Table A7. Annual end-of-year growth rates vs. quarterly Q3-Q4 growth rates.

| | Q3-Q4 | | | Q4-Q4 | | | DEC-DEC | | |
|---------|---------|-------------|-------|---------|-------------|-------|---------|-------------|-------|
| | β | t | R^2 | β | t | R^2 | β | t | R^2 |
| Nominal | -3.1 | -4.3 | 11.3% | -1.2 | -1.9 | 6.6% | -1.2 | -2.2 | 7.5% |
| Excess | -3.6 | -5.3 | 14.5% | -1.4 | -2.2 | 8.4% | -1.4 | -2.4 | 9.5% |
| Real | -3.3 | -4.4 | 12.6% | -1.3 | -2.1 | 7.7% | -1.3 | -2.3 | 8.8% |

We predict calendar-year returns on the world-market portfolio using different measures of end-of-the-year growth in global industrial production. ‘Q3-Q4’ refers to growth between the third and the fourth quarter of a previous year, ‘Q4-Q4’ refers to annual growth from the last quarter of year before the previous year to the last quarter of the previous year, and ‘DEC-DEC’ refers to annual growth from December of the year before the previous year to December of the previous year. Bold font indicates statistical significance at the 5% level. The sample period is 1970-2013.

Table A8. Using GDP growth to predict returns.

| Region | <i>GDP</i> ¹ | | | <i>GDP</i> ² | | | <i>GDP</i> ³ | | | <i>GDP</i> ⁴ | | |
|---------|-------------------------|-------------|-----------------------|-------------------------|----------|-----------------------|-------------------------|----------|-----------------------|-------------------------|-------------|-----------------------|
| | β | <i>t</i> | <i>R</i> ² | β | <i>t</i> | <i>R</i> ² | β | <i>t</i> | <i>R</i> ² | β | <i>t</i> | <i>R</i> ² |
| World | -10.8 | -3.0 | 11.5% | 2.7 | 0.6 | 0.6% | -0.8 | -0.1 | 0.0% | -12.0 | -3.8 | 17.1% |
| Europe | -11.1 | -2.5 | 8.0% | 11.5 | 1.9 | 6.8% | 3.5 | 0.7 | 0.5% | -12.9 | -4.1 | 13.7% |
| EAFA | -11.8 | -2.8 | 8.7% | 7.2 | 1.3 | 2.8% | 3.2 | 0.5 | 0.3% | -13.1 | -3.9 | 13.6% |
| Pacific | -11.1 | -2.4 | 4.7% | 2.4 | 0.3 | 0.2% | 6.2 | 0.6 | 0.7% | -13.0 | -2.7 | 7.4% |

This is similar to Table 2 but instead of using growth in global industrial production to predict real returns on the world portfolios and regional portfolios, this table shows results from using global GDP growth to predict returns. Bold font indicates statistical significance at the 5% level. The sample period is 1970-2013.

Table A9. Bootstrap analysis of end-of-the-year forecasting regressions.

| | Observed | | | Empirical | | | Observed | | | Empirical | | |
|----------------------------------|-----------------|------|-----------------|----------------|------|-----------------|--------------|------|-----------------|-----------|------|-----------------|
| | Statistic | Mean | <i>p</i> -value | Statistic | Mean | <i>p</i> -value | Statistic | Mean | <i>p</i> -value | Statistic | Mean | <i>p</i> -value |
| World | | | | | | | | | | | | |
| | Nominal returns | | | Excess returns | | | Real returns | | | | | |
| β | -3.1 | -0.1 | 0.042 | -3.6 | -0.1 | 0.025 | -3.3 | -0.1 | 0.034 | | | |
| t | -4.3 | -0.1 | 0.006 | -5.3 | -0.1 | 0.003 | -4.4 | -0.1 | 0.005 | | | |
| R^2 | 11.3% | 2.2% | 0.019 | 14.5% | 2.2% | 0.009 | 12.6% | 2.2% | 0.015 | | | |
| Europe | | | | | | | | | | | | |
| | Nominal returns | | | Excess returns | | | Real returns | | | | | |
| β | -3.7 | -0.0 | 0.046 | -4.2 | -0.0 | 0.034 | -3.8 | -0.1 | 0.042 | | | |
| t | -4.9 | -0.1 | 0.002 | -6.5 | -0.0 | 0.004 | -5.7 | -0.1 | 0.001 | | | |
| R^2 | 11.0% | 2.3% | 0.028 | 13.7% | 2.2% | 0.014 | 12.1% | 2.3% | 0.021 | | | |
| Europe, Australasia and Far East | | | | | | | | | | | | |
| | Nominal returns | | | Excess returns | | | Real returns | | | | | |
| β | -3.9 | -0.1 | 0.042 | -4.4 | -0.1 | 0.026 | -4.1 | -0.1 | 0.033 | | | |
| t | -4.3 | -0.1 | 0.006 | -5.1 | -0.1 | 0.003 | -4.3 | -0.1 | 0.006 | | | |
| R^2 | 12.1% | 2.3% | 0.021 | 14.8% | 2.3% | 0.010 | 13.1% | 2.3% | 0.017 | | | |
| Pacific | | | | | | | | | | | | |
| | Nominal returns | | | Excess returns | | | Real returns | | | | | |
| β | -4.1 | -0.1 | 0.101 | -4.6 | -0.1 | 0.077 | -4.3 | -0.1 | 0.091 | | | |
| t | -2.5 | -0.0 | 0.064 | -2.8 | -0.1 | 0.049 | -2.5 | -0.0 | 0.069 | | | |
| R^2 | 7.3% | 2.3% | 0.079 | 8.9% | 2.3% | 0.049 | 8.0% | 2.3% | 0.064 | | | |

