Can Investment Shocks Explain Value Premium and Momentum Profits?*

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First draft: April 15, 2012

This draft: December 15, 2014

*We are grateful to Burton Hollifield, Jun Li, Laura Liu (SIF discussant), Pablo Moran, Georgios Skoulakis, Tan Wang (CICF discussant), Lu Zhang (LAEF discussant) and seminar participants at the Third LAEF-Tepper Advance in Macro Finance Conference, Cheung Kong Graduate School of Business, China International Conference in Finance, and the Summer Institute of Finance Conference for valuable comments and discussions. We especially thank Ryan Israelsen for sharing with us the quality-adjusted investment goods price series.

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Abstract

In this paper we assess whether investment-specific technology (IST) shocks can explain the value premium and momentum profits. Using proxies of IST shocks based on both macroeconomic and financial market data from 1930 to 2012, we find that: (i) IST risk premium estimates are positive; (ii) the evidence that exposures to IST shocks can explain the value premium is weak; and (iii) exposures to IST shocks cannot explain the large magnitude of momentum profits. We further show that the IST risk premium estimates are sensitive to the sample period, the test assets representing the cross-section, and the data frequency. We find that the sensitivity of IST risk premium estimates also affects the ability of IST shocks to explain the value and momentum effects.

JEL Classification Codes: G12; O30

Keywords: Investment-specific shocks; Value premium; Momentum profits

1 Introduction

Investment-specific technology shocks (IST shocks hereafter)—i.e., technological innovations that materialize through the creation of new capital stock—have long been recognized by economists as important determinants of economic growth and business cycle fluctuations.[1] More recently, financial economists have stressed investment-specific shocks' role as an economically motivated risk factor in explaining properties of asset prices in both the cross section and time series. Theoretically, the effect of IST shocks on asset prices depends crucially on key parameters such as investors' preferences towards the resolution of uncertainty (e.g., Papanikolaou (2011)) and firms' flexibility in varying capital utilization (e.g., Garlappi and Song (2013)). Empirically, the evidence from existing studies that rely on IST shocks to study cross sectional equity returns appears to be mixed. On the one hand, Kogan and Papanikolaou (2014) argue that a *negative* price of risk is needed to explain the value premium. On the other hand, Li (2013) argues that a *positive* price of risk is needed to explain the profitability of momentum strategies. To establish the relevance of IST shocks as an economically motivated risk factor and differentiate among alternative theories, it is therefore important to analyze in depth the empirical evidence on the ability of these shocks to explain cross-sectional returns.

In this paper, we assess the role of IST shocks for cross sectional asset prices by focusing on the same return patterns that brought forth the aforementioned disagreement: the value premium—i.e., the fact that high book-to-market (B/M) firms earn higher returns than low B/M firms (see Fama and French (1992))—and the momentum effect—i.e., the fact that stocks with high past returns outperform stocks with low past returns (see Jegadeesh and Titman (1993)). We conduct our study over a long sample period ranging from 1930 to 2012 and base our empirical analysis on measures of investment-specific technology shocks that have been widely used in the macro-finance literature. The first measure (*Ishock*), proposed by Greenwood, Hercowitz, and Krusell (1997), is based on the (quality adjusted) price of capital goods relative to that of consumption goods and aims

[1] See, for example Solow (1960), Greenwood, Hercowitz, and Krusell (1997, 2000), Christiano and Fisher (2003), Fisher (2006), and Justiniano, Primiceri, and Tambalotti (2010, 2011).

to capture shocks to the cost of investment in new capital. The second measure (*IMC*), proposed by Papanikolaou (2011), is based on the stock return spread between investment and consumption good producers. The third measure (*gIMC*), first used by Kogan and Papanikolaou (2014), is the growth rate spread between investment and consumption. The last measure (*PC1*), which we propose, is the first principal component of the first three measures.

We use the above four measures of IST shocks in Fama-MacBeth regressions over the entire 1930–2012 sample in which we employ a broad cross section of 40 test assets (10 size, 10 B/M, 10 momentum, and 10 industry portfolios). Our estimation procedure delivers a positive and significant IST risk premium. Combining these findings with the estimates of IST loadings, we infer that exposure to *Ishock* can explain up to 62% of the value premium while the explanatory power of the other three measures is weaker (below 32%). Although the two macro-based IST measures (*Ishock* and *gIMC*) can explain a sizable fraction of momentum profits (up to 46%), none of the four shocks can explain the full magnitude of momentum profits. For robustness, we confirm that results are qualitatively similar if we exclude the Great Depression period and use only the post-World War II sample from 1948 to 2012.

Our finding that macro-based IST measures can explain a sizable fraction of momentum profit in the long 1930–2012 annual sample is broadly consistent with Li (2013), who uses IST shocks to explain momentum profits. However, our analysis shows also that the effect of IST shocks on momentum may be sample dependent. For example, in the quarterly post-WWII sample, none of the four IST proxies can generate sizable momentum profits (IST measures can explain up to only 11% of momentum profits). Similarly, our finding that one of the IST measures, *Ishock*, can explain a large fraction of the value premium in the long annual sample of 1930–2012, is broadly consistent with that of Papanikolaou (2011) and Kogan and Papanikolaou (2014), who use IST risk exposure to explain the value effect. However, similar to the case of momentum, our analysis shows that the ability of IST shocks to account for the value effect also depends on the sample period used. For example, none of the four IST measures can generate sizable value premia in the annual post-WWII sample (the IST measures can explain up to only 13% of value premium).

Our positive estimates of the IST risk premium from 1930–2012 are in contrast to the negative estimates of Papanikolaou (2011) and Kogan and Papanikolaou (2014, 2013), obtained from post-1963 data. To understand and reconcile this difference, we first replicate and confirm their negative estimates using post 1963 data and a cross section of ten book-to-market portfolios. We then further document that the inference based on the four proxies of IST shocks depends crucially on both the sample period and the test assets employed. For example, using book-to-market portfolios as the only test assets, the estimated IST risk premium is negative for post-1963 but *positive* for pre-1963 data. Moreover, even for post 1963 data, the IST risk premium is positive when estimated via a cross section of test assets broader than the ten book-to-market portfolios.

Our finding that the sign of the IST risk premium differs across testing assets and sample periods has important implications for theoretical models. For example, in the general equilibrium model of Papanikolaou (2011), IST risk premia are negative because a positive IST shock induces a drop in consumption and hence increases marginal utility. This makes an asset with positive IST exposure as a 'hedge' against consumption risk. On the other hand, Garlappi and Song (2013) show that if firms can increase their capital utilization upon a positive IST shock, consumption may increase rather than decrease. This in turn implies that marginal utility may be lower when IST shock is positive. In other words, an asset with positive IST exposure is 'risky' and therefore investors demand a positive risk premium for holding the asset.

Our paper is closely related to the recent finance literature that studies the effect of IST shocks on asset prices. Papanikolaou (2011) is the first to study the implications of these shocks for asset prices in the cross-section of stocks. Papanikolaou (2011) introduces IST shocks in a two-sector general equilibrium model and shows how financial data can be used to measure IST shocks at a higher frequency. In a partial equilibrium setting, Kogan and Papanikolaou (2014, 2013) explore how IST shocks can explain the value premium as well as other return patterns in the cross-section that are associated with firm characteristics, such as Tobin's Q, past investment, earnings-price ratios, market betas, and idiosyncratic volatility of stock returns. Li (2013) proposes a rational explanation of the momentum effect in the cross-section by using investment shocks as the key risk factor. Yang (2013) uses investment shocks to explain the commodity basis spread.

More broadly, our paper is related to a large literature that uses heterogeneity in firms' investment decisions and their exposures to disembodied productivity shocks to explain cross-sectional returns, as pioneered by Cochrane (1996) and Berk, Green, and Naik (1999). The investment based asset pricing literature is too vast to be reviewed here. Significant contributions to this literature that are closely related to the cross-sections we study include Carlson, Fisher, and Giammarino (2004) and Zhang (2005) for the value effect, and Sagi and Seasholes (2007) and Liu and Zhang (2008, 2014) for the momentum effect.

We make two contributions to the literature on cross sectional asset pricing. First, we provide a thorough empirical analysis of the effect of investment-specific shocks on *both* the value premium and momentum profits. The long sample period (1930–2012) we consider in this paper offers an "out-of-sample" analysis that complements that in existing studies where the focus is mainly on relatively recent data (post 1963). Second, the new evidence we document can help to differentiate among alternative pricing theories of IST shocks, and therefore enhance our understanding of the effect of IST shocks on asset prices.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 provides empirical evidence from cross-sectional analysis. Section 4 compares our empirical findings on the IST risk premium with the existing literature. Section 5 concludes. Appendix A contains details of the data we use.

2 Data

In this section, we briefly describe the construction of the empirical measures of IST shocks and report their statistical properties. We conduct our main analysis using annual data starting from 1930 until 2012. To allay the concern that this sample period contains the tumultuous time of the Great Depression, for robustness, we also consider post-World War II data, both at the annual and quarterly frequency. Appendix A contains a more detailed description of all the data used in the paper.

2.1 Construction of IST measures

The first measure of IST shock (*Ishock*), originally proposed by Greenwood, Hercowitz, and Krusell (1997), is the change in the price of investment goods relative to that of non-durable consumption goods. Specifically, for period t, *Ishock* is defined as

$$Ishock_t = -\left(\ln\left(P_I/P_C\right)_t - \ln\left(P_I/P_C\right)_{t-1}\right), \tag{1}$$

where P_I is the price deflator for equipment and software of gross private domestic investment, and P_C is the price deflator for nondurable consumption goods. The price deflator for nondurable consumption goods, P_C, is from the National Income and Product Accounts (NIPA) tables. The price deflator of investment goods, P_I, is from the quality-adjusted series of Israelsen (2010).[2]

The idea behind this measure is intuitive. If a new investment-specific technology improves the production of investment goods, the increased supply of investment goods would lead to a drop in the price of investment goods relative to consumption goods. That is, a positive IST shock leads to a reduction in the relative price of equipment, and therefore, a positive measure of *Ishock*.

The second measure of IST shocks (*IMC*), originally proposed by Papanikolaou (2011), is the return difference between investment and consumption sectors,

$$IMC_t = r_t^I - r_t^C, \tag{2}$$

[2]We are grateful to Ryan Israelsen for sharing with us the annual series of quality-adjusted prices from 1930 to 2012.

where r_t^I and r_t^C are the returns of firms producing investment goods and consumption goods, respectively. The classification of a firm as belonging to the consumption or investment sector is based on the procedure of Gomes, Kogan, and Yogo (2009) who classify each Standard Industry Classification (SIC) code into either investment or consumption sector based on the 1987 benchmark input-output accounts.

