Growth Options and The Cross Section of Residual Variances*

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Abstract

In the data, portfolios of stocks with high average returns have low average variances. We show that when we remove from total variance the business cycle variance as captured by the Chen, Roll, and Ross (1986) macroeconomic factors, these stocks actually have a larger residual variance as a fraction of total variance. This residual variance is informative of the stock of unexercised growth options that emerge upon arrival of embodied technological shocks. We find that: (i) stocks with high average returns have high residual variance and a larger stock of growth options to be depleted; (ii) stocks with low average returns have low residual variance and have converted most of their growth options into assets in place.

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1 Introduction

In the data, stocks with high average returns have low average variances and their returns are negatively correlated with their variances. These facts are puzzling. Intuitively, if stocks with higher returns are riskier, we expect them to have a higher variance as well because variance is also a measure of risk. We show that the negative contemporaneous relation of the first two moments of returns can be explained by the Chen, Roll, and Ross (1986) macroeconomic factors: when the business conditions are poor, realized variances are high and realized returns are low. We want to highlight that we think of the variance summarized by the Chen, Roll, and Ross macroeconomic factors as capturing business conditions at the business cycle frequency. When we remove this variance from total variance, we obtain a measure of residual variance that is related to growth options due to embodied technology shocks which arrive at a frequency lower than the business cycle as in Gârleanu, Panageas, and Yu (2012).

We study the cross-sectional differences in variances for portfolios sorted by book-to-market, asset growth, and gross profitability, and use the two-step Fama and MacBeth (1973) methodology. Our findings show that 67% of the cross-sectional differences in variances can be attributed to business conditions as summarized by the Chen, Roll, and Ross (CRR) macroeconomic factors. In addition, stocks with high book-to-market ratios, low asset growth, and high profitability, all associated with high expected returns (see, Hou, Xue, and Zhang, 2014), have more residual variance as a fraction of total variance. Thus, we uncover a positive relation between expected returns and residual variance. These firms increase the investment rates in the years following portfolio formation. In contrast, the firms with low book-to-market ratios, high asset growth, and low profitability have higher average investment rates at the portfolio formation, but the average investment rates decline in the years following portfolio formation. This evidence implies that firms with a higher fraction of residual variance have more growth options to be depleted compared with those firms with a lower fraction of residual variance that have already converted most of their growth options into assets in place. The intuition we put forth draws on the implications of the model in Gârleanu, Panageas, and Yu (2012) which we describe next.

Gârleanu, Panageas, and Yu (2012) build a general equilibrium model in which they use the adoption of new technology to describe the behaviour of asset prices. In their model there are two types of technological shocks. Shocks of the first type, disembodied technological shocks, affect the productivity of the entire capital stock irrespective of its vintage. Shocks of the second type, embodied technological shocks, represent arrivals of major technological or organizational innovations. These shocks affect the economy only after firms have invested in new vintages of the capital stock that embody the technological innovations. Firms choose the optimal time to invest in the new capital vintages which leads to a lag between the arrival of embodied technological shocks and their effects on macroeconomic aggregates. The link between the macroeconomy and asset prices stems from the assumption that growth options of firms exhibit a life-cycle as technologies diffuse. Specifically, when a major technological shock arrives, growth options emerge in the prices of all securities. These growth options are riskier than assets in place such that they increase both the risk premia on the stocks and the volatility of equity prices. As time passes, firms start to convert growth options into assets in place, which reduces the risk premium on their stock.

In the calibration of the model, the arrival rate of the embodied technological shocks is set to 10 years and the authors emphasize that their model captures medium-run fluctuations rather than business cycle fluctuations. Guided by the intuition in this model, we argue that the CRR factors capture the business cycle related variance and removing this variance from total variance results in a proxy of the stock of unexercised growth options that emerge upon arrival of embodied technological shocks.

We show that stocks with high book-to-market ratios, low asset growth, and high profitability have more unexercised growth options (more residual variance), which makes them riskier (high expected returns). When these firms undertake investment, they are exercising risky growth options; hence the increase in the investment rates following portfolio formation. However, firms with low book-to-market, high asset growth, and low gross profitability have a lower fraction of residual variance and lower expected returns suggesting that these firms have already exercised most of their growth options. In the portfolio formation year, these firms have higher average investment rates than firms with high book-to-market ratios, low asset growth, and high profitability. This finding adds weight to the view that these firms have already converted growth options into assets in place.

We next study the predictive ability of residual variance for future economic variables to strengthen our interpretation that this measure is related to the stock of unexercised growth options emerging upon arrival of embodied technological shocks. We compute the time-series of residual variance as the difference between realized variance and variance related to business conditions. The latter is computed as the product of the factor loadings from regressions of variances on the CRR factors and the returns on the mimicking portfolios for the CRR factors. Again, as in the model of Gârleanu, Panageas, and Yu (2012), if growth options have a life cycle, then as firms start to invest and exercise their growth options, aggregate output will respond only following the new investment. Consequently, as more firms start to convert the growth options into assets in place, we should see an increase in aggregate investment. In addition, as more profitable firms start first to exercise their growth options, times of high investment should coincide with times of high profitability. Also, there should be an impact on future hiring rates given the evidence in Basu, Fernald, and Kimball (2006) who show that, following technological improvements, employment falls in the short run, but recovers in the year following the technology shocks.

We split investment into investment in structures and investment in equipment and software. Considering investment in structures, we document that in the first seven quarters there is a negative covariance with residual variance turning into positive eleven quarters hence. Because there is a lag between the time growth options emerge and the time the firms start to convert their growth options, it makes sense to see a lagged impact on the economic quantities. This lagged impact is also consistent with the investment lags of the type discussed in Lamont (2000) and with the two-year length of time-to-build documented in Koeva (2000). Considering future investment in equipment and software, we see a positive covariance of future investment with residual variance at the horizon of three quarters, earlier than for investment in structures. Thus, it takes less time to invest in equipment and software than in structures. Over all horizons, we find a strong positive covariance of future profitability rates and residual variance. This evidence lends support to the interpretation that more profitable firms start first to convert their growth options. The covariances are always larger when using residual variance corresponding to portfolios with high expected returns than that of portfolios with low expected returns; again, suggesting that stocks with high residual variance have more growth options to be depleted than stocks with low residual variance. Finally, we show that future manufacturing hiring rates covary negatively with residual variance and the predictability we uncover concentrates in the first two quarters.

We also investigate whether sorting by residual variance as a fraction of total variance gives a spread in average returns. Intuitively, if residual variance is related to expected returns, we should see a positive return on the residual variance factor: the excess return on high residual variance quintile over the low residual variance quintile. We find that the residual variance factor earns an average return of 0.22% per month. If high residual variance firms have a higher return than low residual variance firms due to a larger stock of growth options to be depleted, then as the high residual variance firms start to exercise their growth options and undertake investment both long-run aggregate consumption and investment will respond. We should also see higher subsequent hiring rates. There is a lagged impact because the economy has yet to absorb the gains from the technological improvement as suggested in the model of Gârleanu, Panageas, and Yu (2012). Our empirical evidence shows that the residual variance factor forecasts higher consumption growth, aggregate dividend growth, investment, and manufacturing hiring rates.

The literature has informally connected growth opportunities to firms idiosyncratic risk defined as the square of the residuals relative to various empirical asset pricing models for returns. We use a measure of idiosyncratic variance and repeat the forecasting exercise for the macroeconomic aggregates to disentangle the information comprised in the two different measures. We compute idiosyncratic variance as the square of the residuals from regressions of returns on the CRR factors. We first remove the extent of predictability for the macroeconomic aggregates attributed to residual variance and study whether idiosyncratic variance has additional predictive power. The empirical evidence suggests that idiosyncratic variance is related to the level and volatility of firm profitability. We next remove the predictive part attributed to idiosyncratic variance and investigate the relation between residual variance and subsequent macroeconomic variables. Residual variance retains its economic and statistical power lending support to our interpretation that it proxies for the stock of unexercised growth options that emerge upon arrival of embodied technological shocks.

The remainder of the paper is organized as follows. Section 2 motivates the choice of the portfolio sorts. Section 3 describes the data and variable construction. Section 4 presents the decomposition of total variance into variance related to business conditions and residual variance. In Section 5, we discuss the relation between residual variance and future macroeconomic aggregates. Section 6 shows the results for the relation between the residual variance factor and the macroeconomy. In Section 7, we uncover the differences between residual variance and idiosyncratic variance. Section 8 concludes.

2 The value, investment, and profitability effects

We choose to study the variances of portfolios associated with asset growth and profitability given the recent evidence of Hou, Xue, and Zhang (2014). They show that an empirical q-factor model consisting of an investment factor and a profitability factor along with the market factor and a size factor does a good job in summarizing the cross section of average stock returns. The investment factor has a 0.69 correlation with the value factor of Fama and French (1993) such that it is interesting to study the book-to-market portfolios as well. In addition, from the perspective of the q-theory of investment it is much more intuitive to motivate our interpretation that residual variance relates to the stock of unexercised growth options.

For example, Cooper and Priestley (2011) provide evidence for a risk-based explanation for the investment effect in the cross section of stock returns. They show that the expected returns produced by the Chen, Roll, and Ross macroeconomic model match well the average spread in low and high investment portfolios. Their evidence points towards a link between investment and the growth options firms have: during investment periods, risk and expected returns are lower because when a firm undertakes investment it exercises a risky real option or according to the q-theory of investment firms start to invest when their discount rates are lower; therefore high investment firms should have already exercised most of the growth options, whereas low investment firms should have more growth options to be depleted.

Considering the profitability effect, Chen and Zhang (2010) argue that high profitable firms invest more than low profitable firms. They start from the optimality condition of firms that choose productive assets A_{io} to maximize firm market value:

$$r_i = \frac{\Pi_{i1} + 1 - \delta}{1 + a(\frac{I_{i0}}{A_{io}})} \tag{1}$$

where the numerator is the marginal benefit of investment consisting of Π_{i1}, the marginal product of capital (return on assets, ROA, or return on equity, ROE), and $1 - \delta$, the marginal liquidation value of capital. The denominator represents the marginal cost of investment and consists of one, the marginal purchasing cost of investment, and $a(\frac{I_{i0}}{A_{io}})$, the marginal adjustment cost.

Under constant returns to scale, the marginal cost of investment in the denominator equals marginal q, which in turn equals average q, that is, the market-to-book ratio. In a two-period model, the optimality condition says that the expected return is expected return-on-assets divided by market-to-book; we interpret it as follows: high expected profitability relative to low market-to-book means high discount rates, whereas low expected profitability means low discount rates.

From the capital budgeting perspective, the optimality condition implies that high expected profitability relative to low investment means high discount rates otherwise firms will see high net present values and invest more. Similarly, low expected profitability relative to high investment means low discount rates, else the net present value of projects will be lower and firms will decrease investment. The positive relation between profitability and expected returns is conditional on investment and more profitable firms will have higher investment rates than less profitable firms. Following this intuition, high profitability firms should have more growth options to be depleted relative to the low profitability firms.

3 Data

The test assets include 10 equal-weighted book-to-market portfolios, 10 equal-weighted asset growth portfolios, and 10 equal-weighted gross profitability portfolios. The sample period is from July 1964 to December 2011 with a total of 570 monthly observations.

We construct the portfolios using monthly return data and shares outstanding from the Center for Research in Security Prices (CRSP) and accounting data from Compustat merged annual files. We use the common stocks listed on NYSE, Amex, and Nasdaq. We exclude financial firms (Standard Industrial Classification codes between 6000 and 6999) and firms in regulated utilities (Standard Industrial Classification codes between 4000 and 4999). Monthly variances are the sum of squared daily returns. Book-to-market is non-negative book equity scaled by six month lagged market equity. Book equity is shareholder equity, plus deferred taxes, minus preferred stock, when available. Shareholder equity is as given in Compustat (SEQ) when available, or else common equity plus the carrying value of preferred stock (CEQ+PSTK) if available, or else total assets minus total liabilities (AT-LT). Deferred taxes is deferred taxes (TXDB) if available, or else deferred taxes and investment tax credit (TXDITC) if available, or else investment tax credit (ITCB). Preferred stock is carrying value (PSTK) if available, or else liquidating value (PSTKL) if available, or else redemption value (PSTKRV). Asset growth is calculated as the year-on-year percentage change in total assets and profitability is gross profits scaled by the book value of assets.

The Chen, Roll, and Ross (CRR) factors are used as proxies for macroeconomic conditions. Following Liu and Zhang (2008) and Cooper and Priestley (2011), the factors are formed as follows. The growth rate of industrial production, MP, is defined as $MP_t = logIP_t - logIP_{t-1}$, where IP_t is the index of industrial production in month t from the Federal Reserve Bank of St. Louis. We lead it by one month to make it contemporaneous with the series of the other variables. To compute the variables for unexpected inflation, UI, and change in expected inflation, DEI, we first define inflation as $I_t = logCPI_t - logCPI_{t-1}$, in which CPI_t is the seasonally adjusted consumer price index at time t from the Federal Reserve Bank of St. Louis. The variables for UI and DEI are defined as $UI_t = I_t - E[I_t|t-1]$ and $DEI_t = E[I_{t+1}|t] - E[I_t|t-1]$. Guided by the methodology in Fama and Gibbons (1984) and in the literature that followed suit, we model the change in the real rate on Treasury bills as an autoregressive process, $RHO_t - RHO_{t-1} = \theta u_t + u_{t-1}$, where RHO_t is the realized real return on Treasury bills, and back out the expected real return from $E[RHO_t|t-1] = (r_{f,t-1} - I_{t-1}) - \theta\hat{u_t} - \hat{u_{t-1}}$. The expected real return is plugged into $E[I_t|t-1] = r_{f,t} - E[RHO_t|t-1]$ to measure expected inflation. The term premium, UTS, is the yield spread between the ten-year and the one-year Treasury bonds from the Federal Reserve Bank of St. Louis. We define the default spread, UPR, as the yield spread between Moody's Baa and Aaa corporate bonds from the Federal Reserve Bank of St. Louis.

