

Finance and Economics Discussion Series

Federal Reserve Board, Washington, D.C.

ISSN 1936-2854 (Print)

ISSN 2767-3898 (Online)

The Response of Equity Yields to a Long-Run Shock

Martijn Boons, Anthony M. Diercks, Petra Sinagl, Andrea Tamoni

2026-044

Please cite this paper as:

Boons, Martijn, Anthony M. Diercks, Petra Sinagl, and Andrea Tamoni (2026). "The Response of Equity Yields to a Long-Run Shock," Finance and Economics Discussion Series 2026-044. Washington: Board of Governors of the Federal Reserve System, <https://doi.org/10.17016/FEDS.2026.044>.

NOTE: Staff working papers in the Finance and Economics Discussion Series (FEDS) are preliminary materials circulated to stimulate discussion and critical comment. The analysis and conclusions set forth are those of the authors and do not indicate concurrence by other members of the research staff or the Board of Governors. References in publications to the Finance and Economics Discussion Series (other than acknowledgement) should be cleared with the author(s) to protect the tentative character of these papers.

The Response of Equity Yields to a Long-Run Shock*

Martijn Boons Anthony M. Petra Sinagl Andrea Tamoni
Diercks

April 4, 2026

Abstract

We study how macroeconomic developments affect asset prices by analyzing the response of equity yields to a well-identified long-run growth shock. Using synthetic equity yield data from Giglio et al. (2024), we show that a positive long-run shock steepens the equity yield curve by increasing expected dividend growth while leaving discount rates largely unchanged. We examine how the investment driving this growth is financed and how yields respond across value and growth firms. Growth-firm yields respond more strongly than value-firm yields, reflecting larger changes in expected dividend growth. Ai et al. (2018)'s model, modified to separate cash dividends from total payout, best matches these responses relative to benchmark equity term structure models.

Keywords: Equity term structure, TFP news shock, equity yields, dividend growth, discount rates, payout policy.

JEL Classification: G12, E32, O40.

*Martijn Boons is at Nova School of Business and Economics (martijn.boons@novasbe.pt). Anthony M. Diercks is at the Federal Reserve Board of Governors (anthony.m.diercks@frb.gov). Petra Sinagl is at the University of Iowa (petra-sinagl@uiowa.edu). Andrea Tamoni is at Mendoza College of Business at the University of Notre Dame (atamoni@nd.edu). We are grateful to Roberto Marfè and Tobias Sichert for insightful comments, and participants at the 2024 China International Conference in Finance, the SGF Conference 2024, and the Mini Finance & Econometrics conference at the University of Iowa. We also thank Benjamin Golez, Serhiy Kozak, and Jens Kvaerner for providing data and clarifying discussions. The views expressed herein are those of the authors and not necessarily those of the Board of Governors of the Federal Reserve System. *Corresponding author:* Petra Sinagl, University of Iowa, Tippie College of Business, 21 E Market St, Iowa City, Iowa 52242-1994; petra-sinagl@uiowa.edu.

1 Introduction

A central question in financial economics is how different macroeconomic shocks affect asset prices. We shed light on this question using a novel approach: we study the response of the equity term structure to a long-run growth shock, both empirically and in theoretical models. Identification of key economic drivers is crucial, as recent studies propose a host of different explanations that align with stylized facts about the unconditional equity term structure and its slope during good and bad times (see van Binsbergen and Koijen, 2017; Gormsen, 2021; Bansal et al., 2021). However, moments based on a specific definition of bad times (e.g., recessions or periods with low valuation ratios) are rarely the result of a single, well-identified primitive shock that can be mapped directly into a model. Consequently, even if a model is consistent with these facts, we cannot be certain that its proposed mechanism truly drives the observed data, as other forces might produce similar patterns.

Empirically, our main focus is on impulse responses to the total factor productivity (TFP) news shock of Kurmann and Otrok (2013). This shock is identified in a standard macro VAR as the structural innovation that explains most of the variation in long-run TFP. A large macroeconomic literature shows that it also raises consumption in the long run, making it a natural proxy for the long-run growth shock featured in asset-pricing models since Bansal and Yaron (2004). While prior studies document that this shock raises aggregate stock prices (e.g., Beaudry and Portier, 2004; Bretscher et al., 2021), we take a more granular approach by examining the response of key quantities that characterize the equity term structure. At the same time, we recognize that TFP news is only one of several primitive shocks that may affect consumption over the long run. For this reason, we also examine responses to innovations in the expected consumption growth series of Schorfheide et al. (2018), which reflects the combined influence of all shocks that drive consumption. Our findings are robust to either method, confirming that TFP news effectively captures the long-run consumption risks that matter for asset pricing.