The rationale for using the *IMC* return as a measure of IST shocks is that, under the assumptions of the two-sector general equilibrium model of Papanikolaou (2011) or the vintage capital partial equilibrium model of Kogan and Papanikolaou (2013, 2014), firms producing investment goods (investment firms) and consumption goods (consumption firms) have the same loadings on the neutral productivity shock, but different loadings on IST shocks. If so, the return spread between investment and consumption firms loads only on IST shocks and can therefore be used as an alternative proxy for these shocks. Because it is constructed from financial markets data, the *IMC* measure has the advantage of being available at higher frequency than *Ishock*.

The third measure of IST shocks (*gIMC*), is the growth rate difference between aggregate investment and consumption,

$$gIMC_t = g_t^I - g_t^C, \tag{3}$$

where g_t^I and g_t^C are the log growth rates of aggregate investment and consumption, respectively. The intuition behind the *gIMC* measure is similar to that of *IMC*. In a model with both neutral TFP shocks, affecting both investment and consumption, and capital embodied IST shocks, affecting investment, the growth difference between investment and consumption should be closely related to IST shocks. We take the spread $gIMC$ between growth rate as a proxy for IST shocks.[3]

Finally, as our fourth proxy for IST shock we take the first principal component (*PC1*) from the previous three proxies. The rationale for using the principal component

[3]Note that our *gIMC* is equivalent to the growth rate in investment-to-consumption ratio used by Kogan and Papanikolaou (2014). We use a different notation to emphasize the similar intuition behind the growth rate spread (*gIMC*) and return spread (*IMC*).

is that, if the previous three proxies are measures of IST shocks, their principal component should also measure IST. Moreover, by extracting a common component across the three measures, the principal component helps mitigate the effect of noise that may affect each individual measure. A downside of using the principal component is that, unlike the previous three proxies, *PC1* does not have a direct economic interpretation, being simply a linear combination of the three IST proxies. We consider the use of *PC1* as a robustness analysis on the previous three IST proxies.

2.2 Time series properties of IST measures

Table 1 reports summary statistics of four IST measures and their correlations with macro factors (the growth rates of consumption expenditures, *GDP*, and *TFP*) and return factors (market, size, value, and momentum). The two macro-based measures, *Ishock* and *gIMC* are available from 1930 at the annual frequency and from 1948 at the quarterly frequency. For annual frequency data, we also report results for the pre- and post-1963 samples.

The annual mean and standard deviation for *Ishock* over the entire sample period (1930–2012) are 3.45% and 3.68%, respectively. The average *Ishock* is positive and significant for all the sample periods we report. In other words, according to the *Ishock* measure, we do observe improvement in investment-specific technology in the US economy. In contrast, the averages of *IMC* and *gIMC* are not significant across different sample periods. This lack of significance is potentially due to the fact the volatility of these measures is much higher than that of *Ishock*. Note that by construction, the principal component *PC1* has mean of zero and 100% volatility.

The contemporaneous correlations of *Ishock* with the growth rate of personal consumption expenditure (*PCE*), *GDP*, and *TFP* are, respectively, 0.20, 0.46, and 0.22 over the entire 1930–2012 annual sample and become statistically insignificant in the post-war 1948–2012 sample and over the more recent 1963–2012 sample. Unlike *Ishock*, *IMC* does not exhibit any significant correlation with the macro factors in the annual time series. However, in the quarterly time series spanning the 1948–2012 period, *IMC* is positively correlated with all three macro factors. The growth spread *gIMC* and the principal component *PC1* are positively correlated with the three macro factors across different sample periods.

The correlation between IST proxies and the return factors (market (*MKT*), size (*SMB*), value (*HML*), and momentum (*UMD*)) shows interesting time-varying patterns. For example, the correlations of *Ishock* with Fama-French 3-factors are all positive and significant for the 1930–1962 period and they all turn negative over the 1963–2012 period. A similar switch also happens for the correlation between *IMC* and *HML*. Note also that the two macro-based proxies, *Ishock* and *gIMC*, are positively correlated with the momentum factor, however, the financial-based proxy, *IMC* seems uncorrelated with momentum.

The last four columns of Table 1 report the correlation matrix for the four IST measures. A few interesting observations can be made from analyzing these correlations. First, at the annual frequency, *Ishock* does not seem to be correlated with *IMC*, and is positively correlated with *gIMC* only in the more recent sample periods. Second, *IMC* is not correlated with *gIMC*. Finally, the two macro-based measures (*Ishock* and *gIMC*) are highly correlated with the principal component of the three measures, while the correlation between *IMC* and *PC1* depends on sample period (higher correlation in the earlier annual subsample) and frequency (higher correlations in the quarterly post-war subsample). Overall, the three individual proxies of IST shocks are not highly correlated, and the principal component *PC1* does seem capture the common component of the three measures.

In summary, the analysis in this section shows that the measures of IST shocks introduced in Subsection 2.1 are pro-cyclical and exhibit positive correlation with return factors. The subsample analysis suggests that the statistical properties of these measures are time-varying. We formally investigate the asset pricing implications of this time variation in Section 4.

2.3 Cross sectional returns

We are interested in assessing whether IST shocks can help explain two widely studied cross sectional phenomena: the value premium and momentum profits. The first refers to the spread in returns between portfolios of high and low book-to-market (Fama and French (1992)) stocks. The latter refers to the spread in returns between portfolios of winners and losers (Jegadeesh and Titman (1993)). In order to assess whether IST shocks can explain these phenomena it is necessary to determine (i) the market risk premium associated with IST shocks and (ii) the exposure of book-to-market and momentum portfolios to the IST shocks.

To estimate the risk premium of IST shocks, we choose a cross section of 40 test portfolios: size deciles, book-to-market deciles, momentum deciles, and ten industry portfolios. The first thirty portfolios have been used in the literature as test assets for the estimation of risk premia associated to aggregate risk factors (see for example, Liu and Zhang (2008) and Cooper and Priestley (2011)). We also include as test assets the ten industry portfolios because the impact of investment shocks is likely to differ across industries.

3 IST shocks, value and momentum

In this section, we empirically investigate whether the value premium and momentum profits can be linked to firms' exposure to IST shocks. Our analysis consists of three steps. First, using a wide cross-section of test portfolios, we estimate the risk premium associated to IST shocks via Fama-MacBeth regressions (Section 3.1). Second, we compute the beta loadings of book-to-market and momentum portfolios on the chosen measure of IST shocks (Section 3.2). Third, we use the estimated IST risk premium and betas of book-to-market and momentum portfolios to infer the contribution of IST shocks in explaining value premium and momentum profits (Section 3.3). In sections 3.1 to 3.3 we perform our main analysis using annual data from 1930 to 2012. In Section 3.4 we ignore the years of the Great Depression and focus the analysis on post-World War II data both at the annual and quarterly frequencies.

3.1 The risk premium of IST shocks

We first estimate the risk premium associated with the IST shocks through cross-sectional analysis using the four measures of IST shocks introduced in the previous section. We perform our main analysis in this section through Fama-MacBeth approach and on annual data. We use the full sample to estimate portfolio loadings in the first-stage of Fama-MacBeth regressions.[4]

When estimating the IST risk premium, we control for a common, disembodied, aggregate factor in the economy which we measure using three different proxies: (i) the market excess return (MKT), (ii) the growth rate of *TFP*, and (iii) the growth rate of consumption (gC). For each proxy of IST shocks, we estimate the IST risk premium both in univariate and bivariate models where we control for the common aggregate factor. Details of the construction of MKT, *TFP* and gC are in Appendix A.

Table 2 reports the risk premium estimates from the second stage of Fama-MacBeth regressions using the full 1930–2012 annual sample. The risk premium estimates from *Ishock* are positive and significant. For example, in the univariate model (model (1a)), the risk premium for *Ishock*, λ_{Ishock}, is 3.77% per year with a Newey-West adjusted t-statistic of 3.26. The results are similar after we control for one of the three common factors in bivariate cross-sectional regressions (models (1b), (1c), and (1d)).

The risk premium estimates from IMC (λ_{IMC}) are also positive in both univariate and bivariate models. The point estimates vary from 0.66% (model (2c)) to 3.69% (model (2a)). However, all the estimates are not statistically significant. The risk premium estimates from $gIMC$ (λ_{gIMC}) are also positive in both univariate and bivariate models. However, the point estimates and the statistical significance are model dependent. For example, estimates of λ_{gIMC} are high and significant after controlling for MKT (9.59% in model (3b) with t-stat of 3.87) or *TFP* (8.28% in model (3c) with t-stat of 3.60). In

[4]For robustness, we also consider using expanding and rolling windows in the first-stage estimation. The results are qualitatively similar for the case of expanding windows but are too noisy for the case of rolling window due to the low frequency of data. These results are available upon request.

contrast, in both the univariate (model (3a)) and bivariate with *gC*, the λ_{gIMC} estimates are relatively low and insignificant.

Finally, the estimates for IST risk premium from the principal component (λ_{PC1}) are positive and statistically significant in both uni- and bi-variate models. The point estimates range from 62.3% (model (4c) with t-stat of 3.14) to 79% (model (4d) with t-stat of 3.48). The principal component of three individual IST measures seems to capture the common component in the two macro measures (*Ishock* and *gIMC*). As a result, *PC1* provides similar qualitative inference on the IST risk premium as *Ishock* and *gIMC*.[5]

In summary, the results in Table 2 indicate that IST shocks are more likely to demand a positive risk premium in the annual 1930–2012 sample, although the statistical significance of the estimates depends on the empirical proxy for IST shocks (*Ishock*, *gIMC*, *IMC*, or *PC1*) and/or the regression model considered.

3.2 IST loadings of book-to-market and momentum portfolios

The marginal contribution of IST shocks to an asset risk premium is given by the product of the IST risk premium and the loading of the asset on the IST shock. In the previous subsection we determined the IST risk-premium via a two-stage Fama-MacBeth regression. To assess whether IST shocks can explain the value and momentum effect, it is necessary to estimate the IST loadings of book-to-market and momentum portfolios. In our main analysis we compute the loadings via time series regressions over the entire 1930–2012 sample period. For robustness, we also consider expanding- and rolling-windows methodologies. For brevity, we only report the results for the full sample estimation.[6]

Panel A of Table 3 reports the returns and IST loadings of ten book-to-market sorted portfolios for the 1930–2012 annual sample. The portfolio excess returns r increase from 6.61%, for the growth portfolio (Low decile), to 13.67%, for the value portfolio

[5]Note that the point estimates of the IST risk premium are not directly comparable across the four different IST measures because of different volatility in the IST proxies. In particular, *PC1* is normalized to have unit (100% annual) volatility, and therefore has much larger point estimate of IST risk premium. Therefore, to compare the risk premia estimates from *Ishock*, *IMC*, and *gIMC* to the estimate from *PC1* one, one needs to normalize the estimates by the corresponding volatility of the proxy used, thus obtaining the Sharpe ratio associated to the specific IST proxy.