We form mimicking portfolios for the CRR factors and proceed as follows.[1] We use 40 assets, that is, ten equal-weighted book-to-market portfolios, ten equal-weighted size portfolios, ten value-weighted momentum portfolios, and ten equal-weighted asset growth portfolios. We also construct the size and momentum portfolios. Before proceeding to how we construct the mimicking portfolios, we motivate our choice of test assets. First, we choose asset growth since Cooper, Gulen, and Schill (2008) show that asset growth is a strong determinant of the cross section of stock returns even in the presence of standard determinants such as book-to-market, market capitalization, short and long horizon lagged returns, and other growth measures. Moreover, if sorting on value, size, momentum, and asset growth summarizes well the sources of price variation in stocks related to business conditions, the mimicking portfolios for the macroeconomic factors

[1]Eckbo, Masulis, and Norli (2000) and Cooper and Priestley (2011), among others, use a similar methodology of forming mimicking portfolios.

also include the relevant information. This argument is in line with Vassalou's (2003) motivation for using mimicking portfolios: " The information captured in the portfolio (mimicking portfolio) about the economic variable is that which is reflected in the asset returns, and which can therefore affect the prices of assets. There is sometimes much more information about the economic variable which is not captured by the mimicking portfolio, but that is because this additional information may not be relevant for asset returns."

We now turn to the construction of the mimicking portfolios. The returns on each of the 40 portfolios are regressed on the five CRR factors, that is, 40 time-series regressions producing a (40 x 5) matrix B of slope coefficients against the five factors. If V is the (40 x 40) covariance matrix of error terms (assumed to be diagonal), then the weights on the mimicking portfolios are given by: $w = (B'V^{-1}B)^{-1}B'V^{-1}$. The weights w are stacked in a 5 x 40 matrix and the mimicking portfolios are given by wR', where R is a T x 40 matrix of returns and T denotes the length of our sample, that is, 570 observations spanning July 1964 to December 2011. This procedure yields unit-beta mimicking portfolios, in the sense that each of the mimicking portfolios has beta of unity with respect to the factor it mimics and beta of zero with respect to the other factors.[2]

4 A decomposition of total variance: variance related to business conditions and residual variance

In this section, we present first the factor loadings with respect to the mimicking portfolios for the CRR factors for the variances of the test assets, that is, the book-to-market, asset growth, and profitability portfolios. Second, we show the evidence from Fama and MacBeth cross-sectional regressions designed to explain the cross-sectional differences in variances of various portfolios.

To set the stage, Table 1 reports average returns, average variances (rows 1 and 2), and the coefficients from the regressions of returns on variances (row 3) for portfolios sorted

[2]Imposing the error terms to be either diagonal or orthogonal produces unit-beta mimicking portfolios.

by the book-to-market ratio (Panel A), asset growth (Panel B), and gross profitability (Panel C). Over the three portfolio sorts, returns have a strong negative covariance with variances. Moreover, considering the portfolios sorted by the book-to-market ratio and asset growth, a large spread in average returns is accompanied by an inverted spread in average variances. For example, stocks with high book-to-market ratios earn 1.07 % more than stocks with low book-to-market ratios. However, the average variance of the stocks with high book-to-market ratios is smaller by 12.46 percentage points relative to the stocks with low book-to-market ratios. Similarly, stocks in the low investment decile earn 1.15% more than the stocks in the high investment decile. The average variance of low investment stocks is 7.43 percentage points smaller than that of high investment stocks. Considering the gross profitability deciles, stocks in the high profitability decile have returns 0.75% higher than the stocks in the low profitability decile. However, the mean variance of the low profitability decile is 2.23% points smaller than that of the high profitability decile.

Before proceeding to the empirical results, we also put forth some intuition regarding the signs of the loadings of variances corresponding to the mimicking portfolios for the CRR factors. We know that realized returns are procyclical, whereas realized variances are countercyclical. Consequently, if returns covary positively with the factors and since the factors are also returns, then variances should covary negatively with the factors. Put differently, when times are poor, returns are low and variances are high. Moreover, the larger the average variance, the more negative the covariance with the factors.

4.1 Factor loadings with respect to the CRR factors

Panel A of Table 2 reports the factor loadings for the variances of the ten equal-weighted portfolios sorted by the book-to-market ratio. As we move from the low book-to-market decile to the high book-to-market decile, the spread in average variances is matched by a spread in betas. That is, the variances of low book-to-market stocks have more negative (positive) loadings on the five mimicking portfolios for the CRR factors, -2.24, 6.51, 10.28, -2.11, and -1.93, than those of the variances of the low book-to-market decile, -0.95, 5.31, 7.05, -1.73, and -1.14.

In Panel B of Table 2, we show the factor loadings of the variances of the ten equal-weighted portfolios sorted by asset growth. Again, the spread in average variances is accompanied by a spread in the factor loadings with respect to the mimicking portfolios for the CRR factors. Specifically, the coefficient estimates for the variances of high asset growth stocks are: -2.10, 7.35, 11.16, -2.44, and -2.15; those corresponding to the variances of low asset growth stocks are: -1.11, 4.87, 4.34, -1.08, and -0.60.

Finally, panel C of Table 2 contains the factor loadings of the ten portfolios sorted by gross profitability. Recall that the spread in the average variances is fairly small so it is not surprising that it is accompanied by a small spread in the factor loadings with respect to the mimicking portfolio for the UPR factor. The rest of the factor loadings exhibits an inverted spread relative to the spread documented in average variances.

In general, the sign and the size of the coefficients we report in Table 2 are economically important and contribute to a better understanding of the economic dynamics of the second moment of returns showing that macroeconomic conditions as described by the CRR factors play a role in the dynamics of variances.

4.2 Explaining the cross section of average variances with the macroeconomic factor loadings

Table 3 reports the estimates of prices of the CRR factors from the cross-sectional regressions of variances along with the Shanken (1992) corrected t-statistics, and the average cross-sectional adjusted R^2, $\bar{R}^2$. The price of the default spread factor is the most negative and statistically significant: -9.89. The second most negative is the price of the industrial production factor, -7.21. The price of the term spread factor is positive, economically large and statistically significant. The unexpected inflation factor has a positive and statistically significant price of 3.65. Finally, the unexpected change in inflation has a negative price, but statistically insignificant. The adjusted R^2 suggests that about 67 % of the cross-sectional differences in average variances is attributed to business conditions as summarized by the CRR macroeconomic factors.

Next, we decompose total variance into variance related to business conditions,var_{BC}, and residual variance, $var_{residual}$. The variance attributed to business conditions is given by the product between the factor loadings reported in Table 2 and the prices of the CRR factors shown in Table 3:

$$var_{BC,i} = \hat{b}_{i,MP}\hat{\Gamma}_{MP} + \hat{b}_{i,UI}\hat{\Gamma}_{UI} + \hat{b}_{DEI}\hat{\Gamma}_{i,DEI} + \hat{b}_{i,UTS}\hat{\Gamma}_{UTS} + \hat{b}_{i,UPR}\hat{\Gamma}_{UPR} \tag{2}$$

where i depicts the various portfolios, the $\hat{b}$s are the variance factor loadings, and the $\hat{\Gamma}$s are the prices of the CRR factors from the Fama and MacBeth cross-sectional regressions. Total average variance is decomposed into:

$$\overline{var_i} = var_{BC,i} + var_{residual,i} \tag{3}$$

and the ratio of each of the components relative to total variance is computed as $\frac{var_{BC,i}}{\overline{var_i}}$ and $1 - \frac{var_{BC,i}}{\overline{var_i}}$.

Panel A1 of Table 4 shows the variance decomposition for the ten book-to-market portfolios. Looking at the fraction of residual variance as part of total variance, stocks with high book-to-market ratios have more residual variance, 36%, relative to stocks with low book-to-market ratios, 20%. If residual variance is related to the stock of unexercised growth options, the evidence tells us that stocks with high book-to-market ratios have more growth options to be depleted than stocks with low book-to-market ratios that have already exercised most of the growth options. To provide support for this interpretation, we compute the average investment rates of the firms within the portfolios sorted by book-to-market up to four years after portfolio formation year. If firms with a larger residual variance as part of total variance have more unexercised growth options, then these firms should exhibit an increase in investment rates following portfolio formation year because according to the real option models when firms undertake investment they are exercising risky real options. We follow Belo, Lin, and Bazdresch (2014) and compute the investment rate as $IK_t = I_t/[0.5 \times (K_{t-1} + K_t)]$ in which investment I_t is capital expenditure (CAPX) minus sales of plant, property, and equipment (SPPE). Missing values of SPPE are set to zero. Physical capital stock, K_t, is net property, plant, and equipment (PPENT).

As shown in Figure 1, in the ranking year, firms in the low book-to-market decile have higher average investment rates than those in the high book-to-market decile. However, in the years following portfolio formation, there is an increase in the investment rates of the firms in the high book-to-market decile, whereas the investment rates of the firms in the low book-to-market decile decline. This evidence is in line with the economic intuition we put forth earlier.

We now turn to the asset growth deciles. Panel B1 of Table 4 shows the decomposition of total average variances and we find that firms with low asset growth have a higher residual variance as part of total variance. The residual variance of these firms represents 32% of total variance, whereas for the high investment firms the residual variance represents 17% of total variance. This evidence implies that firms with high investment rates have started to convert their growth options into assets in place which reduces the stock of growth options (lower residual variance as a fraction of total variance). Similarly, low investment firms have more growth options to be depleted as captured by the larger residual variance as a fraction of total variance.

We next compute the investment rates of the firms in the deciles sorted by asset growth starting with the ranking year and four years hence and plot them in Figure 2. In the portfolio formation year, the low asset growth decile has a lower average investment rate relative to the high asset growth decile. However, starting with the second year following portfolio formation the firms in the low investment decile increase the investment rates. This evidence suggests that low investment firms have started to deplete the growth options.

Novy-Marx (2013) shows that controlling for book-to-market improves the performance of profitability strategies. Therefore, in Table 5 we show the decomposition of total variance for portfolios double-sorted on profitability and book-to-market.

In the low book-to-market quantile, the residual variance of high profitability stocks represents 44% of total variance, whereas the residual variance of low profitability stocks represents 21% of total variance. We see a similar pattern for the remaining book-to-market quantiles: high profitability stocks have always a larger fraction of residual variance, 37%, 35%, 35%, and 51%, compared with low profitability stocks, 31%, 25%, 30%, and 23%. Our findings indicate that more profitable firms should invest more than less profitable firms because they have more unexercised growth options as indicated by their higher residual variance relative to low profitability firms that have already converted most of their growth options.

Figure 3 shows the investment rates of the firms in the double-sorted portfolios starting with the portfolio formation year and four years hence. The five panels in the figure correspond to the five book-to-market quantiles. Within each panel, the solid line depicts the investment rates of low profitability firms and the dashed one depicts the investment rates of high profitability firms. Note that controlling for book-to-market, in general, most of the firms in the high profitability quantiles increase the investment rates following the ranking year, whereas the firms in the low profitability quantiles exhibit declining investment rates. These patterns are in line with the intuition that high profitable firms have more unexercised growth options as suggested by their larger fraction of residual variance relative to the low profitability firms that have exercised most of the growth options.

In sum, the evidence presented in this section adds weight to the view that residual variance is related to the stock of unexercised growth options that emerge in all securities on arrival of embodied technological shocks. Recall that the portfolios sorted on the characteristics we consider, that is, book-to-market ratio, asset growth, and gross profitability, display a wide spread in average returns. Thus, we uncover a positive relation between the high expected returns of high book-to-market, low asset growth, and high profitability firms and the stock of unexercised growth options these firms have as summarized by our measure of residual variance.

5 Future macroeconomic variables and residual variance

In the previous section, we have reached the conclusion that stocks with high expected returns have more residual variance as a fraction of total variance; we interpret the evidence as these stocks having more growth options to be depleted which makes them riskier. In this section, to provide further evidence on the link between residual variance and the stock of unexercised growth options that emerge upon arrival of embodied technological shocks, we investigate the predictive power of residual variance for aggregate investment, aggregate profitability, and manufacturing hiring rates.

Recall that the link between residual variance and macroeconomic aggregate revolves around the idea that growth options have a life cycle as suggested in Gârleanu, Panageas, and Yu (2012). Specifically, as more firms start to invest in the new technologies, that is, convert the growth options into assets in place, only following the investment, economic quantities will respond. As the technologies diffuse, that is, more firms convert the growth options into assets in place, then we should see eventual effects on the macroeconomic aggregates. For the empirical exercise we split private fixed nonresidential investment into investment in equipment and software, and investment in nonresidential structures. Lettau and Ludvigson (2002) perform a similar split to find which of the components is more predictable by a host of variables that have predictive power for excess returns.