We study two sets of quantities that help us understand how long-run shocks affect the

equity term structure. The first consists of short- and long-maturity equity yields for the market as well as for value and growth portfolios. Our analysis relies on the equity yields and their decomposition constructed and carefully validated by Giglio et al. (2024). These series are obtained from a rich affine model estimated on a large cross section of equity portfolios. Importantly, the model is estimated without using dividend strip prices, yet it closely matches the yields on traded S&P 500 dividend strips at standard maturities, both in levels and in their time-series dynamics, including during the Great Recession. The estimates are also robust across alternative specifications and out-of-sample exercises, providing strong evidence that the resulting yield series capture economically meaningful variation in expected dividend growth and discount rates.¹ Decomposing equity yields into expected dividend growth and risk premium components allows us to isolate the channels through which long-run shocks affect the equity term structure.

The second set of quantities helps us understand the real-side mechanism behind these yield responses. It consists of cash payout (dividends), total payout – defined as cash payout plus net repurchases following Davydiuk et al. (2023)– and investment. While Davydiuk et al. (2023) show that net repurchases are unconditionally acyclical, they may respond systematically to well-identified long-run shocks. If such shocks affect future dividends through investment, an important question is how this investment is financed, whether through reductions in cash payouts or through changes in net repurchases. As emphasized by Belo et al. (2015), understanding this financing margin is crucial for explaining the shape and dynamics of the equity term structure. These payout and investment measures are also valuable empirically because they are constructed from data sources independent of those used to estimate equity yields.

Our analysis uses impulse responses as new moments to discriminate among asset pricing models that feature a close counterpart to the long-run shock. In particular, we study three

¹Using only traded dividend strip data would not deliver the same level of precision, as these data are available only starting in 2004. Such a short sample would place disproportionate weight on the Great Recession.

benchmark equity term structure models: the long-run risk model of Bansal and Yaron (2004) and the affine models of Lettau and Wachter (2007) and Gormsen (2021). We also consider the production-based general equilibrium model of Ai et al. (2018, ACDL), which offers a conceptually distinct perspective. To ensure a consistent comparison, we calibrate the shock size in each model to produce the same increase in long-run dividends. Even though these models were not explicitly designed to speak to a decomposition of market equity yields into expected growth and risk premium components, they do generate distinct testable implications for these quantities. Therefore, evaluating how well these models align with our new moments offers valuable theoretical insights akin to an out-of-sample test. The first three models feature exogenous dividend processes and cannot distinguish between cash and total payouts. In contrast, the ACDL model can accommodate this distinction through an appropriate modification of the payout process. This modification is necessary, because the baseline ACDL model is formulated in terms of total payouts, whereas observed equity strip prices are based on dividends alone.² To separate cash from total payouts, we assume that investment and net repurchases offset each other conditional on a long-run growth shock. Because such a shock does not immediately increase firms' cash flows, unlike a short-run shock, any investment must (at least partly) be financed by raising new capital. Consistent with this assumption, the empirical responses of net repurchases and investment roughly offset each other. In addition, the ACDL model endogenously generates cross-sectional dynamics in equity yields, allowing it to speak to differences in yield-responses of value and growth firms.

We now turn to our results. In the data, the TFP news shock has a positive and significant impact on consumption and aggregate dividends in the long-run. Consistent with mean-reversion in growth, both variables increase rapidly right after the shock and then slowly converge to higher levels, reaching approximately 1% in five years. In line with these dynamics, the TFP shock also has a significant effect on the equity yield curve of the

²Belo et al. (2015) discuss the same challenge for their extension of Bansal and Yaron (2004). The model of Belo et al. (2019) contains some of the same ingredients as ACDL, but does not feature a long-run risk shock.

market portfolio.³ The response is driven by increases in expected dividend growth that are particularly pronounced for short-term claims (e.g., $> 1\%$ for the 1-year claim). The risk premium components of yields do not meaningfully respond. Combining, the level of the equity yield curve declines while the slope steepens following the shock. Quantitatively, the 10-1 year equity yield slope rises by about 1% in the first few quarters, with the effect taking more than two years to fully dissipate.