[6]Results for the expanding- and rolling-windows estimations are available upon request.

(High decile), implying a statistically significant difference of 7.05% per annum (with t-stat=2.56). The IST beta loadings are obtained from time series regression of portfolio excess returns on the chosen measure of IST shock, i.e., *Ishock*, *IMC*, *gIMC*, or *PC1*. In general, IST loadings of value stocks are higher than those of growth stocks. However, the difference between IST betas of value and growth portfolios are not statistically significant. For example, the univariate beta loadings on *Ishock*, β_{Ishock}, increase from 0.22, for the growth portfolio, to 1.19, for the value portfolio. Similarly, the univariate beta loadings on *IMC*, β_{IMC}, increase from 0.69, for the growth portfolio, to 1.09, for the value portfolio. The general pattern is similar for bivariate betas (not tabulated), obtained from time-series bivariate regressions that include, in addition to the IST proxy, either the market factor, *MKT*, the growth rate of total-factor productivity, *TFP*, or consumption growth, *gC*.

Panel B reports the corresponding quantities for the momentum deciles. The excess returns, r, increase from 0.8%, for the portfolio of losers, to 15.70%, for the portfolio of winners, implying a statistically significant difference of about 15% per annum with t-stat=5.47). Betas on *Ishock*, *gIMC*, and *PC1* also show an increasing pattern from losers to winners. For example, the univariate beta loadings on *Ishock*, β_{Ishock}, increase from -0.47, for the loser portfolio, to 1.22 for the winner portfolio, resulting in a beta difference of 1.69 with t-stat of 1.80. The significance of the beta difference between winners and losers is similar for *PC1* (t-stat=1.83) but much higher for *gIMC* (t-stat=2.56). In contrast, *IMC* betas are *lower* for winner portfolios than for loser portfolios. For example, the univariate beta loadings on *IMC*, β_{IMC}, decrease from 1.16, for the loser portfolio, to 0.87 for the winner portfolio, resulting in an insignificant beta for WML. As for book-to-market portfolios, the bivariate IST betas for momentum portfolios (not tabulated) show a similar pattern as the univariate betas.

3.3 Expected value premium and momentum profits

Given the estimation of IST risk premium and betas in the previous sections, we can calculate the fraction of value premium or momentum profits that can be explained by the IST exposures. The observed value premium, HML, is the difference in the return r between the High and Low book-to-market portfolios. Over the 1930–2012 sample period the value premium is 7.05% per annum as reported in Table 3. The component of value premium explained by IST shocks, which we denote by $\beta_{IST}\lambda_{IST}$, is equal to the spread in betas β_{IST} between value and growth portfolios (from Table 3) times the estimate of the risk premium λ_{IST} for IST shocks (from Table 2). For example, using univariate *Ishock* betas, β_{Ishock}, from Panel A of Table 3, and the IST risk premium λ_{Ishock} from the single factor model (1a) in Table 2, the IST component of the value premium is $\beta_{IST}\lambda_{IST} = 0.98 \times 3.77 = 3.69\%$ per annum. Given an observed value premium of 7.05%, this means that *Ishock* can explain 52% of the observed value premium. We follow a similar procedure to determine the contribution of IST shocks to momentum profits. For the cases with two factors, the model-implied expected return $\widehat{HML}$ (or $\widehat{WML}$) includes the contributions from both the IST risk and the second risk factor (MKT, TFP or gC) calculated in a similar fashion.

Panel A of Table 4 reports the results for value premium. Three points are worth mentioning. First, *Ishock* risk exposure explains 52% of the value premium (column labeled $\frac{\beta_{IST}\lambda_{IST}}{HML}$) in the univariate model, close to 40% in bivariate models that use MKT and TPF as aggregate factors, and 62% in bivariate models that use gC as aggregate factor. The column labeled "t(diff2)" reports the t-statistics for the test of the null hypothesis that IST shocks explain the value premium ($\beta_{IST}\lambda_{IST} - HML = 0$).[7] The t-statistics for these tests reveal that, with a 5% significance level, we cannot reject the hypothesis that exposure to *Ishock* explains the value premium. Second, exposure to *IMC* can only explain a small fraction of the value premium (ranging from 3% to 21% depending on models), and we reject the hypothesis that *IMC* risk exposure can explain the value premium. Finally, exposures to *gIMC* generate negative value premium and exposures to *PC1* also fail to explain a large fraction of the observed value premium.[8]

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[7]Similarly, the column labeled "t(diff1)" reports the t-statistics for the test of the null hypothesis that the bivariate models explain the value premium ($\widehat{HML} - HML = 0$).

[8]The results in Table 4 use the full-window in the first-stage beta estimation. We also carry out robustness analysis using either an expanding-window, which gives very similar results as the full-window,

Panel B reports the corresponding results for momentum profits. Exposures to *Ishock* explain about 28% to 43% of momentum profits, but we reject the hypothesis that *Ishock* exposures can explain the magnitude of momentum profits (see the *t*-statistics in column "t(diff2)"). From the *IMC* proxy of IST shocks, we typically infer *negative* implied momentum profits ($\beta_{IST}\lambda_{IST}$). Finally, both *gIMC* and *PC1* generate positive momentum profits, but we reject the hypothesis that either of the two can explain the magnitude of momentum profits.[9]

Our finding that, using annual data, *Ishock* exposures can explain a sizable fraction (ranging from 28% to 43%) of momentum profits is broadly consistent with Li (2013), who claims that IST shocks can explain momentum profits. However, as we discuss above, *Ishock* exposures still fail the statistical test as an explanation for the magnitude of momentum profits. Moreover, our analysis provides two new findings that challenge the claim that IST exposures explain momentum profits. First, in contrast to *Ishock*, the *IMC* measure, which is an alternative measure of IST shocks, does not have any explanatory power for momentum. Second, as we will show in the next subsection, the explanatory power of *Ishock* is very low when using post-WWII data (it explains at most 15% in the annual data and only 4% in the quarterly data.).

In summary, our analysis suggests that, while *Ishock* exposures can explain a large fraction of the value premium, *IMC* and *PC1* exposures can only explain a much smaller fraction. In contrast, *gIMC* exposures generate a negative value premium. Finally, none of the four IST exposures seem to be capable of capturing the magnitude of momentum profits.

3.4 Estimates from post-World War II data

The analysis of the previous subsections is based on annual data spanning from 1930 to 2012 over which all four measures of IST shocks are available. This sample period contains

or a rolling-window, which rejects the hypothesis that exposures to any of the four IST measures explain the value premium.

[9] We also reject the hypothesis that IST exposures can explain momentum profits under either expanding- or rolling-window for the first stage beta estimation.

the years of the Great Depression that are characterized by high level of market volatility. A possible concern is that estimates of risk premia from this sample can be excessively affected by this exceptional period. To allay these concerns, in this subsection we repeat the analysis of the previous three subsections on post-World War II data at both the annual and quarterly frequency. Due to data availability, our analysis on quarterly data covers the period 1948I–2012IV.

Table 5 reports the estimates for the IST risk premium over the 1948–2012 period using the same set of 40 test assets used in our previous analysis. Panel A (Panel B) reports estimates from annual (quarterly) data. Comparing these estimates to those obtained in Table 2 from the 1930–2012 sample period we note that the results are qualitatively similar. Specifically, the IST risk premia estimates tend to be positive in both uni- and bivariate models and across all four IST proxies considered. However, the statistical significance is generally low.

Table 6 reports the results for the expected value premium (Panel A) and momentum profits (Panel B) using annual data from the post-World War II sample. From Panel A we note that the expected value premium implied by IST shocks, $\beta_{IST}\lambda_{IST}$, is *negative* in three of the four models, contrasting the large *positive* estimates in Panel A of Table 4 for the annual sample of 1930-2012. From the value of t-statistics t(diff2), for all the models considered, we reject the hypothesis that the observed value premium is equal to the value premium implied by exposure to IST shocks. Similarly, in Panel B, IST shocks explain only a small fraction of momentum profits (the highest fractions are 42% for bi-variate models when IST shocks are proxied by gIMC) and we reject the hypothesis that the observed momentum profits are equal to the profits implied by exposure to IST shocks.

Table 7 reports the expected value premium (Panel A) and momentum profits (Panel B) using quarterly data. With the exception of the bi-variate model that combines *Ishock* with gC, in which the expected value premium is negative, exposure to *Ishock* can account for about 30 to 40% of the observed value premium, and we cannot reject the assumption that the expected value premium from *Ishock* is equal to the observed value premium. All the other model involving IST proxies other than *Ishock* cannot account for the value premium. Similarly, the results in Panel B indicate that exposure to IST shock cannot account for momentum profits over the 1948–2012 sample period.

In summary, the analysis in this subsection suggests that excluding the Great Depression from our analysis does not change in a significant way our main conclusion from the analysis based on the annual 1930–2012 sample of the previous sections: (i) the IST risk premia estimated from a cross section of 40 assets are typically positive and marginally significant; (ii) exposure to IST shocks can explain part of the value premium, although success depends on the specific IST proxy used and on the data frequency; and (iii) exposure to IST are unlikely to account for the magnitude of momentum profits.

4 Comparison with the existing literature

As we discussed in Section 3.3, our finding that macro-based IST measures (e.g., *Ishock* and *gIMC*) can explain a sizable fraction of momentum profit in the long 1930–2012 annual sample is broadly consistent with Li (2013), who argues that IST shocks can explain momentum profits. However, our analysis shows that the effect of IST shocks on momentum may be sample dependent. For example, in the quarterly post-WWII sample, none of the four IST proxies can generate sizable momentum profits.

Our finding that one of the IST measures, *Ishock*, can explain a large fraction of the value premium in the long annual sample of 1930–2012, is broadly consistent with that of Papanikolaou (2011) and Kogan and Papanikolaou (2014), who use IST risk exposure to explain the value effect. However, similar to the case of momentum, our analysis also shows that the ability of IST shocks to account for the value effect depends on the sample period and on the IST proxy used. For example, except for *Ishock*, the other three IST proxies do not show strong explanatory power for the value premium. In addition, even *Ishock* cannot generate sizable value premium in the post-WWII annual sample. Setting aside these sensitivity issues, our findings differ from the existing studies in a very important *qualitative* dimension. While our estimate of the IST risk premium is *positive* (see Table 2), Papanikolaou (2011) and Kogan and Papanikolaou (2013, 2014) document a *negative* risk premium associated to IST shocks.

Note that the difference in the sign of IST risk premium has at least two important implications. First, a positive IST risk premium implies that in a representative-agent general equilibrium model, the agent's marginal utility is low under a positive IST shock, therefore, assets that have positively correlated payoff with IST shocks are risky. On the other hand, a negative IST risk premium implies that positive IST beta assets are a 'hedge' against consumption risk. Second, the risk premium due to IST risk exposure for assets such as book-to-market or momentum portfolios, depends directly on the sign of the IST risk premium. Therefore, it is important that we compare our findings with the existing literature regarding the sign of the IST risk premium.