Following Bachmann, Caballero, and Engel (2013), we impose the condition for the quarterly investment to add up to annual investment: $I_t^Q = (\frac{I_y^Y}{\sum_{t \in y} \widetilde{I}_t^Q})\widetilde{I}_t^Q$, where I^Y is annual private fixed nonresidential investment by components and $\widetilde{I}^Q$ is quarterly fixed nonresidential investment by components seasonally adjusted at annual rates. Profits are corporate profits with inventory valuation and capital consumption adjustment; we compute cumulative rates of profitability. The data are from the Bureau of Economic Analysis. Manufacturing hiring rates are computed as in Bazdresch, Belo, and Lin (2013): $HN_t = H_t/[0.5 \times (N_{t-1} + N_t)]$, where N_t is the total number of employees in the manufacturing sector provided by the Bureau of Labor Statistics and H_t is the net hiring rate calculated as the change in the number of total employees from quarter t to quarter $t-1$ ($H_t = N_t - N_{t-1}$).

We compute the time-series of residual variance as the difference between realized variance and variance related to business conditions. The latter is computed as the product of the factor loadings reported in Table 3 and the returns on the mimicking portfolios for the CRR factors:

$$var_{BC,it} = \hat{b}_{i,MP}MP_t + \hat{b}_{i,UI}UI_t + \hat{b}_{i,DEI}DEI_t + \hat{b}_{i,UTS}UTS_t + \hat{b}_{i,UPR}UPR_t \quad (4)$$

$$rvar_{it} = var_{it} - var_{BC,it} \quad (5)$$

We study the predictability of the macroeconomic quantities by estimating:

$$x_{t,t+q} = \alpha_i + \delta_i rvar_{it} + \phi_i x_t + \xi_{it+q} \quad (6)$$

where $x_{t,t+q}$ (q=1,2,3,5,7,11, or 15) is the growth rate of the macroeconomic variable q-quarters in the future and $rvar_{it}$ is the residual variance corresponding to various portfolios i. Along with the measure of residual variance, we include the lag of the economic variable to control for persistence and investigate whether the measure of residual variance has additional information not included in the lagged variable. We use the time-series of residual variance corresponding to the following portfolios: high book-to-market, low book-to-market, low asset growth, high asset growth, high profitability, and low profitability. We simply sum the monthly numbers to build the quarterly time-series of residual variances.

If residual variance is related to the stock of unexercised growth options firms have such that firms with higher expected returns have more growth options, then the macroeconomic aggregates should have larger covariances with high residual variance than with low residual variance. Intuitively, a larger quantity of growth options being converted into assets in place leads to a larger increase in aggregate investment.

5.1 Predicting macroeconomic aggregates with residual variance

Table 6 provides evidence on the ability of residual variance to predict the components of future aggregate investment rates. Panel A looks at the predictability of high book-to-market residual variance. For future rates of investment in structures, high residual variance, that is, more unexercised growth options, predicts lower investment in the next seven quarters and higher investment eleven quarters hence. If it takes time for firms to invest, the correlation between growth options and investment should be negative at first as the growth options are to be depleted, but should turn positive at longer horizons as the growth options are converted into assets in place.

The point at which the sign flips, that is, moves from negative to positive, indicates the average length of the investment lags of the type discussed in Lamont (2000): the lags between the decision to invest and the actual investment expenditure. Moreover, this evidence is also consistent with the predictions of the model in Gârleanu, Panageas, and Yu (2012): given the lag between the time when growth options emerge and the time firms decide to convert their growth options into assets in place, there is a lagged impact on the economic quantities. Consequently, we see that at horizons in excess of seven quarters residual variance has positive coefficients for investment rates and the coefficient is economically and statistically significant at the horizon of eleven quarters. Furthermore, from the second quarter hence, there is a monotonic increase in the covariance between future investment rates and residual variance in line with the intuition that as more firms start to exercise their growth options, we see a positive response of the aggregate investment.

We now turn to investment in equipment and software for which we document a positive response following the exercise of growth options and the effect occurs earlier than for the investment in structures: at a horizon of two quarters. The earlier effect for investment in equipment and software suggests that it takes less time to invest in equipment and software than in structures.

In Panel B of Table 6, we examine the predictive ability of low book-to-market residual variance. Recall that if low book-to-market residual variance relates to a smaller stock of unexercised growth options than high book-to-market residual variance, we should find smaller coefficients. The pattern in the coefficients is similar to the one documented for high book-to-market residual variance. That is, there is a negative impact on investment in structures in the first seven quarters. The effect becomes positive in the eleventh quarter. The positive effect on investment in equipment and software shows up three quarters in the future, but it is not significant.

Considering the eleven-quarter horizon, investment in structures, low book-to-market residual variance has an estimated coefficient approximately half the size of the estimated coefficient corresponding to high book-to-market residual variance: 0.003 and 0.005 . Similarly, considering the three-quarter horizon, investment in equipment and software, low book-to-market residual variance has an estimated coefficient one fifth the size of the coefficient reported for high book-to-market residual variance: 0.002 and 0.01. These findings suggest that low book-to-market residual variance is indeed related to a smaller stock of growth options than high book-to-market residual variance. Again, the evidence from the exercise using low residual variance confirms the economic intuition that investment in structures exhibits a longer time to build than the investment in equipment and software.

Table 7 shows the results from a repetition of the previous analysis where residual variance corresponds to the asset growth portfolios. Similarly to high book-to-market residual variance, low asset growth residual variance has a strong negative effect in the first seven quarters that switches to a positive effect at the eleven-quarter horizon: it takes a longer time to build structures. As for investment in equipment and software, the sign of the coefficients is economically significant in the sense that we see a positive effect earlier than for investment in structures, yet statistically not significant.

When we use high asset growth residual variance, a similar pattern emerges in the coefficients. However, the size of the coefficients is smaller than that of the coefficients reported for low asset growth residual variance confirming the intuition that high asset growth firms have already started to convert the growth options into assets in place such that they have a lower stock of unexercised growth options relative to low asset growth firms that have more growth options to be depleted.

Finally, in Table 8, we look at the predictive ability of gross profitability residual variance and reach two conclusions. First, high gross profitability residual variance has no additional information to that included in the lagged investment rates. The sign of the covariances with investment rates at the different horizons is identical to that documented for both book-to-market and asset growth residual variances, but not statistically significant.

Second, low gross profitability residual variance has a positive effect on investment in structures at the eleven-quarter horizon, statistically significant, whereas for the equipment and software component the positive effect appears earlier, at the second-quarter horizon, but not statistically significant.

Next, we investigate the relation between future corporate profits and the various measures of residual variance. We report the results in Table 9.

Panel A of Table 9 shows the extent of predictability attributed to high book-to-market residual variance when controlling for lagged cumulative profitability rates. Over all horizons, there is a strong positive covariance of future profitability rates with high residual variance and it increases monotonically. Considering the eleven-quarter horizon, note that the coefficient estimate is economically and statistically large similarly to the coefficient estimate documented for investment in structures. This finding is in line with the intuition that more profitable firms exploit first their investment opportunities such that times of high profitability coincide with times of high investment.

A similar interpretation carries over when using low book-to-market residual variance (Panel B of Table 9) with the mention that the size of coefficients is smaller, again, suggesting that low book-to-market residual variance relates to a smaller stock of unexercised growth options than high book-to-market residual variance. We reach similar conclusions when using instead of the book-to-market residual variance either asset growth or gross profitability residual variances.

The final predictability results relate to the forecasting power of residual variance for manufacturing hiring rates. Table 10 presents the results. As mentioned in the Introduction, Basu, Fernald, and Kimball (2006) show that following technological improvements, employment falls in the short run, but recovers in the year following the technology shocks. Thus, we expect first a negative covariance between hiring rates and the proxy for growth options in the short horizon, followed by a positive relation at longer horizons. Over the different measures of residual variance, the results show that residual variance predicts a decrease in future manufacturing hiring rates and in general the relation is statistically significant in the first two quarters.

The evidence that we have presented in this section suggests that residual variance relates to the stock of unexercised growth options that emerge upon arrival of embodied technological shocks. Moreover, we find stronger covariance of the aggregate quantities with high residual variance meaning that it relates to a larger stock of unexercised growth options: firms with high residual variance as part of total variance seem to have more unexercised growth options than firms with a lower residual variance as part of total variance.

6 The residual variance factor

In this section, we investigate whether sorting by residual variance as a fraction of total variance gives a spread in average returns. This is interesting because if stocks with a high ratio of residual variance have higher returns than stocks with a low ratio of residual variance, then a zero-investment portfolio that is long in high residual variance stocks and short in low residual variance stocks should earn a positive return. The procedure is as follows.

We first compute the ratio of residual variance as $1-\frac{var_{BC,jt}}{var_{jt}}$, where $var_{BC,jt}$ is stocks's j average variance related to business conditions and var_{jt} is stock's j average realized total variance. The average variance related to business conditions is computed as in equation 2: the product between the factor loadings and the prices of the CRR factors shown in Table 3. The factor loadings and average variances are estimated using a 60-month rolling window. We use all stocks traded on NYSE, AMEX, and Nasdaq during

July 1969 to December 2011. Each month t, we assign stocks to 5 portfolios based on the previous 60 month average ratio of residual variance. Panel A of Table 11 presents the average returns (equal-weighted) on these 5 residual variance portfolios along with the average return of the residual variance factor, the excess return on the high residual variance quintile over the low residual variance quintile. We see that the stocks with a high ratio of residual variance have higher returns than those stocks with a low ratio of residual variance. The difference is 0.22% per month and is statistically significant. The positive excess return on the high residual variance quintile over the low residual variance quintile suggests that residual variance is related to expected returns.

We next investigate whether the residual variance factor has predictive power for economic quantities. If high residual variance firms earn a higher return than low residual variance firms because they have a larger stock of growth options to be depleted, then, as the high residual variance firms start to exercise their growth options and undertake investment, both aggregate consumption and investment will respond. To this end, we estimate:

$$y_{t+h} = \iota_0 + \iota \times RV_t + \zeta_{t+h} \tag{7}$$

where y_{t+h} (h= 1 year, 4years, 5 years, 6 years, 12 years, 13 years, and 14 years) is the log consumption growth, dividend growth, investment in structures, or investment in equipment and software, and manufacturing hiring rates. We use annual data. RV is the residual variance factor.

The remaining panels of Table 11, that is, Panels B, C, D, E, and F show the results. In Panel B, we present the evidence on the ability of the residual variance factor to predict future consumption growth and find that there is a positive covariance between the residual variance factor and subsequent consumption growth, especially at longer horizons. This evidence is consistent with our economic intuition: if high residual variance firms have more unexercised growth options than those firms with low residual variance, then the residual variance factor, a proxy of the quantity of growth options, should forecast higher output as the economy has yet to absorb the gains from the technological improvement as suggested in the model of Gârleanu, Panageas, and Yu (2012). Similarly, the residual variance factor predicts future aggregate dividend growth at longer horizons.

Considering the future investment in structures and in equipment and software, the residual variance factor forecasts higher investment at horizons in excess of 4 years. The residual variance factor also predicts higher subsequent manufacturing hiring rates.

The evidence that most of the predictability concentrates at longer horizons adds more weight to the view that residual variance is a measure of the unexercised growth options that emerge upon arrival of embodied technological shocks.

2.7 Idiosyncratic variance versus residual variance

In this section, to substantiate the link between residual variance and the stock of unexercised growth options firms have, we repeat the predictability exercise from Section 5 using a measure of idiosyncratic variance relative to the CRR factor model for returns and given by the squared residuals. The purpose is not to run a horse race between the two measures: residual variance and idiosyncratic variance. Instead, following the literature that has related idiosyncratic variance to the growth opportunities firms have, we want to investigate the informational content of the two measures.

To calculate idiosyncratic variance we start with the CRR macroeconomic model for returns:

$$r_{it} = \alpha_i + \beta_{i,MP} MP_t + \beta_{i,UI} UI_t + \beta_{i,DEI} DEI_t + \beta_{i,UTS} UTS_t + \beta_{i,UPR} UPR_t + \epsilon_{it} \quad (8)$$

Here idiosyncratic variance is the square of the residuals ϵ_t. We simply sum the monthly numbers to build the quarterly time-series of idiosyncratic variance.

To provide evidence for the role the two measures of variance play, that is, idiosyncratic variance and residual variance, we use the following procedure.[3] First, we estimate equation 6 to remove any predictability of the economic variable related to its own lag and residual variance. Second, we take the residuals ξ_{it+q} and regress them on lagged idiosyn-

[3]The correlations between the measures of idiosyncratic variance and residual variance are as follows: high book-to-market, 0.11; low book-to-market, 0.35; low asset growth, 0.32; high asset growth, 0.43; high profitability, 0.31; and low profitability, 0.28.

cratic variance, $ivar_{it}$, where i depicts the various portfolios, to investigate whether it has additional predictability after removing the predictive part in the economic variable attributed to residual variance. To this end we specify:

$$\xi_{it+q} = \alpha_0 + \alpha_i ivar_{it} + \eta_{it+q} \tag{9}$$

We repeat the exercise by switching the roles of residual variance and idiosyncratic variance. That is, we start by estimating equation 6 and we use idiosyncratic variance instead of residual variance. Next, we take the residuals and regress them on lagged residual variance.

Table 12 shows the results for residual variance and idiosyncratic variance corresponding to high book-to-market and low book-to-market portfolios. In Panel A1 of Table 12, we see that, after removing the predictable part in investment in structures attributed to residual variance, idiosyncratic variance has a strong positive effect over all horizons. When we remove the predictive part attributed to idiosyncratic variance from investment in structures, the pattern emerging in the coefficients is identical to that documented in Table 6. This finding tells us that the information contained in the measures of idiosyncratic variance and residual variance is different.