Importantly, these results are not specific to our choice of the TFP shock. Synthetic equity yields and their components respond similarly to innovations in expected consumption growth (Schorfheide et al., 2018). While this innovation does not qualify as a primitive shock as commonly defined in the macroeconomics literature (Ramey, 2016), it has two relative advantages. First, whereas TFP news is especially informative for production-based asset pricing models, the expected consumption growth shock directly reflects the mechanisms featured in theoretical consumption-based asset pricing models. Second, this shock can offer greater statistical power because it aggregates the effects of all primitive shocks that influence long-run consumption. Consistent with this last point, the estimated responses are quantitatively stronger than those obtained for TFP news. Our conclusions are also not specific to synthetic equity yields: we obtain similar responses using the option-implied short-term equity yield of van Binsbergen et al. (2012).

What do models have to say about these new moments? We find that all four models generate higher expected growth in response to a shock, leading equity yields to decline at all maturities but especially for the shortest 1-year claim. However, in the models of Bansal and Yaron (2004) and Lettau and Wachter (2007), these effects are quantitatively too small. For instance, the 10-1 year yield slope response is less than one-third of what we see in the data. Furthermore, the response of expected growth is too persistent in these models. The model of Gormsen (2021) features less persistent growth and matches market equity

³A forecast error variance decomposition shows that the variance contribution of the news shock is large for yields of all maturities (about 20% at horizons beyond 2 years) and well above the variance contribution of a short-run TFP shock ($< 7\%$).

yields more closely, but it counterfactually attributes too large a share of these yields to the risk-premium component and too little to expected growth. The reason is that this model assumes a negative correlation between the long-run growth shock and the discount rate shock – an assumption that is not supported by the data.

ACDL matches the response of equity yields about as well as Gormsen (2021), but correctly assigns all of this response to expected growth. Consistent with the data, the response of the risk premium component of both the 1- and 10-year claim is small in ACDL. Thus, with our reinterpretation of the payout process, ACDL does a good job matching the empirical responses of equity yields and their components to a long-run growth shock. Importantly, this conclusion could not have been reached by examining only the response of the realized term premium, defined as the return spread between a long- and short-term claim as in Gormsen (2021). The reason is that all models generate a higher realized term premium of about 1.5 to 3%, broadly consistent with the data.⁴ The response of the realized term premium is a combination of the responses of equity yields at different maturities and this combination turns out to hide important variation across models.

In the data, we further find that the aggregate cash and total payout for the market respond with opposite signs to the long-run shock, at about 0.05% and -0.55% (both measured as a fraction of consumption, as in Davydiuk et al. (2023)) at the peak and trough, respectively. This implies a large negative response of net repurchases, on the order of -0.6% , indicating that new issuance is the main source of funding for the increase in investment following a long-run growth shock. In other words, investment and net repurchases are strongly negatively correlated conditional on the long-run growth shock, as in our modification of the payout process in ACDL. This insight contributes to Davydiuk et al. (2023), who extend the Bansal and Yaron (2004) long-run risk model to account for the high volatility of net repurchases compared to cash payouts. Their extension assumes that the net repurchase process is

⁴This exposure is the main reason why a downward sloping term structure of expected dividend strip returns remains such a puzzle. Since long-run risk is larger for the long-term claim, exposure to other shocks must more than offset the long-run risk exposure to generate a downward sloping term structure.

independent of the long-run growth shock, an assumption we show to be counterfactual. While our modified ACDL model reproduces the opposite-signed responses of cash and total payouts to the long-run shock, it can only match the magnitude of the cash payout response.

Finally, we study cross-sectional variation in equity-yield responses. In the data, the responses of equity yields for the value and growth portfolios are qualitatively similar to the market, especially at horizons beyond the immediate impact of long-run shocks. The response of the equity yield slope and its components is roughly two to three times stronger for growth than for value, however. This model incorporates heterogeneous exposure to aggregate productivity risk across capital vintages and provides a structural interpretation in which value stocks represent claims on physical capital-intensive firms, while growth stocks correspond to intangible capital-intensive firms. The model effectively captures the longer-horizon dynamics of value versus growth because, beyond the initial shock, the demand for growth options (and subsequently, the cash flow for the growth firm) increases at a swift rate alongside physical investment. In contrast, the physical capital (value firm) cash flow, which is effectively the marginal product of capital, rises less quickly as the increase in productivity and labor are offset by the eventual rise in capital. This leads to a relatively smaller response in yields and expected dividend growth for the value firms, consistent with what we find in the data.