There are three main differences between our analysis and that of Papanikolaou (2011) and Kogan and Papanikolaou (2013, 2014). First, their analysis is based on post-1963 annual data, while ours rely on longer samples spanning from 1930 to 2012, for the annual data, and from 1948 to 2012, for the quarterly data. Second, their estimate of the IST risk premium is based on cross sections of test portfolios that are different from the set of 40 test portfolios that we use.[10] Third, their estimates of the IST risk premium are obtained via GMM while we use a two-stage Fama-MacBeth methodology.

In this section, we asses the sensitivity of IST risk premium estimation along the above three dimensions. In Section 4.1, we divide our 1930–2012 annual sample into two subperiods, 1930–1962 and 1963–2012, and show the IST risk premium estimates in both subperiods are positive when we use the same broad cross section of 40 portfolios of Section 3. In Section 4.2, we show that the IST risk premium estimates are sensitive to the test assets used. In particular, we find that if only BM portfolios are used, the IST risk premium estimates can switch from positive in the early sample to negative in the

[10]Specifically, Kogan and Papanikolaou (2013) estimate the IST risk premium using a cross section of 20 portfolio obtained by taking the first, second, ninth, and tenth decile portfolio from each of the following five cross sectional sorts: Tobin's q, Investment-to-capital ratio (I/K), price/earning ratio (P/E), market beta ($MBETA$), and idiosyncratic volatility ($IVOL$). Kogan and Papanikolaou (2014) estimate the IST risk premium using three separate cross sections: (i) 10 IMC beta sorted portfolios, (ii) 10 book-to-market sorted portfolios and (iii) 30 Fama and French (1997) industry portfolios.

more recent sample. Finally, in Section 4.3, we compare our Fama-McBeth estimates with those from GMM and show that the two approaches generate equivalent point estimates and differ only slightly in their statistical significance (i.e., the t-stat).

4.1 Different sample periods

Table 8 reports the risk premium estimates obtained by using as test assets the 40 portfolios we used in our main cross sectional analysis of Section 3.1 and splits the 1930–2012 sample period in two subsamples: 1930–1962 (Panel A) and 1963–2012 (Panel B). The risk premium estimates for 1963–2012 period are typically positive (although most are statistically insignificant). In both the 1930–1962 subsample (Panel A) and the entire 1930–2012 sample (Table 2), IST risk premia estimates are usually positive and statistically significant. Overall, IST risk premium estimates across the two subsample periods are quantitatively but not qualitatively different.

From our analysis in Section 3.4, the estimate of the IST risk premium from annual and quarterly data over the 1948–2012 sample (Table 5) are qualitatively similar to both the long sample of 1930-2012 and the more recent 1963-2012 sample. The stability of the IST risk premium estimate over different sample periods highlights the importance of using a broad set of test assets in the estimation.

4.2 Different test assets

Panel A of Table 9 reports the IST risk premium estimates obtained from Fama-MacBeth regression on ten book-to-market portfolios over the 1963–2012 annual subsample. This set of test assets and sample period have been used by Kogan and Papanikolaou (2014) in their estimation of the IST risk premium. Consistent with Papanikolaou (2011) and Kogan and Papanikolaou (2013, 2014) the IST risk premium estimates obtained through either the *Ishock* or *IMC* measures are negative, with the exception of the estimate obtained from the *IMC* measure after controlling for *TFP* (model (2c)) which is positive but statistically insignificant. The risk premia obtained from the *gIMC* measure are positive but statistically insignificant, with the exception of the estimate from a bivariate model including *MKT* (model (3b)) that is positive and significant at the 5% level. The risk premia estimated from *PC1* are all negative and significant.

To assess the robustness of the above estimates, we repeat the above estimation from the ten book-to-market portfolios on the earlier subsample ranging from 1930 to 1962. Panel B in Table 9 reports the risk premia estimates obtained over this sample period. All risk premia estimates are positive for three of the IST proxies (*Ishock*, *IMC*, and *PC1*), although not statistically significant. The estimates from *gIMC* are mostly negative but insignificant. These estimates are in sharp contrast to the negative values obtained in Panel A. In Panel C we combine both subsamples and estimate risk premia from book-to-market portfolios over the entire 1930–2012 sample. The risk premia estimates over this sample period from three measures (*Ishock*, *IMC*, and *PC1*) are positive and statistically significant, with the exception of the estimates obtained after controlling for *MKT*, which are not statistically significant. In contrast, estimates from *gIMC* is mostly negative, and statistically significant only when consumption growth is controlled for (model (3d)).

In summary, our analysis suggests that, when using book-to-market portfolios as test assets, the estimates of the IST risk premium seem to be sensitive to the sample period used. Estimates are typically negative in the more recent 1963–2012 sample but are positive in both the earlier 1930–1962 sample and in the entire 1930–2012 sample. In contrast, as illustrated in the results of Table 2 and the subsample analysis of Tables 5 and 8, our estimates of the IST risk premium are much less sensitive to the sample period used. This finding illustrates the importance of using a broad cross-section of test assets in the estimating IST risk premia.[11]

4.3 Different methodologies: Fama-MacBeth versus GMM

Our analysis relies on two-stage Fama-MacBeth regressions in estimating the IST risk premium. This approach has the flexibility to use different samples in estimating betas

[11] We also estimate the IST risk premium using only 30-industry portfolios. The estimates are mostly positive (but insignificant) for the 1930–2012 sample period and negative (but insignificant) for the 1963–2012 period. Results are available upon request.

(e.g., full-window vs. expanding- or rolling-window estimates). However, the majority of studies that estimate the IST risk premium do so by using GMM in estimating the price of risk parameter in a stochastic discount factor (SDF) where one of the risk sources are IST shocks. Theoretically, the estimates from the two methodologies should be identical and the difference should only concern the computation of the standard errors of the estimates. In this subsection we verify that our analysis is indeed not affected by whether we rely on two-stage Fama-MacBeth regressions or on GMM when estimating the IST risk premium.

The GMM approach usually starts by positing a model for the SDF, e.g.,

$$m = a - b_x \Delta x - b_z \Delta z, \tag{4}$$

where a is a constant, b_x and b_z are the price of risk for the two shocks x and z respectively. In our setting, z shock is the IST shock and the x shock is the disembodied shocks (e.g., *MKT*, *TFP*, or gC).

The model pricing errors are used as moment restrictions. That is, to estimate the parameters in (4) it is imposed the SDF (4) prices the cross section of asset returns. In most applications, the SDF is normalized to one, i.e., $\mathbb{E}[m] = 1$, which allows to state the moment restrictions in terms of excess returns as follows:

$$\mathbb{E}[R_i^e] = -\text{cov}(m, R_i^e), \tag{5}$$

where R_i^e denotes excess return over the risk-free rate of the i-th portfolio. In the estimation, moment restrictions are weighted via a weighting matrix (typically the identity matrix is used in the first-stage GMM estimate) and standard errors of the estimates are computed using the Newey and West (1987) procedure.

To compare the risk premia estimate from GMM to those from Fama-MacBeth, note that the $b's$ in eq.(4) are different from the $\lambda's$ we reported in Section 3. The relation between these two quantities is given by (see, e.g., Section 13.4 of Cochrane (2005)):

$$\lambda = E(ff')b, \tag{6}$$

where $\lambda = (\lambda_x, \lambda_z)'$, $f = (\Delta_x, \Delta_z)'$ and $b = (b_x, b_z)'$.

Table 10 reports the GMM estimates of the IST risk premium which is obtained from the GMM estimates of the prices of risk in (4) via the transformation (6). Panel A assumes that (5) holds, while panel B allows a constant error in the pricing equation, i.e., $\mathbb{E}[R_i^e] + \text{cov}(m, R_i^e) = \alpha$, where α is a constant to be estimated. Allowing for a constant pricing error in the moment conditions (5) is equivalent to allowing for an intercept in the second stage Fama-MacBeth cross-sectional regressions. Indeed, the point estimates in Panel B of Table 10 are exactly identical to the point estimates in Table 2. The only difference between the two methodologies is in the t-statistics and the overall inference from the two approaches are the same. Second, when we assume a zero pricing error in (5) (Panel A of Table 10), the point estimates of IST risk premium can be quite different from those obtained by allowing for a constant pricing error (Panel B). For example, in model (2a), the point estimate of IST risk premium is 11.4% assuming no pricing error (panel A), it becomes 3.69% if we allow pricing error (panel B). Therefore, restricting the model to have a zero pricing error in GMM may bias the slope estimates as in regressions without intercept. Finally, as we report in Table 1, the correlation between the IST measures (z) and the disembodied shocks ($x = MKT, TFP, gC$) may switch signs across different sample period. Time-varying correlations across the factors may imply that, the λ's and b's may have opposite signs when the factors are negatively correlated.

In summary, the analysis in this section shows that the negative estimate for the IST risk premium obtained by using post 1963 data and ten book-to-market portfolios is sample specific: the estimate becomes positive if we either use a longer sample (while still relying on ten book-to-market portfolios) or if we use a larger set of test assets for the post-1963 period. These findings help us understand the difference in the sign of the IST risk premium estimates between our analysis and existing studies.

5 Conclusion

In this paper we assess whether capital-embodied investment specific (IST) shocks can explain the value premium and momentum profits. We obtain three main results: (1) using commonly used measures of IST shocks, a long data sample from 1930 to 2012, and a broad cross section of 40 test assets, we estimate a *positive* annual risk premium for IST shocks; (2) we show that empirical inferences based on commonly used proxies of IST shocks are sensitive both to the time period considered and to the set of test assets employed; (3) we find some weak evidence that IST shocks can explain value premium but much less so for the case of momentum profits.

Our findings call for further efforts in understanding how investment shocks and heterogeneity in firms' investment decisions can generate cross sectional return patterns of the magnitude observed in the data. Exploring alternative measures of IST shocks to those existing in the literature appears to be of first-order importance to gain a better understanding of their effect on asset returns.

A Data details

A.1 Macroeconomic variables

Price deflator of consumption goods (P_C): the price deflator for nondurable consumption goods (row 5 of NIPA table 1.1.9). The annual series is available since 1929. The quarterly series is available since 1947I.

Price deflator of investment goods (P_I): the price deflator for equipment and software in the gross private domestic investment (row 11 of NIPA table 1.1.9). The availability of this series is the same as P_C. To take into account the quality adjustment, we employ instead the quality-adjusted series of Israelsen (2010).

Israelsen (2010) follows Gordon (1990) and Cummins and Violante (2002) and extends the annual quality-adjusted price series to the period of 1947-2006. We are grateful to Ryan Israelsen for kindly providing us with the long annual series for the period 1930–2012 which he constructed using the same methodology of Israelsen (2010).