Considering investment in equipment and software, both high book-to-market and low book-to-market idiosyncratic variance have no additional predictive power, whereas residual variance keeps its predictive ability uncovered in Table 6.

In Table 13, we compare the predictive ability of asset growth residual variance and idiosyncratic variance for investment in structures and equipment and software. Several features bear noting. First, removing the predictable part in the future investment, structures, and equipment and software, attributed to idiosyncratic variance, both low and high asset growth residual variances give coefficients that match the magnitude and sign of those documented in Table 7. Second, idiosyncratic variance, both low and high asset growth, is positively related to future investment in structures up to seven quarters in the future, but negatively related eleven quarters hence. Third, we uncover no predictive power for investment in equipment and software of either idiosyncratic variance or residual variance. Finally, low profitability idiosyncratic variance (Panel B2 of Table 14) predicts positive investment in equipment and structures in the first quarter and negative second quarter hence.

In general, in the first quarters, we uncover a positive relation between idiosyncratic variance and subsequent investment. Earlier research has linked idiosyncratic variance to uncertainty about profitability and volatility of profitability measured as return on equity (Pastor and Veronesi, 2003; Wei and Zhang, 2006). If idiosyncratic variance proxies for news about profitability and we know that high profitability means higher investment, then we should see positive coefficients.

In Table 15, we report the coefficients from the regressions of future profits on idiosyncratic variance and residual variance. Low asset growth and high profitability idiosyncratic variance covary negatively with future profits. Wei and Zhang (2006) document that profitability and its variance are negatively related so our results are consistent with their intuition. That is, if idiosyncratic variance relates to the variance of future profitability: a larger uncertainty around profitability has a negative effect on its level. After removing the predictability attributed to idiosyncratic variance from future profit rates, the different measures of residual variance retain their predictive ability that we have previously documented (Table 9).

Regarding the predictability of future manufacturing hiring rates, the evidence shown in Table 16 tells us that the different measures of residual variance are negatively related to future hiring rates after removing the effect of idiosyncratic variance. It is worth mentioning that both low asset growth and high asset growth idiosyncratic variance are positively related to future hiring rates up to two quarters in the future. Again, if idiosyncratic variance is informative of the level of firm future profitability, the positive coefficients tell us that higher profitability means higher hiring rates in the future.

The bulk of evidence we have presented in this section has two implications. First, idiosyncratic variance seems to be related to the level and volatility of firm future profitability. Second, controlling for the explanatory power of idiosyncratic variance, residual variance retains its economic and statistical power lending support to our interpretation that it proxies for the stock of unexercised growth options that emerge upon arrival of embodied technological shocks.

2.8 Conclusion

This paper sheds some light on the puzzling fact in the data: stocks with high expected returns have lower variance than stocks with low expected returns. We show that when we remove from total variance the variance related to business conditions as summarized by the Chen, Roll, and Ross (1986) macroeconomic factors firms with high expected returns actually have more residual variance as a fraction of total variance.

We provide evidence that residual variance is informative of the stock of unexercised growth options that emerge upon arrival of embodied technological shocks. This evidence is in line with the predictions of both the q-theory of investment and of real option models. That is, high investment firms have less residual variance as a fraction of total variance consistent with these firms having exercised the growth options. High profitability firms have more residual variance consistent with these firms possessing more growth options to be depleted. We also find that low book-to-market firms have already converted most of their growth options, whereas high book-to-market firms have more unexercised growth options as suggested by their higher fraction of residual variance.

Residual variance is a predictor of future economic variables. As in the model of Gârleanu, Panageas, and Yu (2012), if growth options have a life cycle, then as firms start to invest and exercise their growth options, aggregate quantities will respond only following the new investment. Moreover, a sort on the ratio of residual variance gives a spread in average returns and a residual variance factor has a positive covariance with subsequent output, investment growth, and manufacturing hiring rates.

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Figure 1: Investment rates in the years following portfolio formation: portfolios formed on book-to-market ratio

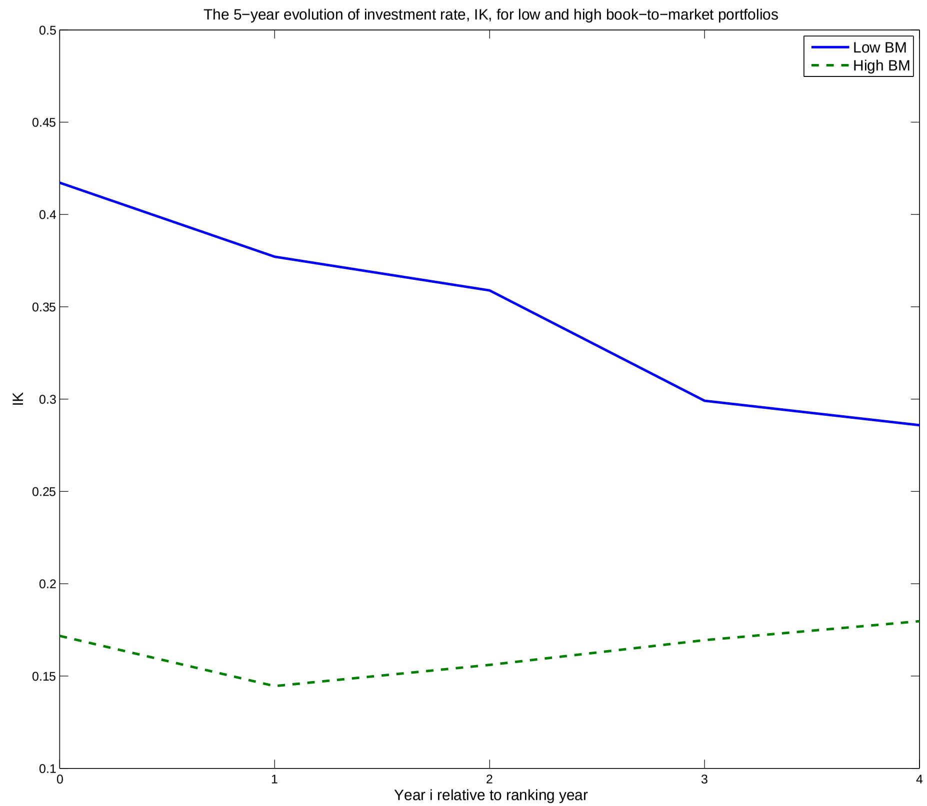

Figure 2: Investment rates in the years following portfolio formation: portfolios formed on asset growth

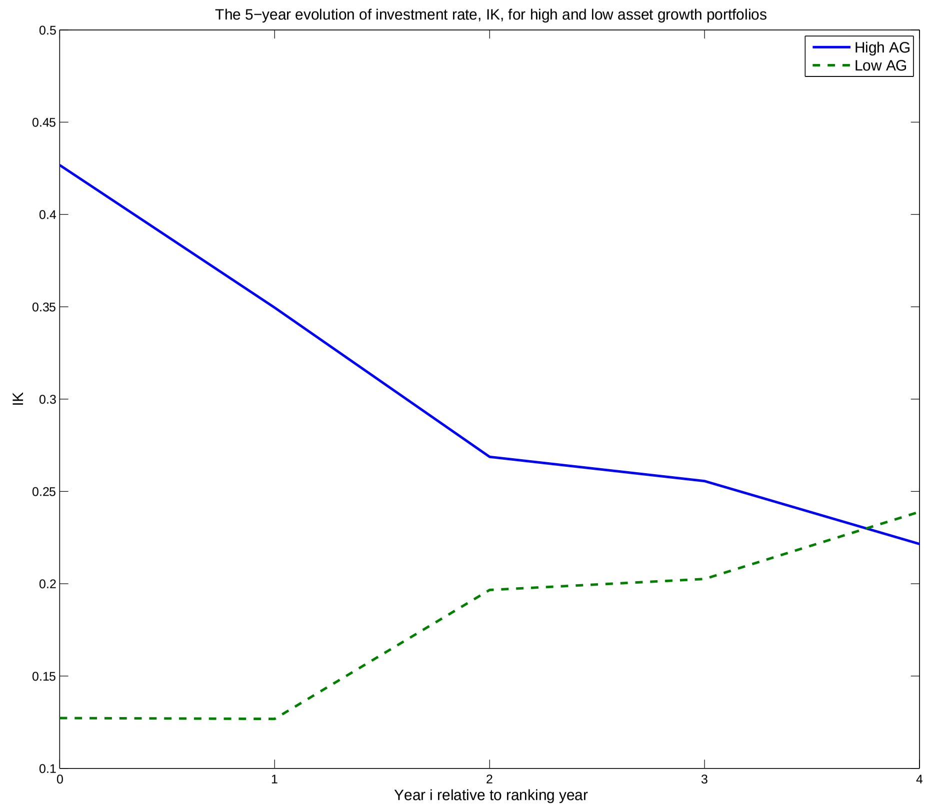

Figure 3: Investment rates in the years following portfolio formation: portfolios formed on gross profits-to-assets and book-to-market

P1 refers to the portfolio with the lowest profitability, and P5 includes the most profitable firms. Similarly, B1 includes firms with the lowest book-to-market ratio and B5 the highest.

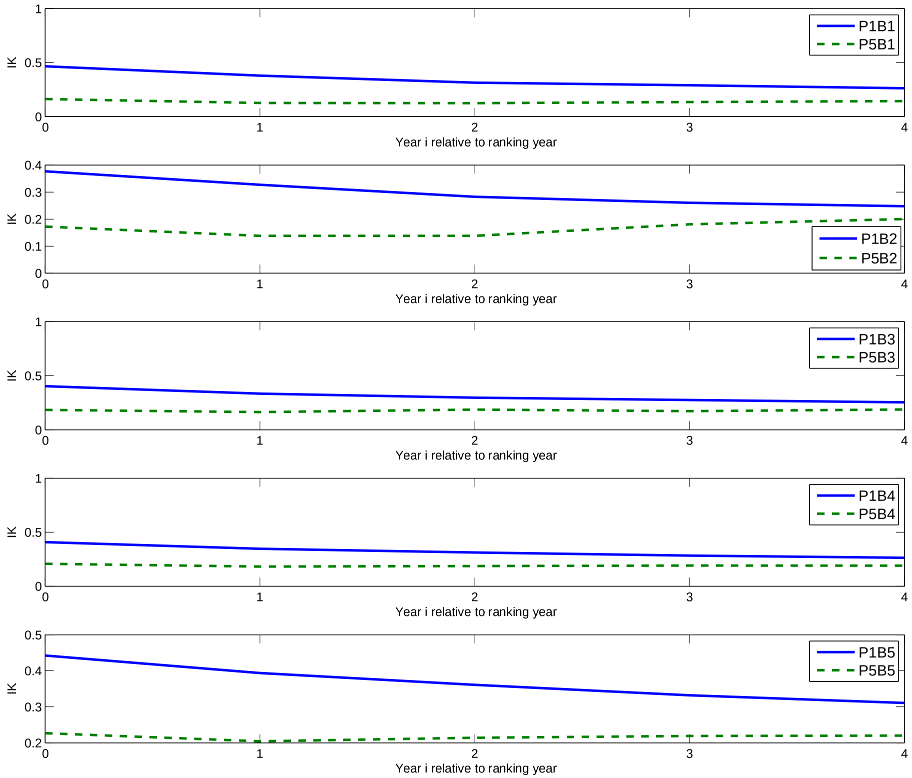

Table 1: Summary statistics and variance loadings for portfolio returns

Panels A, B, and C present average raw returns, variances, and loadings from monthly regressions of portfolio returns on portfolio variances. The portfolios are formed on book-to-market, asset growth, and gross profitability. Rows 1 and 2 present average returns and variances. We construct monthly variances as the sum of squared daily returns. Row 3 shows the loadings with respect to portfolio variances, whereas row 4 reports the Newey and West (1987) corrected t-statistics in parentheses. Data are monthly from July 1964 to December 2011.