In contrast to ACDL, models that rely on the exogenous dividend share processes proposed in Lettau and Wachter (2007) imply identical responses for value and growth firms, a prediction that is not supported by the data. While Bansal and Yaron (2004) do not examine the cross-section, Breugem et al. (2024) extend the long-run risk framework to model value and growth firms separately. They assume that value firms have greater payout exposure to long-run shocks than growth firms, making them riskier. This assumption implies that equity yields at all maturities respond more strongly for value than for growth firms, an implication we show to be counterfactual. Overall, our results indicate that the value premium is not driven by value firms' exposures to long-run risk shocks, providing discipline for models

seeking to explain this premium.

We contribute to the literature by highlighting the important role of long-run shocks in shaping the equity term structure. We examine equity yields of different portfolios (market, value, and growth) as well as their decomposition into growth and risk premium components. We also analyze how the responses of these quantities vary across maturities (e.g., the 10-versus 1-year claim) and horizons (instantaneous versus long-run) as well as how investment shapes the dynamics of future dividends through the difference between cash and total payout. This broad empirical perspective offers new moments for distinguishing among competing models. Our analysis shows that a simple modification of the payout process in ACDL provides a compelling framework for understanding many of the responses we document. The model matches the data well in at least four key dimensions: (i) emphasizing the importance of expected dividend growth rather than risk premia; (ii) capturing larger responses of short-term claims; (iii) capturing the opposite response of cash versus total payout and thus the fact that new investment is largely financed through issuance; and, (iv) assigning a larger response to growth than value claims. In contrast, the benchmark equity term structure models that we consider match the data in at most two of these dimensions. Two aspects of our results present a challenge for ACDL. First, just like the other models, ACDL requires the shock to long-run dividends to be relatively large to generate impulse responses that match the data. Second, total payout is considerably less volatile in the model than it is in the data.

Our findings relate to a large and growing literature on the unconditional and conditional equity term structure. van Binsbergen et al. (2012); van Binsbergen and Koijen (2017); Golez and Jackwerth (2024) document that the market term premium is unconditionally negative (the term structure of expected dividend strip returns is downward sloping).⁵ However, Boguth et al. (2023a); Bansal et al. (2021) raise concerns about estimation and small sample

⁵Among others, Lettau and Wachter (2007, 2011); Weber (2018); Gormsen and Lazarus (2023); Gonçalves (2021) build on the idea of a downward sloping term structure to explain variation in average returns across assets with different duration, such as value versus growth.

issues. In particular, Bansal et al. (2021) argue that the unconditional evidence is sensitive to the relative frequency of bad versus good times. This fact highlights the importance of analyzing a long historical sample, as we do. Existing studies typically derive conditional moments by comparing recessions and expansions or periods of high and low valuation ratios. van Binsbergen et al. (2013); Gormsen (2021); Bansal et al. (2021) find that the term structure of equity yields and their risk premium component (i.e., hold-to-maturity returns) is pro-cyclical, sloping downward in bad times. Gormsen (2021) additionally studies the term structure of one-period returns (term premia) and finds it to be counter-cyclical (see also Golez and Jackwerth, 2024).

Unlike these studies, we focus on the response of both cash flows and discount rates to a well-identified long-run productivity shock and examine how this response aligns with the predictions of theoretical models that contain a similar shock. This approach – popular in macroeconomics since the seminal work of Sims (1980); Kydland and Prescott (1982) – allows for a clean comparison of models.^{6/7} Recessions or low valuation ratios are typically the result of a combination of shocks that propagate through the economy due to, among other possible causes, rational agents’ responses, binding (financial) constraints, and deteriorating sentiment. Each of these propagation mechanisms has a distinct impact on equity risk premia and dividend growth, both contributing to variation in the dividend-to-price ratio. The structural productivity shock we study holds many confounding factors constant. Consequently, comparing model fit based on impulse responses leads to a different ranking than, for instance, Gormsen (2021). This finding confirms that some models may match certain moments studied in Gormsen (2021) for the wrong reasons, namely for reasons unrelated to the theoretical response to a long-run growth shock. We view the two approaches – studying unconditional and conditional moments, and analyzing responses to a well-identified shock – as complementary. Combining them should increase the power of future tests for models of

⁶As an alternative to classical impulse response functions, Borovička and Hansen (2014) propose shock-elasticities to capture state dependent and non-linear dynamics.