Because the quarterly series of quality-adjusted investment goods price is not directly available, we approximate the growth rate of the quality-adjusted price from the unadjusted price. Specifically, we adjust equally the growth rates of investment good price for the four quarters in a year by the same amount as the annual quality adjustment. The annual growth rate adjustment is the difference in the growth rate between quality-adjusted price and NIPA's unadjusted price. This approach captures the year to year variation in quality adjustment while keeping the within year quarterly adjustment constant.

GDP and consumption expenditure growth: we measure economy-wide macroeconomic conditions using the annual growth rates of real GDP (row 1 of NIPA Table 1.1.1) and consumption (NIPA Table 1.1.1 contains personal consumption expenditures (PCE in row 2)). The annual data are available since 1930, and the quarterly data start from 1947II.

Growth rate spread in investment and consumption (gIMC): we measure the aggregate investment as the nonresidential investment (row 9 of NIPA Table 1.1.5) and the consumption as nondurable goods plus services (row 5 plus row 6 of NIPA Table 1.1.5). The $gIMC$ measure is the difference in the log growth rates of investment (gI) and consumption (gC). The annual data are available since 1930, and the quarterly data start from 1947II.

Total factor of productivity (*TFP*): the annual total factor of productivity data for 1930-1947 are from Kendrick (1961) (Table A-XXII for private domestic economy) and data for 1948-2012 are from the Bureau of Labor Statistics (multifactor productivity measure for private business sector). The quarterly data for 1947II-2012IV are from the Federal Reserve's business sector total factor productivity (available at http://www.frbsf.org/economic-research/total-factor-productivity-tfp/). In our regression analysis, we use the percentage change in TFP as a measure of the neutral technology risk.

A.2 Sector classification

Investment (I) and consumption (C) sectors: we rely on the procedure outlined in Gomes, Kogan, and Yogo (2009) and classify each Standard Industry Classification (SIC) code into either investment or consumption sector based on the 1987 benchmark input-output accounts. Gomes, Kogan, and Yogo (2009) provide a one-to-one match between SIC code and different categories of final demand, such as consumption (further classified as durable, nondurable, and services), investment, net exporter (NX), and government expenditure (G). Each industry specified by a SIC code is classified into the category of final demand to which it has the highest contribution. Their classification is available from Motohiro Yogo's website. We do not need the detailed classification within the consumption sector and we allocate NX and G to either the investment or consumption sector depending on whether they contribute more to the investment or consumption sector.

A.3 Financial data

Return factors: the standard Fama-French 3 factors (*MKT*, *SMB*, *HML*), and the momentum (*UMD*) factors are all available at the monthly frequencies since January 1930 from Ken French's website. We then construct these factors at the quarterly and annual frequencies from the corresponding raw returns. For example, the annual market factor (*MKT*) is the raw annual market return minus the annual risk-free rate.

Test portfolios: we employ 10 size, 10 book-to-market, 10 momentum, and 10 industry portfolios in our main cross-sectional estimation of the IST risk premium. All these portfolios are downloaded from Ken French's website and are available since January 1930. We construct the corresponding quarterly and annually series from the monthly portfolio returns.

***IMC* return:** to construct the *IMC* return, a firm's sector classification at June t is based on its SIC code from Compustat for the fiscal year ending in year $t-1$, if not missing, and on its SIC code from CRSP for June of year t, otherwise. The portfolio classification is then assigned to the firm in the next 12 months, from July of year t to June of year $t+1$. We calculate the value-weighted returns for each portfolio (I and C) using the lagged market value as weight, and then compound the monthly portfolio returns to quarterly and annual frequency based on calendar time. The *IMC* return is the investment sector return minus the consumption sector return. The *IMC* return is available since January 1930, at monthly, quarterly, and annually frequencies.

A.4 Principal component of IST measures

Principal component (*PC1*): we extract the first principal component of the three individual IST measures (*Ishock*, *IMC*, and *gIMC*). The *PC1* is normalized to have zero mean and unit volatility (i.e., 100%). The principal component depends on the sample period used in the extraction.

Table 1: Time series properties of IST shocks

This table reports the time series properties of the four measures of investment-specific shocks over different sample periods. *Ishock* is based on the relative price of capital goods to consumption goods, as defined in equation (1). *IMC* is the return spread between firms in investment and consumption goods sectors defined in equation 2. *gIMC* is the growth rate difference in investment and consumption defined in equation 3. The *PC1* is the first principal component of *Ishock*, *IMC*, and *gIMC*. The reported summary statistics are in percentage (per year for the annual data and per quarter for quarterly data). Panels A, B, C, and D report results for *Ishock*, *IMC*, *gIMC*, and *PC1*, respectively. *PCE* is the growth rate of personal consumption expenditures, *GDP* is the growth rate of real gross domestic product, and *TFP* is the growth rate of total factor of productivity. The return factors include Fama-French 3-factors (*MKT*, *SMB*, *HML*) and the momentum factor (*UMD*). The data are at either annual (A) or quarterly (Q) frequency. * and ** denote significance at the 10% and 5% levels, respectively.

	Summary Statistics		Correlations										
			Macro Factors			Return Factors				IST Measures			
	Mean	Stdev	*PCE*	*GDP*	*TFP*	*MKT*	*SMB*	*HML*	*UMD*	*Ishock*	*IMC*	*gIMC*	*PC1*
Panel A: *Ishock*													
1930-2012 (A):	3.45**	3.68	0.20*	0.46**	0.22**	0.07	0.15	0.11	0.26**	1.00	0.03	0.15	0.61**
1930-1962 (A):	1.96**	4.08	0.30*	0.68**	0.51**	0.50**	0.55**	0.43**	0.23	1.00	0.11	0.13	0.55**
1963-2012 (A):	4.44**	3.04	-0.01	0.21	-0.05	-0.35**	-0.19	-0.22	0.39**	1.00	0.02	0.33**	0.82**
1948-2012 (A):	3.87**	3.03	-0.02	0.16	-0.04	-0.29**	-0.05	-0.10	0.30**	1.00	0.03	0.23*	0.78**
1948-2012 (Q):	0.97**	1.25	0.00	0.14**	0.03	0.01	0.03	0.11*	0.03	1.00	0.12**	0.06	0.66**
Panel B: *IMC*													
1930-2012 (A):	0.50	13.76	0.06	-0.02	0.10	0.43**	0.22**	0.18	0.12	0.03	1.00	0.13	0.54**
1930-1962 (A):	1.81	13.97	0.07	-0.07	0.05	0.61**	0.41**	0.69**	0.28	0.11	1.00	0.22	0.70**
1963-2012 (A):	-0.37	13.70	0.06	0.04	0.14	0.26*	0.10	-0.32**	0.04	0.02	1.00	-0.00	0.05
1948-2012 (A):	0.03	12.94	0.09	0.05	0.16	0.35**	0.12	-0.11	0.06	0.03	1.00	0.00	0.10
1948-2012 (Q):	0.02	5.20	0.20**	0.22**	0.25**	0.41**	0.27**	-0.13**	-0.00	0.12**	1.00	0.07	0.69**
Panel C: *gIMC*													
1930-2012 (A):	0.18	12.22	0.72**	0.16	0.28**	0.01	-0.12	0.01	0.26**	0.15	0.13	1.00	0.75**
1930-1962 (A):	0.39	18.40	0.79**	0.09	0.31*	0.06	-0.12	-0.01	0.30*	0.13	0.22	1.00	0.72**
1963-2012 (A):	0.04	5.35	0.47**	0.65**	0.21	-0.12	-0.19	0.10	0.42**	0.33**	-0.00	1.00	0.82**
1948-2012 (A):	0.14	5.48	0.50**	0.66**	0.28**	-0.21*	-0.22*	-0.02	0.45**	0.23*	0.00	1.00	0.78**
1948-2012 (Q):	0.03	2.32	0.29**	0.52**	0.29**	-0.10*	-0.12*	0.03	0.11*	0.06	0.07	1.00	0.52**
Panel D: *PC1*													
1930-2012 (A):	0.00	100.00	0.57**	0.32**	0.32**	0.23**	0.10	0.14	0.34**	0.61**	0.54**	0.75**	1.00
1930-1962 (A):	0.00	100.00	0.60**	0.30*	0.41**	0.57**	0.38**	0.54**	0.55**	0.55**	0.70**	0.72**	1.00
1963-2012 (A):	0.00	100.00	0.29**	0.53**	0.11	-0.28*	-0.23	-0.08	0.50**	0.82**	0.05	0.82**	1.00
1948-2012 (A):	0.00	100.00	0.31**	0.52**	0.16	-0.29**	-0.16	-0.09	0.49**	0.78**	0.10	0.78**	1.00
1948-2012 (Q):	0.00	100.00	0.25**	0.43**	0.29**	0.20**	0.12**	-0.01	0.06	0.66**	0.69**	0.52**	1.00

Table 2: Risk premium of IST shocks (annual)

This table reports the estimated IST risk premium (in percentage) from Fama-MacBeth cross-sectional regressions. The sample is based on annual data from 1930 to 2012, and the test assets are: size deciles, book-to-market deciles, momentum deciles, and 10 industry portfolios. The four IST measures are *Ishock*, *IMC*, *gIMC*, and *PC1*. We consider both a one factor model and two-factor models with the second factor being either the market return (MKT), the growth rate of TFP (TFP), or the growth rate of aggregate consumption (gC). We use the full-sample window in the first-stage beta estimation. The t-statistics in parentheses for the risk premium are Newey-West adjusted with a lag length of 3 years.

	(1) *Ishock*				(2) *IMC*				(3) *gIMC*				(4) *PC1*			
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)	(3a)	(3b)	(3c)	(3d)	(4a)	(4b)	(4c)	(4d)
Intercept	7.32	3.70	4.99	7.66	6.75	2.13	3.90	4.25	9.48	-1.32	3.79	7.30	5.72	4.22	4.14	5.50
	(3.71)	(1.12)	(2.44)	(3.62)	(3.66)	(0.49)	(1.86)	(2.19)	(4.41)	(-0.37)	(1.83)	(3.70)	(3.14)	(1.24)	(1.97)	(2.97)
λ_{Ishock}	3.77	3.31	3.08	3.81												
	(3.26)	(3.70)	(3.49)	(3.21)												
λ_{IMC}					3.69	1.67	0.66	3.19								
					(1.69)	(1.04)	(0.40)	(1.50)								
λ_{gIMC}									2.09	9.59	8.28	1.62				
									(0.67)	(3.87)	(3.60)	(0.50)				
λ_{PC1}													71.6	64.6	62.3	79.0
													(2.93)	(3.72)	(3.14)	(3.48)
λ_{MKT}		4.88				6.71				10.4				4.78		
		(1.34)				(1.46)				(2.53)				(1.28)		
λ_{TFP}			2.04				3.49				3.40				2.12	
			(1.66)				(3.29)				(3.02)				(1.62)	
λ_{g_c}				0.97				4.70				4.40				3.01
				(0.64)				(3.43)				(2.84)				(2.44)
adj.R^2	0.10	0.29	0.23	0.17	0.17	0.27	0.21	0.22	0.13	0.28	0.27	0.17	0.11	0.30	0.22	0.17

Table 3: Portfolio returns and factor loadings on IST shocks

This table reports the portfolio returns and their factor loadings on IST shocks. Panel A and B report quantities for portfolio sorted on book-to-market and past performance, respectively. The sample is based on annual data from 1930 to 2012. The average returns in excess of risk-free rate are in percentage per year. The factor loadings (betas) are estimated using the full sample time series. We report the univariate loadings of portfolio returns on four IST measures. The column HML (WML) reports values for the high-minus-low (winner-minus-loser) portfolio. The t-statistics (in parentheses) are adjusted for heteroskedasticity and autocorrelations.