Panel A: Book-to-market portfolios: Equal-weighted

Decile	Low	2	3	4	5	6	7	8	9	High
$\overline{r}$	0.67	0.94	1.10	1.33	1.27	1.32	1.42	1.57	1.67	1.74
$\overline{var}$	29.30	24.05	21.50	19.57	18.15	17.35	15.93	15.51	14.90	16.84
$\beta_{variance}$	-0.039	-0.045	-0.042	-0.018	-0.048	-0.041	-0.047	-0.041	-0.048	-0.041
	(-3.58)	(-4.69)	(-4.10)	(-0.85)	(-3.82)	(-2.73)	(-3.44)	(-1.96)	(-2.17)	(-3.10)

Panel B: Asset growth portfolios: Equal-weighted

Decile	Low	2	3	4	5	6	7	8	9	High
$\overline{r}$	1.75	1.50	1.44	1.38	1.34	1.25	1.28	1.19	1.11	0.60
$\overline{var}$	20.97	17.25	16.02	15.64	15.72	15.95	17.67	19.04	22.29	28.40
$\beta_{variance}$	-0.023	-0.043	-0.040	-0.042	-0.041	-0.045	-0.040	-0.044	-0.042	-0.040
	(-1.20)	(-2.36)	(-2.23)	(-2.96)	(-3.14)	(-3.65)	(-3.19)	(-4.16)	(-4.30)	(-4.46)

Panel C: Gross profitability portfolios: Equal-weighted

Decile	Low	2	3	4	5	6	7	8	9	High
$\overline{r}$	0.81	1.05	1.18	1.14	1.16	1.28	1.28	1.33	1.43	1.56
$\overline{var}$	21.66	19.56	23.12	26.12	24.65	25.69	27.07	26.83	24.21	23.89
$\beta_{variance}$	-0.042	-0.042	-0.018	-0.035	-0.036	-0.038	-0.040	-0.046	-0.048	-0.050
	(-5.94)	(-6.57)	(-1.04)	(-5.27)	(-7.63)	(-6.83)	(-7.31)	(-7.47)	(-5.56)	(-9.04)

Table 2: Macroeconomic exposure for variances of portfolios formed on book-to-market, asset growth, and gross profitability: July 1964-December 2011, 570 months

Panels A, B, and C report the loadings on the mimicking portfolios of the five Chen, Roll, and Ross (1986) (CRR) factors for 10 portfolios formed on book-to-market, asset growth, and gross profitability. The loadings are estimated from regressions of monthly portfolio returns on the five mimicking portfolios for the CRR factors, that is: growth rate of industrial production MP, unexpected inflation UI, the change in expected inflation DEI, the term spread UTS, and the default spread UPR. The table also reports the corresponding Newey and West (1987) corrected t-statistics (in parentheses).

Panel A: Book-to-market portfolios: Equal-weighted

Decile	Low	2	3	4	5	6	7	8	9	High
β_{MP}	-2.24	-1.89	-1.65	-1.51	-1.34	-1.33	-1.22	-1.07	-0.99	-0.95
	(-3.84)	(-3.55)	(-3.20)	(-3.24)	(-3.04)	(-2.78)	(-2.81)	(-2.56)	(-2.35)	(-2.01)
β_{UI}	6.51	5.88	6.55	5.80	5.59	5.87	5.21	5.42	5.45	5.31
	(2.10)	(2.18)	(2.34)	(2.27)	(2.22)	(2.12)	(2.06)	(2.02)	(2.05)	(1.99)
β_{DEI}	10.28	9.73	9.83	8.31	7.67	7.50	6.76	5.52	5.33	7.05
	(2.53)	(2.38)	(2.29)	(2.28)	(2.19)	(2.03)	(1.99)	(1.77)	(1.67)	(1.55)
β_{UTS}	-2.11	-2.08	-2.09	-1.79	-1.71	-1.69	-1.52	-1.40	-1.43	-1.73
	(-2.37)	(-2.36)	(-2.37)	(-2.38)	(-2.30)	(-2.15)	(-2.08)	(-2.02)	(-1.97)	(-1.77)
β_{UPR}	-1.93	-1.85	-1.45	-1.20	-1.12	-0.86	-0.80	-0.45	-0.55	-1.14
	(-1.29)	(-1.24)	(-0.98)	(-0.91)	(-0.86)	(-0.62)	(-0.63)	(-0.38)	(-0.45)	(-0.76)

Panel B: Asset growth portfolios: Equal-weighted

Decile	Low	2	3	4	5	6	7	8	9	High
β_{MP}	-1.11	-1.23	-1.23	-1.19	-1.24	-1.24	-1.43	-1.52	-1.83	-2.10
	(-2.27)	(-2.69)	(-2.63)	(-2.75)	(-2.81)	(-2.90)	(-2.88)	(-3.05)	(-3.21)	(-3.62)
β_{UI}	4.87	5.81	5.69	5.45	5.34	5.18	5.70	5.93	7.06	7.35
	(2.42)	(2.08)	(1.97)	(2.11)	(2.10)	(2.12)	(2.02)	(2.15)	(2.30)	(2.34)
β_{DEI}	4.34	6.78	6.56	7.03	7.32	7.29	7.89	8.97	10.05	11.16
	(1.51)	(1.95)	(1.86)	(1.98)	(1.99)	(2.08)	(1.95)	(2.16)	(2.19)	(2.39)
β_{UTS}	-1.08	-1.51	-1.54	-1.59	-1.64	-1.64	-1.84	-1.98	-2.32	-2.44
	(-1.68)	(-2.02)	(-2.06)	(-2.15)	(-2.15)	(-2.24)	(-2.15)	(-2.24)	(-2.36)	(-2.37)
β_{UPR}	-0.60	-0.48	-0.53	-0.73	-0.87	-1.02	-1.14	-1.47	-1.69	-2.15
	(-0.60)	(-0.38)	(-0.42)	(-0.61)	(-0.69)	(-0.82)	(-0.82)	(-0.98)	(-0.99)	(-1.19)

Panel C: Gross profitability portfolios: Equal-weighted

Decile	Low	2	3	4	5	6	7	8	9	High
β_{MP}	-1.33	-1.33	-1.57	-1.76	-1.24	-1.37	-1.39	-1.24	-1.03	-1.05
	(-2.76)	(-2.64)	(-2.51)	(-2.60)	(-2.21)	(-2.36)	(-2.81)	(-2.72)	(-2.78)	(-2.48)
β_{UI}	3.55	4.57	5.80	6.18	4.81	4.25	3.20	1.95	2.05	1.70
	(1.52)	(1.83)	(1.65)	(1.80)	(1.64)	(1.60)	(1.27)	(0.83)	(1.03)	(0.84)
β_{DEI}	7.94	7.96	9.71	11.77	9.08	7.96	7.85	5.33	4.34	4.35
	(1.80)	(1.80)	(1.70)	(1.80)	(1.65)	(1.55)	(1.68)	(1.33)	(1.38)	(1.21)
β_{UTS}	-1.48	-1.73	-2.22	-2.52	-2.14	-1.82	-1.63	-1.14	-1.04	-1.18
	(-1.61)	(-1.94)	(-1.77)	(-1.84)	(-1.89)	(-1.69)	(-1.70)	(-1.49)	(-1.70)	(-1.72)
β_{UPR}	-2.07	-1.73	-1.86	-2.45	-2.68	-2.44	-2.71	-2.37	-2.02	-2.49
	(-1.38)	(-1.24)	(-0.94)	(-1.14)	(-1.33)	(-1.37)	(-1.63)	(-1.86)	(-1.74)	(-1.95)

Table 3: Prices of the CRR factors from two-stage Fama and MacBeth (1973) cross-sectional regressions of variances: July 1964-December 2011, 570 months

We estimate the prices of the five Chen, Roll, and Ross factors, that is: industrial production (MP), unexpected inflation (UI), change in expected inflation (DEI), term spread (UTS), and default spread (UPR), from the two-stage Fama and MacBeth (1973) cross-sectional regressions. In the first stage we estimate factor loadings. We use the following testing portfolios for variances: ten equal-weighted book-to-market portfolios, ten equal-weighted asset growth portfolios, and ten equal-weighted gross profitability portfolios. We report results from the second stage cross-sectional regressions, including intercept (Γ_0), prices of the factors (Γ), and average cross-sectional $\bar{R}^2$s. The Shanken (1992) corrected t-statistics are reported in parentheses.

$\hat{\Gamma}_0$	$\hat{\Gamma}_{MP}$	$\hat{\Gamma}_{UI}$	$\hat{\Gamma}_{DEI}$	$\hat{\Gamma}_{UTS}$	$\hat{\Gamma}_{UPR}$	$\bar{R}^2$
5.22	-5.66	3.65	-0.79	11.35	-9.89	0.67
(2.38)	(-1.91)	(2.72)	(-1.11)	(1.75)	(-3.83)	

Table 4: Decomposition of total variances: book-to-market and asset growth portfolios

We regress variances on the five mimicking portfolios for the CRR factors, that is: growth rate of industrial production MP, unexpected inflation UI, the change in expected inflation DEI, the term spread UTS, and the default spread UPR:

$$var_{it} = a + b_{i,MP}MP_t + b_{i,UI}UI_t + b_{i,DEI}DEI_t + b_{i,UTS}UTS_t + b_{i,UPR}UPR_t + e_t \tag{10}$$

Variance related to business conditions, $var_{i,BC}$, is given by:

$$var_{BC,i} = \hat{b}_{i,MP}\hat{\Gamma}_{MP} + \hat{b}_{i,UI}\hat{\Gamma}_{UI} + \hat{b}_{DEI}\hat{\Gamma}_{i,DEI} + \hat{b}_{i,UTS}\hat{\Gamma}_{UTS} + \hat{b}_{i,UPR}\hat{\Gamma}_{UPR} \tag{11}$$

where i depicts the various portfolios, the $\hat{b}$s are the variance factor loadings, and the $\hat{\Gamma}$s are the prices of the CRR factors from the Fama and MacBeth cross-sectional regressions. Total average variance is decomposed into:

$$\overline{var_i} = var_{BC,i} + var_{residual,i} \tag{12}$$

and the ratio of each of the components relative to total variance is computed as $\frac{var_{BC,i}}{var_i}$ and $1 - \frac{var_{BC,i}}{var_i}$.

Panel A: Book-to-market portfolios, Equal-weighted

Decile	Low	2	3	4	5	6	7	8	9	High
$\overline{var}$	29.30	24.05	21.50	19.57	18.15	17.35	15.93	15.51	14.90	16.84
var_{BC}	23.45	19.20	16.09	14.70	13.50	12.38	11.23	10.13	10.53	10.85
$\frac{var_{BC}}{var}$	0.80	0.80	0.75	0.75	0.74	0.71	0.70	0.65	0.71	0.64
$1 - \frac{var_{BC}}{var}$	0.20	0.20	0.25	0.25	0.26	0.29	0.30	0.35	0.29	0.36

Panel B: Asset growth portfolios, Equal-weighted

Decile	Low	2	3	4	5	6	7	8	9	High
$\overline{var}$	20.97	17.25	16.02	15.64	15.72	15.95	17.67	19.04	22.29	28.40
var_{BC}	14.28	10.46	10.30	10.33	10.67	11.66	12.99	15.17	18.54	23.58
$\frac{var_{BC}}{var}$	0.68	0.61	0.64	0.66	0.68	0.73	0.74	0.80	0.83	0.83
$1 - \frac{var_{BC}}{var}$	0.32	0.39	0.36	0.34	0.32	0.27	0.26	0.20	0.17	0.17

Table 5: The decomposition of total variances: portfolios double-sorted on book-to-market and gross profitability

We regress variances on the five mimicking portfolios for the CRR factors, that is: growth rate of industrial production MP, unexpected inflation UI, the change in expected inflation DEI, the term spread UTS, and the default spread UPR:

$$var_{it} = a + b_{i,MP}MP_t + b_{i,UI}UI_t + b_{i,DEI}DEI_t + b_{i,UTS}UTS_t + b_{i,UPR}UPR_t + e_t \quad (13)$$

Variance related to business conditions, $var_{i,BC}$, is given by:

$$var_{BC,i} = \hat{b}_{i,MP}\hat{\Gamma}_{MP} + \hat{b}_{i,UI}\hat{\Gamma}_{UI} + \hat{b}_{DEI}\hat{\Gamma}_{i,DEI} + \hat{b}_{i,UTS}\hat{\Gamma}_{UTS} + \hat{b}_{i,UPR}\hat{\Gamma}_{UPR} \quad (14)$$

where i depicts the various portfolios, the $\hat{b}$s are the variance factor loadings, and the $\hat{\Gamma}$s are the prices of the CRR factors from the Fama and MacBeth cross-sectional regressions. Total average variance is decomposed into:

$$\overline{var_i} = var_{BC,i} + var_{residual,i} \quad (15)$$

and the ratio of each of the components relative to total variance is computed as $\frac{var_{BC,i}}{\overline{var_i}}$ and $1 - \frac{var_{BC,i}}{\overline{var_i}}$. P1 refers to the portfolio with the lowest profitability, and P5 includes the most profitable firms. Similarly, B1 includes firms with the lowest book-to-market ratio and B5 the highest.