⁷Golez and Matthies (2021) explore the impact of monetary policy shocks on the term structure of equity prices, but their shock does not feature in benchmark asset pricing models – unlike our long-run shock.

the equity term structure.

2 Data and motivation

Previous literature on the equity term structure uses a variety of unconditional and conditional moments to differentiate asset pricing models. Our contribution is to introduce new moments derived from responses to a well-identified long-term growth shock. We consider responses of a variety of quantities, including equity yields for different maturities and portfolios, as well as measures of cash versus total firm payout. In this section, we introduce our data and discuss the benefits of our approach.

2.1 Equity yield data

We thank Giglio et al. (2024, GKK) for sharing the long historical sample of synthetic equity yields. These data are derived from a rich affine model for equities that describes prices, dividends, and returns as well as their dynamics. The model generates a term structure of discount rates for cash flows of arbitrary maturity and with a time series going back to the 1970s. In this paper, we study cash flows paid by the aggregate market portfolio (S&P 500) as well as the value and growth portfolios (the top and bottom tercile portfolio from sorting on book-to-market using NYSE breakpoints).

For the market and other portfolios, the equity yield is defined for each annual maturity n as:

$$e_{t,n} = \frac{1}{n} \log \frac{D_t}{P_{t,n}}, \quad (1)$$

where D_t is the dividend paid in the current year and $P_{t,n}$ is the current price of a strip that pays the annual dividend in n years. GKK further decompose the n -year equity yield into annual hold-to-maturity expected excess returns and annual expected dividend growth rates

over the n -year period:

$$e_{t,n} = \frac{1}{n} \log \mathbb{E}_t \left(\frac{R_{t,t+n}}{R_{f,t,t+n}} \right) - \frac{1}{n} \log \mathbb{E}_t \left(\frac{D_{t+n}/D_t}{R_{f,t,t+n}} \right), \quad (2)$$

where both components are net of the risk-free rate. For convenience, we refer to these components as risk premia ($rp_{t,n}$) and expected growth (egt_{n}) in the following. Our main focus is on the yields of the shortest 1-year claim, $e_{t,1}$, and a long-term 10-year claim, $e_{t,10}$.

We use the equity yields and their decomposition from Giglio et al. (2024) because these series have been carefully validated in the source paper. Importantly, their affine model is estimated without using dividend strip prices, and yet it is able to match the yields on traded S&P 500 dividend strips at standard maturities along key dimensions such as the average slope of the term structure, the time-series behavior of yields, and the inversion during the Great Recession. Giglio et al. (2024) further show that the implied yields are robust in split-sample and rolling out-of-sample exercises, and to alternative model specifications and portfolio sets, which reduces concerns about in-sample overfitting.

Next we explain why studying a well-identified long-term growth shock in combination with equity yields for the market and for value and growth portfolios provides useful insights.

2.2 The benefits of identification

We begin by reviewing some basic facts. Table I presents standard variance decompositions for the equity yields. These decompositions confirm that there is substantial variation in the total variance of the equity yield as well as the relative contribution of risk premia and growth across maturities and portfolios. The 1-year yield is more volatile than the 10-year yield. As a consequence, the variance decomposition for the 10-1 year slope is always similar to the 1-year yield. The 1-year yield is primarily driven by growth, with risk premia contributing a maximum of 17% (for the market portfolio). In contrast, for the 10-year claim that is closer to the total claim on all future dividends, we see that the contribution of risk premia to yield

variation is larger, ranging from 26% (growth) to 83% (value).