Panel A: B/M portfolios

Variable	Low	2	3	4	5	6	7	8	9	High	HML
r	6.61	7.96	7.31	8.24	8.94	9.40	9.50	11.91	12.08	13.67	7.05
β_{Ishock}	0.22	0.13	0.20	0.74	0.97	0.97	0.68	0.36	0.89	1.19	0.98
t-stat	(0.27)	(0.17)	(0.26)	(0.75)	(1.07)	(1.03)	(0.68)	(0.35)	(0.87)	(1.07)	(1.48)
β_{IMC}	0.69	0.48	0.47	0.72	0.66	0.69	0.64	0.83	0.72	1.09	0.40
t-stat	(4.52)	(3.75)	(3.73)	(2.93)	(2.89)	(3.34)	(2.33)	(2.72)	(2.30)	(2.66)	(0.97)
β_{gIMC}	0.00	-0.09	-0.09	0.06	0.01	0.28	0.08	-0.01	-0.02	-0.23	-0.23
t-stat	(0.00)	(-0.41)	(-0.44)	(0.24)	(0.02)	(1.04)	(0.27)	(-0.04)	(-0.05)	(-0.61)	(-1.06)
β_{PC1}	0.05	0.02	0.03	0.06	0.06	0.08	0.06	0.06	0.06	0.07	0.03
t-stat	(1.94)	(0.93)	(1.07)	(1.81)	(1.73)	(2.58)	(1.51)	(1.41)	(1.45)	(1.44)	(0.68)

Panel B: Momentum portfolios

Variable	Loser	2	3	4	5	6	7	8	9	Winner	WML
r	0.80	5.25	5.60	7.20	6.68	7.79	8.60	10.41	11.47	15.70	14.90
β_{Ishock}	-0.47	0.23	-0.02	0.46	0.04	0.10	0.31	0.90	0.96	1.22	1.69
t-stat	(-0.37)	(0.22)	(-0.02)	(0.51)	(0.05)	(0.11)	(0.35)	(1.16)	(1.19)	(1.26)	(1.80)
β_{IMC}	1.16	0.80	0.57	0.69	0.44	0.61	0.50	0.70	0.69	0.87	-0.29
t-stat	(4.15)	(3.87)	(2.80)	(2.61)	(2.78)	(3.10)	(2.91)	(3.61)	(3.39)	(4.89)	(-0.99)
β_{gIMC}	-0.52	-0.16	-0.11	-0.01	0.00	0.02	0.08	0.15	0.14	0.18	0.71
t-stat	(-1.45)	(-0.52)	(-0.38)	(-0.06)	(0.01)	(0.07)	(0.33)	(0.68)	(0.57)	(0.66)	(2.56)
β_{PC1}	0.02	0.04	0.03	0.05	0.03	0.04	0.04	0.07	0.07	0.09	0.07
t-stat	(0.52)	(1.07)	(0.74)	(1.39)	(0.90)	(1.31)	(1.38)	(2.65)	(2.62)	(3.53)	(1.83)

Table 4: Expected value premium and momentum profits (annual)

This table reports the estimated value premium and momentum profits (in percentage) based on the high-minus-low (HML) and winner-minus-loser (WML) portfolios. The sample is based on annual data from 1930 to 2012. The expected risk premium due to the exposure to a risk factor is calculated as the risk exposure (β) multiplied with the risk premium of the corresponding risk factor (λ). The risk exposures are estimated using the full-sample as in Table 3, and the risk premia of risk factors are estimated using the same models as in Table 2. Column t(diff1) reports the t-statistics testing the null hypothesis that the differences between the observed value premium or momentum profits and the expected values (using all the risk factors in the model) are on average zero. Column t(diff2) reports the t-statistics testing the null hypothesis that the differences between the observed value premium or momentum profits and the expected values based on the IST exposure alone ($\beta_{IST}\lambda_{IST}$) are on average zero. Note that for univariate models, the two tests are equivalent and we therefore report only the second test. The t-statistics are Newey-West adjusted with a lag length of 3 years.

Panel A: Value Premium						
Factors	$\widehat{HML}$	$\frac{\widehat{HML}}{HML}$	t(diff1)	$\beta_{IST}\lambda_{IST}$	$\frac{\beta_{IST}\lambda_{IST}}{HML}$	t(diff2)
Ishock:	—	—	—	3.69	52%	1.60
Ishock & *MKT*:	4.79	68%	1.24	2.67	38%	1.84
Ishock & *TFP*:	4.28	61%	1.43	2.63	37%	1.85
Ishock & *gC*:	4.10	58%	1.55	4.34	62%	1.34
IMC:	—	—	—	1.47	21%	2.51
IMC & *MKT*:	2.94	42%	2.54	0.24	3%	2.54
IMC & *TFP*:	3.32	47%	1.90	0.25	4%	2.77
IMC & *gC*:	2.54	36%	2.09	1.31	19%	2.57
gIMC:	—	—	—	-0.47	-7%	3.30
gIMC & *MKT*:	2.36	33%	2.52	-2.27	-32%	3.41
gIMC & *TFP*:	2.54	36%	2.46	-2.60	-37%	3.66
gIMC & *gC*:	1.74	25%	2.93	-0.53	-8%	3.59
PC1:	—	—	—	1.81	26%	2.22
PC1 & *MKT*:	2.39	34%	2.51	0.29	4%	2.54
PC1 & *TFP*:	2.93	42%	2.15	1.15	16%	2.34
PC1 & *gC*:	1.86	26%	2.18	2.23	32%	2.01

Panel B: Momentum Profit						
Factors	$\widehat{WML}$	$\frac{\widehat{WML}}{WML}$	t(diff1)	$\beta_{IST}\lambda_{IST}$	$\frac{\beta_{IST}\lambda_{IST}}{WML}$	t(diff2)
Ishock:	—	—	—	6.37	43%	2.94
Ishock & *MKT*:	4.74	32%	5.45	5.90	40%	3.83
Ishock & *TFP*:	6.00	40%	3.29	4.95	33%	4.31
Ishock & *gC*:	5.07	34%	5.40	4.20	28%	4.03
IMC:	—	—	—	-1.08	-7%	6.46
IMC & *MKT*:	-1.40	-9%	6.60	-0.32	-2%	6.00
IMC & *TFP*:	3.96	27%	4.62	-0.21	-1%	6.35
IMC & *gC*:	4.86	33%	5.59	-0.78	-5%	6.40
gIMC:	—	—	—	1.47	10%	6.67
gIMC & *MKT*:	4.51	30%	6.91	6.82	46%	4.79
gIMC & *TFP*:	6.05	41%	5.98	5.82	39%	6.19
gIMC & *gC*:	3.60	24%	7.37	0.95	6%	6.91
PC1:	—	—	—	4.72	22%	3.51
PC1 & *MKT*:	3.74	25%	6.45	5.21	35%	4.38
PC1 & *TFP*:	4.43	30%	3.80	4.01	27%	4.20
PC1 & *gC*:	6.13	41%	4.45	3.59	24%	4.66

Table 5: Risk premium of IST shocks: 1948–2012

This table reports the estimated IST risk premium from Fama-MacBeth cross-sectional regressions. The table is the same as Table 2, except that the sample starts from 1948 instead of 1930. We use both the annual (Panel A) and quarterly (Panel B) data, and the full-sample is used in the first-stage beta estimation.

	(1) *Ishock*				(2) *IMC*				(3) *gIMC*				(4) *PC1*			
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)	(3a)	(3b)	(3c)	(3d)	(4a)	(4b)	(4c)	(4d)
Panel A: annual data																
Intercept	11.1	8.00	10.2	11.2	8.76	10.5	8.20	11.4	10.8	4.48	9.88	12.0	11.2	10.4	9.01	12.0
	(6.03)	(2.34)	(5.27)	(6.11)	(5.31)	(2.83)	(4.61)	(7.03)	(5.96)	(1.24)	(5.03)	(6.99)	(6.02)	(3.20)	(4.73)	(7.11)
λ_{Ishock}	1.06	1.42	1.09	-0.73												
	(1.78)	(2.18)	(1.85)	(-0.93)												
λ_{IMC}					0.70	1.18	0.76	1.44								
					(0.38)	(0.66)	(0.40)	(0.74)								
λ_{gIMC}									1.87	3.31	2.81	1.04				
									(1.86)	(3.02)	(2.88)	(0.86)				
λ_{PC1}													32.4	23.6	23.3	20.0
													(2.06)	(2.05)	(1.87)	(1.62)
λ_{MKT}		1.30				-1.35				5.41				-1.05		
		(0.36)				(-0.37)				(1.38)				(-0.32)		
λ_{TFP}			0.77				0.71				1.06				0.54	
			(1.30)				(1.32)				(1.91)				(0.93)	
λ_{g_c}				2.28				2.01				1.78				1.52
				(3.34)				(3.40)				(2.39)				(2.93)
adj.R^2	0.11	0.25	0.23	0.18	0.13	0.26	0.23	0.22	0.16	0.27	0.27	0.25	0.14	0.27	0.21	0.19
Panel B: quarterly data																
Intercept	2.04	2.38	1.91	1.89	1.99	3.29	1.81	2.17	2.35	2.10	2.04	2.15	1.95	3.09	1.73	2.10
	(4.21)	(3.58)	(4.41)	(3.95)	(4.59)	(4.15)	(4.16)	(5.02)	(4.74)	(3.20)	(4.07)	(4.29)	(4.50)	(4.13)	(3.89)	(4.86)
λ_{Ishock}	0.78	0.85	0.61	-0.24												
	(1.90)	(2.19)	(1.37)	(-0.68)												
λ_{IMC}					0.22	0.72	-0.03	-0.01								
					(0.49)	(1.57)	(-0.07)	(-0.02)								
λ_{gIMC}									0.47	0.70	0.99	0.95				
									(0.68)	(1.06)	(1.63)	(1.46)				
λ_{PC1}													11.2	28.9	0.32	15.2
													(0.85)	(2.09)	(0.02)	(1.14)
λ_{MKT}		-0.28				-1.13				0.09				-0.92		
		(-0.37)				(-1.32)				(0.12)				(-1.14)		
λ_{TFP}			0.40				1.67				1.40				1.22	
			(0.46)				(1.86)				(2.06)				(1.28)	
λ_{g_c}				0.81				0.87				0.78				0.87
				(3.60)				(3.91)				(3.74)				(3.84)
adj.R^2	0.07	0.22	0.19	0.15	0.14	0.21	0.21	0.22	0.11	0.21	0.22	0.22	0.12	0.22	0.20	0.20