	Gross profitability				
	P1B1	**P2B1**	**P3B1**	**P4B1**	**P5B1**
$\overline{var}$	35.62	24.48	17.89	15.10	17.92
var_{BC}	28.18	17.85	11.39	8.62	10.01
$\frac{var_{BC}}{\overline{var}}$	0.79	0.73	0.64	0.57	0.56
$1 - \frac{var_{BC}}{\overline{var}}$	0.21	0.27	0.36	0.43	0.44
	P1B2	**P2B2**	**P3B2**	**P4B2**	**P5B2**
$\overline{var}$	33.61	26.84	23.48	20.41	17.96
var_{BC}	23.11	17.02	13.77	12.27	11.30
$\frac{var_{BC}}{\overline{var}}$	0.69	0.63	0.59	0.60	0.63
$1 - \frac{var_{BC}}{\overline{var}}$	0.31	0.37	0.41	0.40	0.37
	P1B3	**P2B3**	**P3B3**	**P4B3**	**P5B3**
$\overline{var}$	30.53	24.38	21.17	19.29	18.34
var_{BC}	23.05	17.30	13.88	12.23	11.89
$\frac{var_{BC}}{\overline{var}}$	0.75	0.71	0.66	0.63	0.65
$1 - \frac{var_{BC}}{\overline{var}}$	0.25	0.29	0.34	0.37	0.35
	P1B4	**P2B4**	**P3B4**	**P4B4**	**P5B4**
$\overline{var}$	28.39	21.74	19.74	17.66	16.62
var_{BC}	19.76	14.75	14.13	12.04	10.82
$\frac{var_{BC}}{\overline{var}}$	0.70	0.68	0.72	0.68	0.65
$1 - \frac{var_{BC}}{\overline{var}}$	0.30	0.32	0.28	0.32	0.35
	P1B5	**P2B5**	**P3B5**	**P4B5**	**P5B5**
$\overline{var}$	23.51	18.39	17.66	16.77	15.50
var_{BC}	18.20	13.16	10.72	9.41	7.58
$\frac{var_{BC}}{\overline{var}}$	0.77	0.72	0.61	0.56	0.49
$1 - \frac{var_{BC}}{\overline{var}}$	0.23	0.28	0.39	0.44	0.51

Table 6: Future investment growth and book-to-market residual variance

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future investment rates and its components, structures, and equipment and software, on lagged residual variance and lagged investment rates:

$$x_{t+q} = \alpha_i + \delta_i rvar_{it} + \phi_i x_t + \xi_{it+q} \tag{16}$$

The horizon, q, is 1, 2, 3, 5, 7, 11, and 15 quarters in the future. To compute residual variance we subtract variance related to business conditions from total variance, where variance related to business conditions is given by:

$$var_{BC,it} = \hat{b}_{i,MP} MP_t + \hat{b}_{i,UI} UI_t + \hat{b}_{i,DEI} DEI_t + \hat{b}_{i,UTS} UTS_t + \hat{b}_{i,UPR} UPR_t \tag{17}$$

In Panel A, we use high book-to-market residual variance, whereas, in Panel B, we use low book-to-market residual variance. Data are sampled quarterly from third quarter 1964 to fourth quarter 2011. We sum monthly residual variance to obtain the quarterly time-series.

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A: High book-to-market residual variance							
Structures							
δ	-0.013	-0.014	-0.011	-0.005	-0.002	0.005	0.007
	(-8.77)	(-5.36)	(-4.59)	(-1.85)	(-0.84)	(4.70)	(0.52)
ϕ	0.55	0.35	0.17	-0.06	-0.25	-0.32	-0.28
	(6.39)	(4.75)	(1.33)	(-0.36)	(-1.57)	(-1.86)	(-1.54)
$\bar{R}^2$	0.57	0.40	0.19	0.03	0.05	0.09	0.04
Equipment and software							
δ	-0.004	0.006	0.010	0.009	0.008	0.003	0.008
	(-1.33)	(2.45)	(3.66)	(1.85)	(2.18)	(0.92)	(0.63)
ϕ	0.58	0.56	0.48	0.17	-0.02	-0.26	-0.27
	(6.26)	(5.02)	(5.43)	(1.27)	(-0.14)	(-1.80)	(-2.03)
$\bar{R}^2$	0.41	0.23	0.15	0.03	0.04	0.09	0.04
Panel B: Low book-to-market residual variance							
Structures							
δ	-0.008	-0.009	-0.008	-0.004	-0.002	0.003	0.003
	(-2.23)	(-2.27)	(-3.18)	(-2.54)	(-1.23)	(3.03)	(1.03)
ϕ	0.60	0.40	0.20	-0.05	-0.24	-0.33	-0.26
	(6.46)	(6.46)	(1.95)	(-0.31)	(-1.72)	(-2.06)	(-1.68)
$\bar{R}^2$	0.51	0.33	0.17	0.02	0.05	0.08	0.04
Equipment and software							
δ	-0.005	-0.001	0.002	0.001	0.001	0.001	0.003
	(-2.23)	(-0.11)	(0.36)	(0.23)	(0.23)	(0.67)	(1.22)
ϕ	0.57	0.46	0.37	0.06	-0.12	-0.29	-0.26
	(5.58)	(3.17)	(2.83)	(0.43)	(-0.92)	(-2.30)	(-2.01)
$\bar{R}^2$	0.42	0.21	0.11	0.00	0.02	0.08	0.04

Table 7: Future investment growth and asset growth residual variance

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future investment rates and its components, structures and equipment and software, on lagged residual variance and lagged investment rates:

$$x_{t+q} = \alpha_i + \delta_i rvar_{it} + \phi_i x_t + \xi_{it+q} \quad (18)$$

The horizon, q, is 1, 2, 3, 5, 7, 11, and 15 quarters in the future. To compute residual variance we subtract variance related to business conditions from total variance, where variance related to business conditions is given by:

$$var_{BC,it} = \hat{b}_{i,MP}MP_t + \hat{b}_{i,UI}UI_t + \hat{b}_{i,DEI}DEI_t + \hat{b}_{i,UTS}UTS_t + \hat{b}_{i,UPR}UPR_t \quad (19)$$

In Panel A, we use low asset growth residual variance, whereas, in Panel B, we use high asset growth residual variance. Data are sampled quarterly from third quarter 1964 to fourth quarter 2011. We sum monthly residual variance to obtain the quarterly time-series.

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A: Low asset growth residual variance							
Structures							
δ	-0.011	-0.012	-0.011	-0.003	-0.002	0.005	0.005
	(-2.18)	(-1.92)	(-2.47)	(-0.93)	(-0.70)	(3.88)	(0.72)
ϕ	0.58	0.39	0.19	-0.03	-0.24	-0.32	-0.27
	(6.66)	(5.67)	(1.62)	(-0.21)	(-1.61)	(-2.08)	(-1.61)
$\bar{R}^2$	0.51	0.31	0.15	0.01	0.05	0.09	0.04
Equipment and software							
δ	-0.003	0.005	0.008	0.005	0.005	0.001	0.003
	(-1.07)	(0.77)	(0.97)	(0.52)	(0.85)	(0.43)	(0.72)
ϕ	0.61	0.51	0.40	0.09	-0.09	-0.29	-0.28
	(6.44)	(3.95)	(3.44)	(0.61)	(-0.70)	(-2.46)	(-1.96)
$\bar{R}^2$	0.41	0.22	0.13	0.01	0.02	0.08	0.04
Panel B: High asset growth residual variance							
Structures							
δ	-0.009	-0.010	-0.008	-0.004	-0.001	0.003	0.002
	(-3.66)	(-2.99)	(-3.55)	(-2.21)	(-1.02)	(3.57)	(0.39)
ϕ	0.56	0.37	0.18	-0.06	-0.24	-0.32	-0.26
	(6.33)	(5.54)	(1.57)	(-0.35)	(-1.67)	(-1.95)	(-1.71)
$\bar{R}^2$	0.544	0.364	0.180	0.023	0.049	0.085	0.031
Equipment and software							
δ	-0.004	0.002	0.005	0.004	0.003	0.002	0.002
	(-1.77)	(0.48)	(1.14)	(0.99)	(1.24)	(0.84)	(0.60)
ϕ	0.567	0.508	0.430	0.123	-0.068	-0.278	-0.264
	(5.55)	(3.48)	(3.47)	(0.93)	(-0.55)	(-2.10)	(-2.12)
$\bar{R}^2$	0.54	0.36	0.18	0.02	0.05	0.09	0.03

Table 8: Future investment growth and gross profitability residual variance

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future investment rates and its components, structures and equipment and software, on lagged residual variance and lagged investment rates:

$$x_{t+q} = \alpha_i + \delta_i rvar_{it} + \phi_i x_t + \xi_{it+q} \tag{20}$$

The horizon, q, is 1, 2, 3, 5, 7, 11, and 15 quarters in the future. To compute residual variance we subtract variance related to business conditions from total variance, where variance related to business conditions is given by:

$$var_{BC,it} = \hat{b}_{i,MP} MP_t + \hat{b}_{i,UI} UI_t + \hat{b}_{i,DEI} DEI_t + \hat{b}_{i,UTS} UTS_t + \hat{b}_{i,UPR} UPR_t \tag{21}$$

In Panel A, we use high profitability residual variance, whereas, in Panel B, we use low profitability residual variance. Data are sampled quarterly from third quarter 1964 to fourth quarter 2011. We sum monthly residual variance to obtain the quarterly time-series.

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A: High profitability residual variance							
Structures							
δ	-0.010	-0.011	-0.009	-0.004	-0.002	0.003	-0.000
	(-2.00)	(-1.65)	(-1.85)	(-1.09)	(-0.93)	(1.17)	(-0.06)
ϕ	0.61	0.42	0.23	-0.03	-0.24	-0.34	-0.27
	(6.15)	(6.72)	(2.33)	(-0.22)	(-1.70)	(-2.16)	(-1.71)
$\bar{R}^2$	0.50	0.31	0.14	0.01	0.05	0.08	0.03
Equipment and software							
δ	-0.003	0.002	0.005	0.004	0.005	0.001	-0.001
	(-0.79)	(1.02)	(1.54)	(0.90)	(1.64)	(0.29)	(-0.21)
ϕ	0.61	0.49	0.38	0.07	-0.09	-0.30	-0.28
	(6.36)	(4.28)	(3.95)	(0.63)	(-0.84)	(-2.63)	(-1.99)
$\bar{R}^2$	0.41	0.22	0.12	0.01	0.03	0.08	0.04
Panel B: Low profitability residual variance							
Structures							
δ	-0.008	-0.009	-0.008	-0.003	-0.001	0.004	0.004
	(-2.47)	(-1.91)	(-2.50)	(-1.50)	(-0.63)	(3.17)	(0.69)
ϕ	0.60	0.41	0.21	-0.04	-0.23	-0.33	-0.26
	(5.99)	(6.25)	(2.06)	(-0.24)	(-1.64)	(-2.03)	(-1.73)
$\bar{R}^2$	0.51	0.31	0.14	0.01	0.05	0.09	0.04
Equipment and software							
δ	-0.004	0.003	0.006	0.004	0.005	0.003	0.003
	(-1.25)	(0.74)	(1.52)	(0.85)	(1.34)	(1.30)	(0.72)
ϕ	0.60	0.50	0.41	0.09	-0.07	-0.27	-0.27
	(6.24)	(3.95)	(3.80)	(0.73)	(-0.57)	(-2.19)	(-2.06)
$\bar{R}^2$	0.41	0.22	0.13	0.01	0.03	0.09	0.04

Table 9: Future aggregate cumulative corporate profits and residual variance

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future cumulative profit rates on lagged residual variance and lagged profit rates.

$$x_{t+q} = \alpha_i + \delta_i rvar_{it} + \phi_i x_t + \xi_{it+q} \tag{22}$$

The horizon, q, is 1, 2, 3, 5, 7, 11, and 15 quarters in the future. To compute residual variance we subtract variance related to business conditions from total variance, where variance related to business conditions is given by:

$$var_{BC,it} = \hat{b}_{i,MP} MP_t + \hat{b}_{i,UI} UI_t + \hat{b}_{i,DEI} DEI_t + \hat{b}_{i,UTS} UTS_t + \hat{b}_{i,UPR} UPR_t \tag{23}$$

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A: High book-to-market residual variance							
δ	0.017	0.027	0.039	0.052	0.057	0.060	0.107
	5.976	6.745	7.548	10.285	10.354	5.236	1.690
ϕ	0.126	0.251	0.407	0.278	0.293	0.227	-0.317
	1.857	2.462	3.210	1.594	1.760	1.018	-1.491
$\bar{R}^2$	0.082	0.105	0.141	0.118	0.102	0.068	0.037
Panel B: Low book-to-market residual variance							
δ	0.008	0.013	0.022	0.030	0.036	0.049	0.063
	1.384	1.303	1.500	1.741	2.009	3.450	2.588
ϕ	0.100	0.205	0.358	0.221	0.248	0.209	-0.239
	1.145	1.939	2.859	1.350	1.570	0.982	-0.992
$\bar{R}^2$	0.033	0.042	0.077	0.063	0.065	0.077	0.075
Panel C: Low asset growth residual variance							
δ	0.014	0.009	0.034	0.047	0.053	0.065	0.071
	1.887	1.568	1.837	1.985	1.991	2.843	1.902
ϕ	0.093	0.103	0.334	0.182	0.193	0.129	-0.322
	1.043	1.461	2.780	1.187	1.340	0.645	-1.386
$\bar{R}^2$	0.044	0.021	0.087	0.070	0.064	0.058	0.038
Panel D: High asset growth residual variance							
δ	0.011	0.017	0.026	0.035	0.040	0.050	0.064
	2.267	2.368	2.609	2.894	3.126	4.007	1.709
ϕ	0.114	0.229	0.387	0.255	0.280	0.238	-0.266
	1.421	2.218	3.078	1.477	1.653	1.016	-1.107
$\bar{R}^2$	0.055	0.069	0.110	0.090	0.087	0.080	0.063
Panel E: High profitability residual variance							
δ	0.012	0.021	0.033	0.045	0.048	0.056	0.046
	1.677	1.971	1.910	1.811	1.555	1.609	0.967
ϕ	0.111	0.230	0.387	0.256	0.265	0.187	-0.302
	1.289	2.136	2.892	1.440	1.384	0.746	-1.404
$\bar{R}^2$	0.041	0.061	0.096	0.077	0.064	0.055	0.030
Panel F: Low profitability residual variance							
δ	0.013	0.020	0.029	0.041	0.045	0.051	0.064
	2.521	2.549	2.369	2.721	2.630	2.782	1.490
ϕ	0.125	0.242	0.397	0.272	0.292	0.234	-0.297
	1.660	2.280	3.060	1.514	1.579	0.885	-1.263
$\bar{R}^2$	0.066	0.077	0.107	0.092	0.083	0.066	0.056

Table 10: Future aggregate manufacturing hiring rates and residual variance

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future manufacturing hiring rates on lagged residual variance and lagged manufacturing hiring rates.