Figure 1 plots the 10-minus-1 year equity yield slope over our sample period from 1974Q4 to 2019Q4 for all three portfolios.⁸ Focusing on the market first, Panel A shows that the term structure is usually quite flat, but it has been upward- and downward-sloping for periods of about a few years various times since the 1970s. For instance, long-term yields fall sharply below short-term yields during the recessions of 1990 and 2008 but also in non-recessionary episodes such as 2019. Consistent with the evidence in Table I, these shifts are largely driven by increases in the slope of expected growth. The equity yield and its components for value and growth broadly follow the same patterns, although some additional facts stand out. During the dotcom bubble, the expected growth and risk premia slopes moved in opposite directions for value versus growth. Following the Great Recession, the equity yield slope rose for value (like the market), but showed little movement for growth. In this case, both expected growth and risk premia slopes moved in the same direction for both portfolios, though by markedly different magnitudes.

These variance decompositions and business cycle dynamics traditionally serve as the key moments used in model calibration and evaluation. We take a different approach, recognizing that the variation underlying these moments can have multiple causes. In particular, business cycle turning points are not the result of a single well-identified primitive shock that can be directly mapped to a model. Rather, recessions likely follow from a combination of shocks that propagate through the economy as a result of, among other possible causes, rational agents responding to the shock, (financial) constraints that become binding, and deteriorating sentiment. The same intuition applies to periods with high versus low valuation ratios, as studied in Gormsen (2021), for instance. Therefore, it is not surprising that models relying on only one or a few of these potential drivers struggle to fit such moments. Conversely, even if a model is able to match a given moment, it remains unclear whether the data is truly

⁸The end of the sample is dictated by the availability of the GKK data, with the additional advantage of excluding a small number of extreme observations during the Covid-19 pandemic, which are known to bias estimated responses to structural shocks (see, e.g., Cascaldi-Garcia, 2022).

driven by the modeled cause or by other underlying factors.⁹

For these reasons, we are interested in identification of responses to a primitive shock that one can map directly to models. The long-run growth shock we study is one natural candidate, especially given prior evidence that TFP news shocks are economically important. Combined with the long history of yields provided by GKK, this allows us to estimate with reasonable precision the timing, magnitude, and transmission of the response in the equity term structure. As we discuss below, conclusions are not materially affected by the specific choice of long-run shock.

2.3 The benefits of studying yields

To illustrate the importance of studying yields for understanding the dynamics of the equity term structure, we analyze the object of interest in Gormsen (2021): the realized market term premium. The gross return on an n -year claim equals:

$$R_t^n = \frac{P_{t,n-1}}{P_{t-1,n}} = \frac{D_t}{D_{t-1}} \times e^{ne_{t-1,n} - (n-1)e_{t,n-1}}. \quad (3)$$

Hence, the log return difference between the 10- and 1-year claims, which measures the realized market term premium, is a simple function of equity yields:

$$r_t^{10} - r_t^1 = 10e_{t-1,10} - 9e_{t,9} - e_{t-1,1}. \quad (4)$$

Panel A of Figure 2 shows the impulse response of this realized term premium in the data to the long-run growth shock, defined in detail in Section 3. In the data, the realized term premium increases by more than 3% after a positive long-run growth shock. We find the same result when we define the realized market term premium using the value-weighted average of all claims on the market portfolio, $r_t - r_t^1$ (see Panel A of Figure F.1 of the Online Appendix).

⁹To see the importance of this issue, note that the countercyclicality of term premia in Gormsen (2021), estimated through a regression on the dividend-to-price ratio, is to a large extent due to the discount rate shock, rather than the long run shock on which we focus.

Because the market portfolio has high duration, it behaves similar to the 10-year claim. The exposure of these term premia is economically large and comparable to the exposure of the total market return itself (see Panel B of Figure F.1). Overall, the realized market term premium is significantly and positively exposed to the long-run growth shock. What do asset pricing models have to say about this moment?

To answer this question, Panel B of Figure 2 presents the impulse response to a long-run growth shock in four models that feature (a close equivalent of) this shock: the Bansal and Yaron (2004, BY) long-run risk model, two reference asset pricing models for the equity term structure: Lettau and Wachter (2007, LW) and Gormsen (2021), and the Ai et al. (2018, ACDL) production-based model. We describe these models in detail in Sections 4 and 5, and outline the construction of instantaneous returns in each model in Online Appendix A. The key finding is that all four models qualitatively reproduce the data: the realized market term premium increases by a sizeable amount after a long-run growth shock. Quantitatively, there are some differences between the models. ACDL aligns most closely with the data, showing a response of nearly 3%. In contrast, the responses are smaller in the other models, ranging from 1.5% in BY and Gormsen (2021) to slightly over 2% in LW.