Table 6: Expected value premium and momentum profits (annual): 1948-2012

This table reports the estimated value premium and momentum profits (in percentage) based on the high-minus-low (HML) and winner-minus-loser (WML) portfolios. The sample is based on annual data from 1948 to 2012. The expected risk premium due to the exposure to a risk factor is calculated as the risk exposure (β) multiplied with the risk premium of the corresponding risk factor (λ). The risk exposures are estimated using the full-sample as in Table 3, and the risk premia of risk factors are estimated using the same models as in Table 2. Column t(diff1) reports the t-statistics testing the null hypothesis that the differences between the observed value premium or momentum profits and the expected values (using all the risk factors in the model) are on average zero. Column t(diff2) reports the t-statistics testing the null hypothesis that the differences between the observed value premium or momentum profits and the expected values based on the IST exposure alone ($\beta_{IST}\lambda_{IST}$) are on average zero. Note that for univariate models, the two tests are equivalent and we therefore report only the second test. The t-statistics are Newey-West adjusted with a lag length of 3 years.

Panel A: Value Premium						
Factors	$\widehat{HML}$	$\frac{\widehat{HML}}{HML}$	t(diff1)	$\beta_{IST}\lambda_{IST}$	$\frac{\beta_{IST}\lambda_{IST}}{HML}$	t(diff2)
Ishock:	—	—	—	-0.56	-9%	3.03
Ishock & *MKT*:	-0.34	-6%	2.99	-0.49	-8%	2.92
Ishock & *TFP*:	1.22	20%	2.86	-0.52	-8%	2.99
Ishock & *gC*:	2.59	42%	2.30	0.46	8%	2.95
IMC:	—	—	—	-0.06	-1%	2.67
IMC & *MKT*:	-0.42	-7%	3.31	-0.19	-3%	2.78
IMC & *TFP*:	1.65	27%	2.82	-0.10	-2%	2.65
IMC & *gC*:	1.47	24%	2.09	-0.09	-1%	2.69
gIMC:	—	—	—	-0.69	-11%	3.16
gIMC & *MKT*:	-0.40	-6%	3.03	0.98	-16%	3.20
gIMC & *TFP*:	1.24	20%	2.82	-1.78	-29%	3.37
gIMC & *gC*:	1.67	27%	2.77	-0.60	-10%	3.43
PC1:	—	—	—	-0.77	13%	3.18
PC1 & *MKT*:	-0.91	-15%	3.37	-0.78	-13%	3.11
PC1 & *TFP*:	0.32	5%	4.01	-1.10	-18%	3.11
PC1 & *gC*:	0.71	12%	2.45	-0.80	-13%	3.04
Panel B: Momentum Profit						
Factors	$\widehat{WML}$	$\frac{\widehat{WML}}{WML}$	t(diff1)	$\beta_{IST}\lambda_{IST}$	$\frac{\beta_{IST}\lambda_{IST}}{WML}$	t(diff2)
Ishock:	—	—	—	2.17	14%	5.84
Ishock & *MKT*:	1.99	13%	5.88	2.32	15%	5.38
Ishock & *TFP*:	2.28	14%	5.75	2.24	14%	5.79
Ishock &*gC*:	5.86	37%	4.31	-1.22	-8%	6.03
IMC:	—	—	—	0.22	-1%	5.39
IMC & *MKT*:	0.19	1%	5.65	-0.20	-1%	5.25
IMC & *TFP*:	-0.04	0%	5.29	-0.24	-1%	5.40
IMC & *gC*:	6.24	39%	4.19	-0.33	-2%	5.37
gIMC:	—	—	—	4.05	25%	5.61
gIMC & *MKT*:	5.65	36%	5.71	6.72	42%	4.90
gIMC & *TFP*:	4.40	28%	5.49	6.65	42%	3.91
gIMC & *gC*:	5.35	34%	5.40	1.94	12%	5.53
PC1:	—	—	—	3.62	23%	5.95
PC1 & *MKT*:	2.30	14%	5.82	1.97	12%	5.25
PC1 & *TFP*:	1.71	11%	5.31	2.11	13%	4.82
PC1 & *gC*:	6.14	39%	4.45	1.41	9%	5.03

Table 7: Expected value premium and momentum profits (quarterly): 1948-2012

This table reports the estimated value premium and momentum profits (in percentage) based on the high-minus-low (HML) and winner-minus-loser (WML) portfolios. The sample is based on quarterly data from 1948I to 2012IV. The expected risk premium due to the exposure to a risk factor is calculated as the risk exposure (β) multiplied with the risk premium of the corresponding risk factor (λ). The risk exposures are estimated using the full-sample as in Table 3, and the risk premia of risk factors are estimated using the same models as in Table 2. Column t(diff1) reports the t-statistics testing the null hypothesis that the differences between the observed value premium or momentum profits and the expected values (using all the risk factors in the model) are on average zero. Column t(diff2) reports the t-statistics testing the null hypothesis that the differences between the observed value premium or momentum profits and the expected values based on the IST exposure alone ($\beta_{IST}\lambda_{IST}$) are on average zero. Note that for univariate models, the two tests are equivalent and we therefore report only the second test. The t-statistics are Newey-West adjusted with a lag length of 6 quarters.

Panel A: Value Premium

Factors	$\widehat{HML}$	$\frac{\widehat{HML}}{HML}$	t(diff1)	$\beta_{IST}\lambda_{IST}$	$\frac{\beta_{IST}\lambda_{IST}}{HML}$	t(diff2)
Ishock:	—	—	—	0.51	39%	1.74
Ishock & *MKT*:	0.55	41%	1.65	0.55	42%	1.63
Ishock & *TFP*:	0.50	38%	1.74	0.38	29%	1.70
Ishock & *gC*:	1.15	87%	0.38	-0.09	-7%	2.60
IMC:	—	—	—	0.00	0%	2.31
IMC & *MKT*:	-0.02	-1%	2.37	0.00	0%	2.31
IMC & *TFP*:	0.55	42%	2.11	0.00	0%	2.32
IMC & *gC*:	1.47	111%	-0.37	0.00	0%	2.31
gIMC:	—	—	—	-0.00	-1%	2.35
gIMC & *MKT*:	-0.01	-1%	2.35	-0.01	-1%	2.34
gIMC & *TFP*:	0.31	23%	1.97	-0.18	-13%	2.61
gIMC & *gC*:	1.26	95%	0.14	-0.11	-8%	2.54
PC1:	—	—	—	0.05	4%	2.25
PC1 & *MKT*:	0.13	10%	2.08	0.14	10%	2.06
PC1 & *TFP*:	0.37	28%	2.39	0.00	0%	2.28
PC1 & *gC*:	1.46	110%	-0.33	0.02	1%	2.30

Panel B: Momentum Profit

Factors	$\widehat{WML}$	$\frac{\widehat{WML}}{WML}$	t(diff1)	$\beta_{IST}\lambda_{IST}$	$\frac{\beta_{IST}\lambda_{IST}}{WML}$	t(diff2)
Ishock:	—	—	—	0.12	3%	5.39
Ishock & *MKT*:	0.23	6%	5.79	0.15	4%	5.41
Ishock & *TFP*:	0.07	2%	5.78	0.10	3%	5.61
Ishock & *gC*:	1.18	31%	3.78	0.02	1%	5.75
IMC:	—	—	—	-0.06	-2%	5.99
IMC & *MKT*:	0.24	6%	6.22	-0.07	-2%	5.75
IMC & *TFP*:	0.07	2%	5.65	0.01	0%	5.82
IMC & *gC*:	1.33	34%	3.92	0.00	0%	5.95
gIMC:	—	—	—	0.18	5%	6.19
gIMC & *MKT*:	0.17	4%	6.23	0.19	5%	5.68
gIMC & *TFP*:	0.24	6%	6.05	0.44	11%	5.55
gIMC & *gC*:	1.26	33%	4.29	0.30	8%	5.99
PC1:	—	—	—	-0.00	-1%	5.82
PC1 & *MKT*:	0.33	9%	6.03	0.05	1%	5.64
PC1 & *TFP*:	-0.05	-1%	5.87	-0.00	-0%	5.68
PC1 & *gC*:	1.30	34%	3.76	-0.10	-3%	5.97

Table 8: Risk premium of IST shocks estimated from 40 test assets (annual)

This table reports the estimated IST risk premium (in percentage) from Fama-MacBeth cross-sectional regressions on the same 40 test assets used in Table 2 but for different sample periods: 1930–1962 in Panel A and 1963–2012 in Panel B. The full-window for each sample period is used in the first-stage beta estimation. The t-statistics for the risk premium are Newey-West adjusted with a lag length of 3 years.