The table reports results from a bootstrap resampling procedure where we for each return series generate 10,000 artificial β , t , and R^2 statistics under the null of no predictability. We report the mean values of the artificial statistics. The empirical p -value is calculated as the fraction of the artificial statistics that are larger than the observed statistic in absolute terms.

Table A10. Forecasting country excess returns (in USD) using global economic growth.

| | IP^1 | | | IP^2 | | | IP^3 | | | IP^4 | | |
|-----------|---------|-------------|-------|---------|------|-------|---------|------|-------|---------|-------------|-------|
| | β | t | R^2 | β | t | R^2 | β | t | R^2 | β | t | R^2 |
| Australia | -5.4 | -1.8 | 9.6% | 1.6 | 0.5 | 0.6% | -3.4 | -0.7 | 1.3% | -7.0 | -5.7 | 25.7% |
| Belgium | -1.2 | -0.3 | 0.3% | 7.1 | 1.8 | 6.2% | 3.5 | 1.0 | 1.8% | -3.2 | -2.0 | 4.7% |
| Canada | -3.6 | -1.3 | 5.1% | -0.2 | -0.1 | 0.0% | 2.7 | 0.8 | 1.3% | -3.6 | -2.4 | 10.3% |
| France | -1.1 | -0.4 | 0.3% | 7.6 | 1.7 | 7.9% | -2.6 | -0.5 | 0.8% | -4.3 | -4.1 | 9.0% |
| Germany | -1.6 | -0.6 | 0.5% | 5.6 | 1.7 | 5.3% | 1.1 | 0.3 | 0.3% | -3.1 | -3.4 | 4.2% |
| Italy | 1.9 | 0.4 | 0.4% | 0.4 | 0.1 | 0.0% | 2.6 | 0.8 | 0.6% | -2.2 | -1.7 | 1.5% |
| Japan | 1.8 | 0.5 | 0.7% | -3.6 | -1.2 | 1.7% | -3.0 | -0.9 | 0.9% | -3.6 | -1.7 | 4.5% |
| Netherl. | -3.3 | -1.2 | 4.7% | 2.6 | 0.8 | 1.6% | -0.3 | -0.1 | 0.0% | -4.5 | -6.8 | 17.3% |
| Sweden | -3.3 | -0.8 | 2.0% | -3.1 | -0.8 | 1.0% | -4.3 | -1.1 | 2.1% | -5.3 | -3.5 | 12.6% |
| Switzerl. | -1.8 | -0.7 | 1.2% | 2.9 | 0.9 | 1.9% | -0.0 | -0.0 | 0.0% | -3.4 | -4.3 | 7.7% |
| UK | -3.3 | -1.5 | 4.6% | 2.3 | 0.8 | 1.3% | -0.1 | -0.0 | 0.0% | -7.1 | -2.7 | 24.7% |
| US | -3.1 | -2.0 | 6.3% | -1.9 | -0.7 | 1.3% | -1.2 | -0.4 | 0.5% | -2.8 | -3.9 | 9.2% |

We regress one-year ahead country returns on the lag of quarterly growth rates in global industrial production. The returns are in US dollar and in excess of the US of risk-free rate. Bold font indicates statistical significance at the 5% level. The sample period is from 1970 to 2013.

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