Taken together, the response of the realized term premium to the long-run growth shock has limited power to distinguish between models. Does this result imply that different models have similar implications for the dynamics of the equity term structure or are their implications more distinct than this evidence alone suggests? Equation (4) implies that the realized term premium response is a combination of the responses of equity yields at different maturities, shaped by shifts in expected growth and risk premia. Thus, a model may accurately capture the response of the realized market term premium while being off for one or more of its components. This is precisely what we uncover in our analysis below, which underscores the economic value of studying granular equity yield data.

Differences across value and growth portfolios provide another valuable dimension for model evaluation and are studied in detail in Section 6. While Giglio et al. (2024) show that

the level and slope of expected returns and dividend growth rates vary in the cross-section, unconditional differences in term structures are typically insignificant. This raises the concern that cross-sectional variation in yields may largely reflect noise. The shocks we study, however, provide us with the opportunity to separate signal from noise: if time-variation in yields (or their components) is mostly due to noise, impulse responses would show no systematic cross-sectional differences. Investigating these cross-sectional dynamics is also interesting from a theoretical perspective. Among the four models we consider, ACDL is the only model that endogenously generates rich cross-sectional responses in yields.

2.4 The benefits of studying cash versus total payout

Davydiuk et al. (2023) emphasize the importance of distinguishing between cash and total payouts, because their time-series dynamics differ markedly (see also Belo et al., 2015). We thank Davydiuk et al. (2023) for sharing the payout data. To be precise, cash payouts for equity (debt) are dividends (interest payments), while total payouts equal cash payouts plus net repurchases. Both are suitably aggregated over all public firms in the US economy and deflated by consumption (to account for the fact that payout levels are non-stationary but sometimes negative, such that growth rates are ill-defined).

Davydiuk et al. (2023) show that while total payouts are volatile and largely acyclical, cash payouts are considerably less volatile and procyclical. In their extension of the Bansal and Yaron (2004) long-run risk model, Davydiuk et al. (2023) then assume that the net repurchase process is uncorrelated with all shocks to the consumption process. We are the first to test this assumption in the data using a well-identified long-run growth shock. Intuitively, this test is interesting, as it seems plausible that firms have to raise new financing to fund higher investment following good news about future productivity, thereby creating a wedge between cash and total payouts. Finally, note that models with exogenous dividend processes cannot address the distinction between cash and total payouts, whereas production-based models – such as ACDL – can, as discussed in more detail below.

3 Empirical evidence: Long-run shocks, market equity yields, and payouts

In this section, we present the main empirical evidence. We begin by examining the impulse responses of market equity yields to long-run growth shocks and conclude with a discussion of the responses of cash and total payouts. The main shock we study is the TFP news shock of Kurmann and Otrok (2013). Their structural VAR contains five variables: utilization-adjusted TFP (2016 vintage), consumption (log of real chain-weighted total personal consumption expenditures), inflation (growth rate GDP deflator), the federal funds rate, and the term spread (measuring the slope of the government bond yield curve). Since (i) the response of the term spread to the TFP news shock is primarily driven by the federal funds rate and (ii) our main interest is in the equity yield curve, we replace the term spread with either the 10-1 year equity yield slope or individual yields with maturities ranging from one to ten years. This allows us to analyze both slope and level effects.

To estimate the TFP news shock, we use the improved identification approach of Kurmann and Sims (2020). Two features of their approach are important to highlight. First, Kurmann and Sims (2020) identify the shock that maximizes the forecast error variance (FEV) share of adjusted TFP at a long horizon of 80 quarters, while Kurmann and Otrok (2013) maximize the sum of FEV shares from the impact period onward. The former approach is preferable because new technologies can take a long time to diffuse and it makes the results less sensitive to cyclical measurement issues in the TFP series. Second, Kurmann and Sims (2020) do not impose a zero restriction of the contemporaneous response of TFP, thus allowing measured productivity to react freely to the shock. In Online Appendix B, we show that our results are virtually identical when we change both these features of the identification approach. Standard errors are estimated using a VAR-based bootstrap following Kurmann and Otrok (2013).¹⁰ Note that our primary interest is not whether each response is significantly different

¹⁰We find that these standard errors are more conservative than those in a linear projection, which assumes the shock is observable. This finding indicates that uncertainty about the nature of the TFP shock contributes

from zero. Rather, our main interest is in how responses in the data compare to the predictions of theoretical asset pricing models.