$$x_{t+q} = \alpha_i + \delta_i rvar_{it} + \phi_i x_t + \xi_{it+q} \tag{24}$$

The horizon, q, is 1, 2, 3, 5, 7, 11, and 15 quarters in the future. To compute residual variance we subtract variance related to business conditions from total variance, where variance related to business conditions is given by:

$$var_{BC,it} = \hat{b}_{i,MP} MP_t + \hat{b}_{i,UI} UI_t + \hat{b}_{i,DEI} DEI_t + \hat{b}_{i,UTS} UTS_t + \hat{b}_{i,UPR} UPR_t \tag{25}$$

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A: High book-to-market residual variance							
δ	-0.002	-0.002	-0.001	-0.001	-0.000	-0.000	-0.003
	-2.769	-1.990	-0.810	-0.988	-0.425	-0.078	-1.299
ϕ	0.703	0.442	0.254	-0.043	-0.089	-0.072	-0.103
	9.248	4.510	2.278	-0.384	-0.843	-0.946	-0.979
$\bar{R}^2$	0.616	0.274	0.079	0.002	0.007	0.005	0.012
Panel B: Low book-to-market residual variance							
δ	-0.002	-0.003	-0.002	-0.002	-0.001	-0.000	-0.000
	-4.443	-4.339	-1.916	-1.451	-1.148	-0.306	-0.090
ϕ	0.678	0.393	0.208	-0.095	-0.136	-0.082	-0.068
	9.437	3.904	1.898	-0.863	-1.375	-1.137	-0.601
$\bar{R}^2$	0.637	0.318	0.101	0.027	0.024	0.006	0.004
Panel C: Low asset growth residual variance							
δ	-0.002	-0.002	-0.001	-0.002	-0.002	-0.001	-0.000
	-2.278	-2.045	-0.804	-1.030	-0.940	-0.485	-0.606
ϕ	0.711	0.445	0.257	-0.065	-0.121	-0.087	-0.072
	9.520	4.087	2.388	-0.588	-1.216	-1.237	-0.716
$\bar{R}^2$	0.615	0.276	0.079	0.011	0.017	0.007	0.004
Panel D: High asset growth residual variance							
δ	-0.002	-0.002	-0.001	-0.001	-0.001	-0.000	-0.000
	-3.538	-3.073	-1.665	-1.130	-0.724	-0.018	-0.621
ϕ	0.684	0.408	0.225	-0.077	-0.111	-0.071	-0.078
	9.076	4.091	2.046	-0.679	-1.120	-0.994	-0.725
$\bar{R}^2$	0.627	0.296	0.089	0.013	0.011	0.005	0.005
Panel E: High profitability residual variance							
δ	-0.002	-0.002	-0.001	-0.001	-0.001	-0.000	-0.001
	-2.098	-1.547	-1.072	-0.644	-0.662	-0.129	-0.727
ϕ	0.705	0.449	0.254	-0.039	-0.096	-0.075	-0.082
	9.363	4.166	2.338	-0.364	-0.976	-1.052	-0.800
$\bar{R}^2$	0.623	0.276	0.081	0.002	0.009	0.005	0.007
Panel F: Low profitability residual variance							
δ	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001
	-2.922	-2.232	-1.700	-1.032	-0.955	-0.790	-1.544
ϕ	0.702	0.437	0.230	-0.060	-0.118	-0.098	-0.097
	9.739	4.428	2.149	-0.588	-1.234	-1.270	-0.932
$\bar{R}^2$	0.623	0.283	0.090	0.009	0.016	0.010	0.011

Table 11: Residual variance factor as a predictor of consumption, dividends, investment, and manufacturing hiring rates

Panel A of this table presents the average returns (equal-weighted) on residual variance portfolios, the average return of the residual variance factor, the excess return on the high residual variance quintile over the low residual variance quintile, along with the corresponding Newey and West (1987) corrected t-statistics (in parentheses). The remaining panels show the results from regressing future economic quantities on the prior equal-weighted yearly returns of the residual variance factor:

$$y_{t+h} = \iota_0 + \iota \times RV_t + \zeta_{t+h} \quad (26)$$

where y_{t+h} (h= 1 year, 4years, 5 years, 6 years, 12 years, 13 years, and 14 years) is the log consumption growth, dividend growth, investment in structures, or investment in equipment and software, and manufacturing hiring rates. We report the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s.

Panel A: Average returns of residual variance portfolios

	Low	2	3	4	High	High - Low
$\bar{r}$	1.16	1.16	1.19	1.20	1.38	0.22
	(4.54)	(4.45)	(4.55)	(4.56)	(5.79)	(2.22)

Panel B: Predicting consumption growth

Horizon	1yr	4yr	5yr	6yr	12yr	13yr	14yr
RV	-0.00	-0.03	-0.04	-0.08	0.14	0.12	0.11
	(-0.02)	(-0.45)	(-0.57)	(-0.83)	(3.19)	(2.12)	(1.97)
$\bar{R}^2$	0.00	0.00	0.00	0.00	0.04	0.03	0.02

Panel C: Predicting aggregate dividend growth

Horizon	1yr	4yr	5yr	6yr	12yr	13yr	14yr
RV	0.04	0.52	0.38	0.11	0.63	0.75	0.93
	(0.42)	(1.77)	(1.20)	(0.40)	(3.08)	(3.39)	(3.66)
$\bar{R}^2$	0.02	0.02	0.00	0.00	0.05	0.08	0.17

Panel D: Predicting aggregate investment growth: structures

Horizon	1yr	4yr	5yr	6yr	12yr	13yr	14yr
RV	-0.25	1.45	1.68	1.68	0.56	0.83	0.97
	(-0.81)	(2.35)	(3.55)	(3.17)	(0.80)	(0.99)	(0.94)
$\bar{R}^2$	0.00	0.07	0.09	0.07	0.00	0.00	0.00

Panel E: Predicting aggregate investment growth: equipment

Horizon	1yr	4yr	5yr	6yr	12yr	13yr	14yr
RV	0.35	0.80	0.71	0.66	0.39	0.25	0.16
	(1.56)	(2.01)	(1.85)	(1.47)	(0.59)	(0.33)	(0.16)
$\bar{R}^2$	0.03	0.02	0.00	0.00	0.00	0.00	0.00

Panel F: Predicting aggregate manufacturing hiring rates

Horizon	1yr	4yr	5yr	6yr	12yr	13yr	14yr
RV	0.04	0.30	0.31	0.20	0.36	0.36	0.31
	(0.40)	(1.65)	(1.54)	(0.93)	(2.17)	(1.60)	(0.16)
$\bar{R}^2$	0.00	0.01	0.01	0.00	0.01	0.00	0.00

Table 12: Future aggregate investment, idiosyncratic variance, and residual variance corresponding to high and low book-to-market portfolios

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future investment rates on lagged idiosyncratic variance, lagged residual variance, and lagged investment rates. First, we estimate equation 6 to remove any predictability of the economic variable related to its own lag and residual variance. Second, we take the residuals ξ_{it+q} and regress them on lagged idiosyncratic variance, $ivar_{it}$, where i depicts the various portfolios, to investigate whether it has additional predictability after removing the predictive part in the economic variable attributed to residual variance. To this end we specify: $\xi_{it+q} = \alpha_0 + \alpha_i ivar_{it} + \eta_{it+q}$. We repeat the exercise by switching the roles of residual variance and idiosyncratic variance. That is, we start by estimating equation 6 and we use idiosyncratic variance instead of residual variance. Next, we take the residuals and regress them on lagged residual variance: $\xi_{it+q} = \alpha_0 + \alpha_i rvar_{it} + \eta_{it+q}$.

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A1: Structures							
High book-to-market idiosyncratic variance							
α	0.007	0.007	0.008	0.014	0.012	0.021	0.010
	3.676	2.764	2.458	3.876	1.978	3.884	2.958
$\bar{R}^2$	0.028	0.021	0.021	0.049	0.042	0.107	0.023
High book-to-market residual variance							
α	-0.012	-0.013	-0.011	-0.006	-0.003	0.003	0.003
	-9.282	-5.377	-5.922	-3.134	-1.999	2.297	0.213
$\bar{R}^2$	0.258	0.220	0.128	0.034	0.007	0.012	0.001
Panel A2: Equipment and software							
High book-to-market idiosyncratic variance							
α	0.004	0.008	0.001	0.004	0.006	0.002	-0.010
	0.928	1.368	0.169	0.359	0.813	0.312	-1.442
$\bar{R}^2$	0.005	0.013	0.000	0.003	0.007	0.001	0.014
High book-to-market residual variance							
α	-0.004	0.003	0.007	0.005	0.004	0.002	0.011
	-1.053	1.184	2.597	1.949	3.220	0.774	0.824
$\bar{R}^2$	0.013	0.009	0.031	0.016	0.010	0.002	0.011
Panel B1: Structures							
Low book-to-market idiosyncratic variance							
α	0.011	0.009	-0.005	-0.006	-0.016	-0.002	-0.000
	1.087	0.596	-0.373	-0.620	-1.097	-0.205	-0.035
$\bar{R}^2$	0.007	0.003	0.001	0.001	0.008	0.000	0.000
Low book-to-market residual variance							
α	-0.007	-0.008	-0.007	-0.003	-0.001	0.002	0.003
	-1.979	-2.004	-2.565	-2.103	-0.588	1.874	0.812
$\bar{R}^2$	0.132	0.122	0.077	0.015	0.001	0.010	0.007
Panel B2: Equipment and software							
Low book-to-market idiosyncratic variance							
α	0.012	-0.002	-0.006	-0.005	-0.018	-0.005	0.011
	0.584	-0.097	-0.404	-0.210	-0.662	-0.261	0.689
$\bar{R}^2$	0.004	0.000	0.001	0.000	0.005	0.001	0.002
Low book-to-market residual variance							
α	-0.004	-0.000	0.002	0.001	0.001	0.001	0.002
	-1.898	-0.080	0.358	0.235	0.438	0.498	0.588
$\bar{R}^2$	0.027	0.000	0.003	0.001	0.002	0.001	0.002

Table 13: Future aggregate investment, idiosyncratic variance, and residual variance corresponding to low and high asset growth portfolios

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future investment rates on lagged idiosyncratic variance, lagged residual variance, and lagged investment rates. First, we estimate equation 6 to remove any predictability of the economic variable related to its own lag and residual variance. Second, we take the residuals ξ_{it+q} and regress them on lagged idiosyncratic variance, $ivar_{it}$, where i depicts the various portfolios, to investigate whether it has additional predictability after removing the predictive part in the economic variable attributed to residual variance. To this end we specify: $\xi_{it+q} = \alpha_0 + \alpha_i ivar_{it} + \eta_{it+q}$. We repeat the exercise by switching the roles of residual variance and idiosyncratic variance. That is, we start by estimating equation 6 and we use idiosyncratic variance instead of residual variance. Next, we take the residuals and regress them on lagged residual variance: $\xi_{it+q} = \alpha_0 + \alpha_i rvar_{it} + \eta_{it+q}$.

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A1: Structures							
Low asset growth idiosyncratic variance							
α	0.006	0.013	0.006	0.004	0.005	-0.004	-0.010
	1.779	3.375	3.480	3.256	2.292	-2.319	-5.216
$\bar{R}^2$	0.009	0.029	0.005	0.002	0.003	0.002	0.013
Low asset growth residual variance							
α	-0.010	-0.012	-0.010	-0.003	-0.002	0.005	0.007
	-1.976	-2.087	-2.511	-1.228	-1.045	2.640	1.163
$\bar{R}^2$	0.134	0.126	0.077	0.006	0.004	0.017	0.014
Panel A2: Equipment and software							
Low asset growth idiosyncratic variance							
α	0.010	0.002	-0.004	-0.005	-0.002	-0.002	-0.001
	4.029	1.056	-1.539	-0.958	-0.462	-0.637	-0.363
$\bar{R}^2$	0.014	0.001	0.002	0.002	0.000	0.000	0.000
Low asset growth residual variance							
α	-0.004	0.003	0.006	0.004	0.004	0.001	0.002
	-1.236	0.638	1.026	0.582	0.875	0.363	0.612
$\bar{R}^2$	0.012	0.005	0.020	0.008	0.006	0.001	0.001
Panel B1: Structures							
High asset growth idiosyncratic variance							
α	0.195	0.270	0.060	0.070	-0.132	-0.124	-0.082
	3.490	3.318	0.546	0.745	-0.907	-2.363	-0.692
$\bar{R}^2$	0.037	0.051	0.002	0.002	0.008	0.007	0.003
High asset growth residual variance							
α	-0.008	-0.009	-0.007	-0.003	-0.000	0.003	0.002
	-3.347	-3.287	-2.698	-2.436	-0.133	3.667	0.500
$\bar{R}^2$	0.200	0.187	0.088	0.020	0.000	0.017	0.004
Panel B2: Equipment and software							
High asset growth idiosyncratic variance							
α	0.163	-0.045	-0.070	-0.211	-0.037	-0.095	0.024
	0.944	-0.232	-0.342	-0.797	-0.174	-0.684	0.158
$\bar{R}^2$	0.012	0.001	0.002	0.012	0.000	0.002	0.000
High asset growth residual variance							
α	-0.004	0.001	0.003	0.004	0.002	0.001	0.001
	-1.713	0.490	0.977	1.306	0.916	0.806	0.178
$\bar{R}^2$	0.022	0.002	0.013	0.015	0.004	0.002	0.000

Table 14: Future aggregate investment, idiosyncratic variance, and residual variance corresponding to high and low gross profitability portfolios

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future investment rates on lagged idiosyncratic variance, lagged residual variance, and lagged investment rates. First, we estimate equation 6 to remove any predictability of the economic variable related to its own lag and residual variance. Second, we take the residuals ξ_{it+q} and regress them on lagged idiosyncratic variance, $ivar_{it}$, where i depicts the various portfolios, to investigate whether it has additional predictability after removing the predictive part in the economic variable attributed to residual variance. To this end we specify: $\xi_{it+q} = \alpha_0 + \alpha_i ivar_{it} + \eta_{it+q}$. We repeat the exercise by switching the roles of residual variance and idiosyncratic variance. That is, we start by estimating equation 6 and we use idiosyncratic variance instead of residual variance. Next, we take the residuals and regress them on lagged residual variance: $\xi_{it+q} = \alpha_0 + \alpha_i rvar_{it} + \eta_{it+q}$.