	(1) *Ishock*				(2) *IMC*				(3) *gIMC*				(4) *PC1*			
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)	(3a)	(3b)	(3c)	(3d)	(4a)	(4b)	(4c)	(4d)
Panel A: 1930-1962 sub-sample																
Intercept	2.98	2.64	2.82	3.71	6.07	0.43	3.48	2.51	12.3	-0.36	5.48	8.73	3.65	2.33	2.86	2.80
	(0.76)	(0.60)	(0.73)	(1.17)	(1.75)	(0.08)	(0.98)	(0.85)	(2.67)	(-0.08)	(1.68)	(2.62)	(1.04)	(0.48)	(0.80)	(0.98)
λ_{Ishock}	2.54	2.44	2.76	2.18												
	(1.83)	(1.81)	(2.03)	(1.75)												
λ_{IMC}					4.73	3.29	3.55	4.19								
					(1.76)	(1.56)	(1.51)	(1.63)								
λ_{gIMC}									-3.65	5.60	1.63	-1.86				
									(-0.57)	(1.38)	(0.36)	(-0.33)				
λ_{PC1}													52.6	44.4	60.9	59.9
													(1.93)	(2.52)	(2.04)	(1.99)
λ_{MKT}		7.81				10.2				11.1				8.41		
		(1.54)				(1.54)				(1.98)				(1.47)		
λ_{TFP}			2.03				2.88				3.75				2.57	
			(2.60)				(2.17)				(2.32)				(2.09)	
λ_{g_c}				1.69				3.76				3.02				3.08
				(0.72)				(1.43)				(1.19)				(1.23)
adj.R^2	0.21	0.31	0.25	0.25	0.21	0.31	0.26	0.24	0.10	0.32	0.23	0.15	0.20	0.32	0.24	0.23
Panel B: 1963-2012 sub-sample																
Intercept	8.52	7.61	8.12	8.19	7.59	8.43	7.19	9.67	8.72	3.79	7.97	9.92	8.97	6.24	8.41	9.30
	(4.17)	(1.99)	(3.51)	(3.97)	(4.32)	(2.17)	(3.50)	(5.45)	(4.71)	(0.91)	(3.75)	(5.37)	(4.59)	(1.58)	(3.76)	(4.82)
λ_{Ishock}	0.40	0.47	0.45	-1.08												
	(0.67)	(0.80)	(0.78)	(-1.31)												
λ_{IMC}					-0.13	0.13	-0.07	0.83								
					(-0.06)	(0.06)	(-0.03)	(0.36)								
λ_{gIMC}									1.92	2.97	2.48	1.00				
									(1.69)	(2.34)	(2.44)	(0.73)				
λ_{PC1}													22.5	28.9	28.1	-1.29
													(1.26)	(1.59)	(1.72)	(-0.06)
λ_{MKT}		0.14				-0.87				4.43				1.78		
		(0.03)				(-0.21)				(0.94)				(0.40)		
λ_{TFP}			0.34				0.29				0.66				0.48	
			(0.53)				(0.48)				(1.10)				(0.78)	
λ_{g_c}				2.43				1.98				1.83				2.14
				(2.99)				(2.79)				(2.27)				(2.56)
adj.R^2	0.14	0.27	0.24	0.23	0.15	0.26	0.25	0.25	0.15	0.27	0.25	0.25	0.15	0.28	0.25	0.25

Table 9: Risk premium of IST shocks estimated from B/M portfolios (annual)

This table reports the estimated IST risk premium (in percentage) from Fama-MacBeth cross-sectional regressions based on 10 B/M portfolios. The estimation methods used are the same as those described in Table 2 with the following exceptions: (i) the test assets are the 10 book-to-market portfolios; (ii) we use the full-window in the first-stage beta estimation; (iii) we consider sub-samples of the period 1930–2012. The t-statistics for the risk premium are Newey-West adjusted with a lag length of 3 years.

	(1) *Ishock*				(2) *IMC*				(3) *gIMC*				(4) *PC1*			
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)	(3a)	(3b)	(3c)	(3d)	(4a)	(4b)	(4c)	(4d)
Panel A: 1963-2012 sub-sample																
Intercept	0.78	3.52	1.33	1.63	9.07	-15.0	4.31	8.94	9.87	2.47	3.14	9.68	-0.40	4.35	0.53	0.66
	(0.28)	(0.82)	(0.51)	(0.67)	(4.60)	(-2.97)	(2.21)	(4.34)	(4.27)	(0.56)	(1.31)	(4.31)	(-0.14)	(0.99)	(0.20)	(0.26)
λ_{Ishock}	-3.18	-3.13	-2.15	-3.06												
	(-3.35)	(-3.49)	(-2.73)	(-3.56)												
λ_{IMC}					-5.92	-13.7	1.36	-7.45								
					(-1.51)	(-2.81)	(0.52)	(-2.99)								
λ_{gIMC}									4.42	7.88	-0.21	2.72				
									(1.43)	(2.46)	(-0.09)	(1.13)				
λ_{PC1}													-151	-162	-77.9	-141
													(-3.52)	(-3.18)	(-2.34)	(-3.70)
λ_{MKT}		3.53				22.0				6.38				2.18		
		(0.75)				(4.25)				(1.33)				(0.44)		
λ_{TFP}			1.04				1.91				1.97				1.19	
			(1.21)				(2.90)				(2.53)				(1.44)	
λ_{g_c}				0.56				-0.31				1.17				0.17
				(0.59)				(-0.28)				(1.19)				(0.19)
adj.R^2	0.22	0.33	0.37	0.39	0.14	0.26	0.37	0.11	0.03	0.05	0.32	0.14	0.17	0.30	0.38	0.37
Panel B: 1930-1962 sub-sample																
Intercept	4.53	1.36	5.13	5.43	5.02	-0.09	5.01	5.41	12.3	1.23	9.89	3.81	4.69	1.38	5.11	6.16
	(1.33)	(0.28)	(1.62)	(2.26)	(1.53)	(-0.01)	(1.60)	(2.35)	(2.63)	(0.33)	(2.92)	(1.15)	(1.60)	(0.24)	(1.79)	(2.72)
λ_{Ishock}	2.08	0.73	1.76	1.56												
	(1.61)	(0.76)	(1.41)	(1.45)												
λ_{IMC}					4.93	2.32	4.93	5.22								
					(1.67)	(1.10)	(1.69)	(1.48)								
λ_{gIMC}									-4.41	1.05	-3.14	-4.36				
									(-0.67)	(0.20)	(-0.51)	(-0.66)				
λ_{PC1}													42.3	21.0	38.3	24.7
													(1.72)	(1.12)	(1.48)	(1.31)
λ_{MKT}		8.99				10.5				9.11				8.97		
		(1.70)				(1.34)				(1.77)				(1.49)		
λ_{TFP}			0.11				0.07				1.24				0.09	
			(0.13)				(0.08)				(1.03)				(0.11)	
λ_{g_c}				0.48				-0.99				7.41				-2.63
				(0.18)				(-0.33)				(1.55)				(-0.73)
adj.R^2	0.30	0.37	0.31	0.38	0.33	0.37	0.35	0.39	0.08	0.44	0.17	0.31	0.27	0.43	0.27	0.39
Panel C: 1930-2012 full-sample																
Intercept	7.17	-5.24	5.15	7.53	2.33	-8.27	2.29	2.18	9.56	-5.26	4.40	4.18	5.68	-5.25	4.76	4.52
	(3.97)	(-1.26)	(2.94)	(4.21)	(1.05)	(-1.55)	(1.04)	(0.99)	(4.37)	(-1.27)	(2.41)	(2.09)	(3.40)	(-1.23)	(2.76)	(2.56)
λ_{Ishock}	3.76	0.05	2.66	3.97												
	(2.49)	(0.05)	(1.94)	(2.51)												
λ_{IMC}					10.4	-1.24	9.33	9.69								
					(2.95)	(-0.50)	(2.60)	(2.85)								
λ_{gIMC}									-5.08	0.67	-3.18	-7.40				
									(-1.79)	(0.25)	(-1.21)	(-2.24)				
λ_{PC1}													71.6	9.15	43.1	85.1
													(2.51)	(0.45)	(1.69)	(2.69)
λ_{MKT}		13.8				16.7				13.8				13.8		
		(3.22)				(3.03)				(2.98)				(3.06)		
λ_{TFP}			2.05				0.69				2.50				2.41	
			(2.79)				(0.99)				(2.84)				(2.85)	
λ_{g_c}				0.91				0.55				7.98				-2.91
				(0.57)				(0.36)				(2.62)				(-1.29)
adj.R^2	0.15	0.34	0.17	0.20	0.21	0.31	0.16	0.28	0.05	0.36	0.22	0.35	0.11	0.35	0.15	0.19

Table 10: Risk premium of IST shocks (annual): GMM

This table reports the estimated IST risk premium (in percentage) from GMM approach. The sample is based on annual data from 1930 to 2012, and the test assets are: size deciles, book-to-market deciles, momentum deciles, and 10 industry portfolios. The four IST measures are *Ishock*, *IMC*, *gIMC*, and *PC1*. We consider both a one factor model and two-factor models with the second factor being either the market return (MKT), the growth rate of TFP (TFP), or the growth rate of aggregate consumption (gC). We report the estimates from first-stage GMM using identity weighting matrix. We also report the mean absolute pricing error (MAPE) for each model. The t-statistics for the risk premium are Newey-West adjusted with a lag length of 3 years.

	(1) *Ishock*				(2) *IMC*				(3) *gIMC*				(4) *PC1*			
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)	(3a)	(3b)	(3c)	(3d)	(4a)	(4b)	(4c)	(4d)
Panel A: assuming zero error in moments																
λ_{Ishock}	10.8	3.14	2.80	9.12												
	(0.88)	(3.16)	(1.48)	(0.97)												
λ_{IMC}					11.4	1.03	1.63	5.91								
					(1.94)	(0.67)	(0.38)	(1.16)								
λ_{gIMC}									-11.5	8.76	11.4	-1.78				
									(-1.55)	(2.00)	(1.30)	(-0.08)				
λ_{PC1}													161	59.5	83.2	171
													(1.19)	(3.38)	(1.98)	(1.19)
λ_{MKT}		8.18				8.68				9.16				8.53		
		(2.04)				(3.56)				(2.27)				(2.29)		
λ_{TFP}			4.73				5.44				5.32				4.35	
			(1.62)				(1.83)				(1.66)				(1.58)	
λ_{g_c}				13.0				7.70				14.5				7.13
				(0.70)				(1.43)				(0.86)				(1.20)
MAPE (%)	4.24	1.45	1.89	3.64	2.71	1.64	1.90	2.01	9.26	1.73	1.92	3.22	2.43	1.63	1.90	2.29
Panel B: assuming a constant error in moments																
Constant	7.32	3.70	4.99	7.66	6.75	2.13	3.90	4.25	9.48	-1.32	3.79	7.30	5.72	4.22	4.14	5.50
	(1.64)	(1.10)	(1.53)	(1.67)	(3.08)	(0.57)	(1.13)	(1.07)	(4.18)	(-0.36)	(1.01)	(1.79)	(1.68)	(1.16)	(1.23)	(1.41)
λ_{Ishock}	3.77	3.31	3.08	3.81												
	(3.03)	(3.16)	(2.44)	(3.13)												
λ_{IMC}					3.69	1.67	0.66	3.19								
					(1.93)	(1.31)	(0.20)	(1.17)								
λ_{gIMC}									2.09	9.59	8.28	1.62				
									(0.59)	(2.44)	(1.58)	(0.25)				
λ_{PC1}													71.6	64.6	62.3	79.0
													(2.97)	(3.75)	(2.90)	(3.38)
λ_{MKT}		4.88				6.71				10.4				4.78		
		(1.29)				(1.73)				(2.10)				(1.25)		
λ_{TFP}			2.04				3.49				3.40				2.12	
			(1.39)				(2.52)				(2.21)				(1.69)	
λ_{g_c}				0.97				4.70				4.40				3.01
				(0.55)				(2.65)				(2.41)				(1.88)
MAPE (%)	1.61	1.43	1.48	1.57	1.82	1.68	1.66	1.77	2.21	1.72	1.69	2.12	1.75	1.65	1.56	1.76

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