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A1: Structures							
High profitability idiosyncratic variance							
α	-0.004	0.009	-0.040	-0.045	-0.041	0.005	0.033
	-0.164	0.226	-0.970	-1.245	-1.059	0.209	0.660
$\bar{R}^2$	0.000	0.001	0.010	0.011	0.009	0.000	0.005
High profitability residual variance							
α	-0.008	-0.010	-0.007	-0.003	-0.001	0.002	-0.001
	-1.664	-1.491	-1.395	-0.656	-0.427	0.817	-0.271
$\bar{R}^2$	0.112	0.106	0.055	0.006	0.001	0.005	0.001
Panel A2: Equipment and software							
High profitability idiosyncratic variance							
α	-0.020	-0.017	-0.017	0.016	-0.005	-0.016	0.076
	-0.336	-0.323	-0.376	0.403	-0.068	-0.351	2.133
$\bar{R}^2$	0.002	0.001	0.001	0.001	0.000	0.001	0.017
High profitability residual variance							
α	-0.002	0.002	0.005	0.003	0.004	0.001	-0.003
	-0.511	1.099	1.559	0.732	1.654	0.304	-0.758
$\bar{R}^2$	0.004	0.003	0.013	0.004	0.009	0.001	0.004
Panel B1: Structures							
Low profitability idiosyncratic variance							
α	0.005	0.009	0.002	0.006	-0.010	0.001	0.001
	1.399	3.022	0.855	1.668	-1.842	0.382	0.273
$\bar{R}^2$	0.009	0.022	0.001	0.007	0.021	0.000	0.000
Low profitability residual variance							
α	-0.008	-0.009	-0.007	-0.004	0.000	0.003	0.003
	-2.230	-1.970	-2.288	-2.114	0.151	1.776	0.500
$\bar{R}^2$	0.141	0.123	0.072	0.016	0.000	0.014	0.006
Panel B2: Equipment and software							
Low profitability idiosyncratic variance							
α	0.008	-0.007	-0.014	-0.019	-0.011	-0.002	0.006
	2.021	-1.180	-2.737	-1.727	-3.111	-0.265	0.954
$\bar{R}^2$	0.013	0.007	0.027	0.042	0.014	0.000	0.004
Low profitability residual variance							
α	-0.004	0.003	0.006	0.005	0.004	0.002	0.001
	-1.419	1.057	2.270	1.737	2.363	1.032	0.164
$\bar{R}^2$	0.019	0.007	0.037	0.023	0.016	0.004	0.000

Table 15: Future aggregate cumulative corporate profits, idiosyncratic variance, and residual variance

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future cumulative profit rates on lagged idiosyncratic variance, lagged residual variance, and lagged profit rates. First, we estimate equation 6 to remove any predictability of the economic variable related to its own lag and residual variance. Second, we take the residuals ξ_{it+q} and regress them on lagged idiosyncratic variance, $ivar_{it}$, where i depicts the various portfolios, to investigate whether it has additional predictability after removing the predictive part in the economic variable attributed to residual variance. To this end we specify: $\xi_{it+q} = \alpha_0 + \alpha_i ivar_{it} + \eta_{it+q}$. We repeat the exercise by switching the roles of residual variance and idiosyncratic variance. That is, we start by estimating equation 6 and we use idiosyncratic variance instead of residual variance. Next, we take the residuals and regress them on lagged residual variance: $\xi_{it+q} = \alpha_0 + \alpha_i rvar_{it} + \eta_{it+q}$.

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A1: High book-to-market idiosyncratic variance							
α	0.009	0.012	0.011	0.028	0.027	0.020	-0.030
	1.281	1.175	0.634	0.961	0.762	0.683	-0.876
$\bar{R}^2$	0.006	0.006	0.003	0.010	0.007	0.002	0.004
Panel A2: High book-to-market residual variance							
α	0.015	0.025	0.036	0.047	0.051	0.054	0.109
	3.980	6.202	6.798	8.635	9.668	5.259	1.722
$\bar{R}^2$	0.067	0.084	0.111	0.102	0.088	0.060	0.032
Panel B1: Low book-to-market idiosyncratic variance							
α	-0.000	0.008	0.018	0.061	0.054	0.155	0.176
	-0.015	0.146	0.207	0.489	0.372	0.687	0.877
$\bar{R}^2$	0.000	0.000	0.001	0.005	0.003	0.014	0.017
Panel B2: Low book-to-market residual variance							
α	0.007	0.010	0.017	0.022	0.027	0.033	0.038
	1.039	1.008	1.130	1.179	1.389	1.952	1.611
$\bar{R}^2$	0.021	0.021	0.038	0.035	0.038	0.039	0.027
Panel C1: Low asset growth idiosyncratic variance							
α	-0.009	-0.013	-0.024	-0.036	-0.048	-0.056	-0.058
	-2.909	-1.847	-2.164	-2.708	-3.024	-3.826	-3.846
$\bar{R}^2$	0.003	0.003	0.007	0.008	0.010	0.009	0.009
Panel C2: Low asset growth residual variance							
α	0.014	0.021	0.033	0.046	0.053	0.063	0.070
	1.686	1.644	1.767	1.945	2.041	2.846	1.869
$\bar{R}^2$	0.038	0.042	0.065	0.066	0.063	0.056	0.031
Panel D1: High asset growth idiosyncratic variance							
α	-0.185	-0.274	-0.535	-0.539	-0.680	-0.738	-0.725
	-1.149	-0.927	-1.236	-0.887	-0.970	-0.941	-0.600
$\bar{R}^2$	0.005	0.005	0.012	0.006	0.007	0.005	0.004
Panel D2: High asset growth residual variance							
α	0.009	0.014	0.023	0.030	0.035	0.042	0.046
	1.778	1.975	2.305	2.321	2.565	3.428	1.174
$\bar{R}^2$	0.041	0.046	0.077	0.068	0.067	0.062	0.029
Panel E1: High profitability idiosyncratic variance							
α	0.019	0.042	0.057	0.115	0.195	0.368	0.416
	0.261	0.407	0.393	0.612	0.939	1.734	2.382
$\bar{R}^2$	0.001	0.001	0.002	0.003	0.007	0.014	0.016
Panel E2: High profitability residual variance							
α	0.010	0.017	0.027	0.035	0.035	0.039	0.027
	1.255	1.603	1.575	1.457	1.189	1.128	0.547
$\bar{R}^2$	0.026	0.035	0.054	0.051	0.038	0.030	0.008
Panel F1: Low profitability idiosyncratic variance							
α	-0.011	-0.009	-0.019	-0.016	-0.025	0.014	0.000
	-2.118	-0.641	-0.898	-0.551	-0.775	0.310	0.010
$\bar{R}^2$	0.007	0.002	0.006	0.002	0.004	0.001	0.000
Panel F2: Low profitability residual variance							
α	0.013	0.018	0.027	0.037	0.041	0.041	0.052
	2.449	2.465	2.381	2.544	2.608	2.352	1.203
$\bar{R}^2$	0.059	0.059	0.082	0.078	0.073	0.046	0.033

Table 16: Future aggregate manufacturing hiring rates, idiosyncratic variance, and residual variance

This table reports the coefficients, Newey and West (1987) corrected t-statistics (the lag for the correction is two times the length of the horizon), and adjusted $\bar{R}^2$s for the regressions of future manufacturing hiring rates on lagged idiosyncratic variance, lagged residual variance, and lagged manufacturing hiring rates. First, we estimate equation 6 to remove any predictability of the economic variable related to its own lag and residual variance. Second, we take the residuals ξ_{it+q} and regress them on lagged idiosyncratic variance, $ivar_{it}$, where i depicts the various portfolios, to investigate whether it has additional predictability after removing the predictive part in the economic variable attributed to residual variance. To this end we specify: $\xi_{it+q} = \alpha_0 + \alpha_i ivar_{it} + \eta_{it+q}$. We repeat the exercise by switching the roles of residual variance and idiosyncratic variance. That is, we start by estimating equation 6 and we use idiosyncratic variance instead of residual variance. Next, we take the residuals and regress them on lagged residual variance: $\xi_{it+q} = \alpha_0 + \alpha_i rvar_{it} + \eta_{it+q}$.

	Forecast horizon q						
	1	2	3	5	7	11	15
Panel A1: High book-to-market idiosyncratic variance							
α	-0.000	-0.000	-0.000	-0.002	-0.003	-0.003	-0.003
	-0.336	-0.205	-0.393	-0.876	-1.182	-1.938	-4.584
$\bar{R}^2$	0.000	0.000	0.000	0.006	0.013	0.012	0.017
Panel A2: High book-to-market residual variance							
α	-0.002	-0.002	-0.001	-0.000	-0.000	0.000	-0.001
	-2.250	-1.544	-0.571	-0.675	-0.299	0.049	-0.626
$\bar{R}^2$	0.047	0.022	0.002	0.001	0.000	0.000	0.002
Panel B1: Low book-to-market idiosyncratic variance							
α	-0.003	0.002	0.002	0.004	0.002	0.003	-0.000
	-0.416	0.678	0.296	0.661	0.280	0.301	-0.057
$\bar{R}^2$	0.003	0.001	0.001	0.003	0.001	0.002	0.000
Panel B2: Low book-to-market residual variance							
α	-0.0017	-0.0022	-0.0014	-0.0015	-0.0011	-0.0003	-0.0000
	-3.2913	-4.2123	-1.5536	-1.3279	-1.0082	-0.3565	-0.0441
$\bar{R}^2$	0.0697	0.0640	0.0196	0.0228	0.0135	0.0011	0.0000
Panel C1: Low asset growth idiosyncratic variance							
α	0.0013	0.0018	0.0000	0.0016	-0.0001	-0.0017	-0.0001
	3.1860	3.5238	0.0641	1.3640	-0.0497	-1.3651	-0.1846
$\bar{R}^2$	0.0034	0.0036	0.0000	0.0020	0.0000	0.0025	0.0000
Panel C2: Low asset growth residual variance							
α	-0.0020	-0.0020	-0.0006	-0.0014	-0.0012	-0.0002	-0.0003
	-1.9980	-1.8421	-0.4840	-0.9403	-0.7247	-0.1768	-0.3425
$\bar{R}^2$	0.0423	0.0238	0.0014	0.0092	0.0062	0.0002	0.0002
Panel D1: High asset growth idiosyncratic variance							
α	0.0463	0.0358	-0.0087	0.0039	-0.0257	-0.0677	-0.0087
	1.7338	0.8009	-0.1759	0.0589	-0.4022	-1.8208	-0.4230
$\bar{R}^2$	0.0156	0.0050	0.0002	0.0000	0.0019	0.0123	0.0002
Panel D2: High asset growth residual variance							
α	-0.0016	-0.0017	-0.0007	-0.0008	-0.0003	0.0004	-0.0001
	-3.3023	-2.5222	-1.0016	-0.9294	-0.3802	0.8413	-0.0992
$\bar{R}^2$	0.0681	0.0403	0.0060	0.0073	0.0010	0.0020	0.0000
Panel E1: High profitability idiosyncratic variance							
α	0.0031	0.0026	-0.0045	-0.0133	-0.0084	-0.0073	0.0112
	0.2947	0.1687	-0.2835	-1.0391	-0.7286	-0.6488	1.3643
$\bar{R}^2$	0.0008	0.0003	0.0007	0.0059	0.0024	0.0016	0.0038
Panel E2: High profitability residual variance							
α	-0.0021	-0.0018	-0.0006	-0.0002	-0.0004	-0.0000	-0.0011
	-2.0491	-1.5097	-0.6293	-0.2232	-0.4221	-0.0103	-0.8696
$\bar{R}^2$	0.0614	0.0240	0.0023	0.0003	0.0009	0.0000	0.0044
Panel F1: Low profitability idiosyncratic variance							
α	0.0015	0.0019	0.0004	-0.0030	-0.0038	0.0011	0.0010
	1.6367	1.3688	0.2996	-1.5286	-2.5111	0.4704	1.0101
$\bar{R}^2$	0.0066	0.0057	0.0002	0.0114	0.0185	0.0016	0.0012
Panel F2: Low profitability residual variance							
α	-0.0018	-0.0018	-0.0012	-0.0006	-0.0006	-0.0008	-0.0013
	-2.9203	-2.2511	-1.3746	-0.6488	-0.6429	-0.7742	-1.4789
$\bar{R}^2$	0.0649	0.0354	0.0118	0.0028	0.0027	0.0053	0.0066