We use the TFP news shock to proxy for the unobservable long-run risk shock in popular asset pricing models. Panel (b) of Figure 3 shows that, in the data, a TFP news shock leads to an increase in consumption in the long run, consistent with the theoretical long-run risk shock. In particular, a one standard deviation TFP shock causes consumption to peak at about 0.75% after five years, after which it slowly mean reverts. This consumption response is similar to what is found in Kurmann and Otrok (2013), even though we study a shorter sample period dictated by the availability of equity yield data. Consistent with Kurmann and Otrok (2013), we also find that the federal funds rate and inflation respond negatively to the TFP shock. In Online Appendix Figure F.2, we show that the TFP news shock positively impacts aggregate dividends by roughly 20 to 60% (depending on the specification) more than consumption at the peak, consistent with the idea that dividends represent a levered claim. Like consumption, dividends increase rapidly following the shock, after which the response slows and converges to an increase of more than 1% at the two- to three-year horizon. If these dividend expectations are correctly priced into equity strips, the expected annualized dividend growth of short-term strips should respond more strongly than that of long-term strips. In what follows, we examine this proposition in the data and study how the responses of expected dividend growth and dividend discount rates combine to generate the observed response in equity yields.

3.1 Market equity yields

The response of the 10-minus-1 year market equity yield slope is presented in Panel (e) of Figure 3. The slope increases by about 1% in the first few quarters after the shock. It takes about 2.5 years for the equity yield slope to fully mean-revert. Given that the standard

some variation in the estimates of equity yield responses. Although we cannot easily address the uncertainty derived from the equity yields that are estimated, we discuss in Online Appendix C evidence for an alternative yield derived from option prices.

deviation of the equity yield slope is 8%, this increase is economically significant. Further, Panel (a) of Figure F.3 shows that the TFP news shock explains about 18% of the forecast error variance of the equity yield slope at all horizons from 2 to 10 years.

To understand which component of the equity yield slope drives this result, we present in Figure 4 the 1-year horizon responses of equity yields with maturities ranging from 1 to 10 years.¹¹ We focus on this horizon because equity yields do not peak immediately when the shock hits. At the peak, which occurs roughly one year after the shock, responses are more precisely estimated as well.¹² We observe a clear level effect: all equity yields decline following the shock, with short-term yields falling more than long-term yields. The 1-year yield drops by 1.37%, while the 10-year yield drops by 0.39%.¹³ This does not imply that the impact on long-term yields is economically small, however. Indeed, the TFP news shock explains a larger share of the forecast error variance (at the 10-year horizon) for the long-term yield than for the short-term yield: 40% versus 25%, see Panel (b) of Figure F.3.

The negative level effect of the long-run growth shock must be driven by a decrease in risk premia, an increase in expected dividend growth, or a combination of both. The positive slope effect further indicates that either risk premia fall more or dividend growth rises more for short-maturity strips than long-maturity strips. To assess the relative importance of these cash-flow and discount rate channels, we replace the 10-1 year equity yield with its expected growth and risk premium components and estimate a six-variable VAR.¹⁴ Figure 5 reports

¹¹For each maturity, we replace the 10-1 year equity yield slope with the corresponding individual yield and re-identify the news shock in the modified VAR. More generally, whenever we change the specification or rotate in an additional variable to trace out a new response, we follow the same procedure and verify that the identified disturbance continues to generate a persistent increase in TFP, while the responses of variables common to both systems remain very similar to those in the benchmark specification. This gives us confidence that the reported yield responses are informative about the same underlying long-run growth disturbance.

¹²Appendix Figure F.4 presents on-impact responses and these are qualitatively similar to those observed at the 1-year horizon.

¹³While the response of the level and slope of equity yields is consistent in sign with the response of government bond yields in Kurmann and Otrok (2013), variation in risk-free discount rates does not drive our results. To see this, we show in Figures F.5 and F.6 that our evidence is robust to using forward equity yields, which subtract out the n -year government bond yield ($f_{t,n} = e_{t,n} - y_{t,n}$).

¹⁴Conclusions obtained from a five-variable VAR that replaces the yield slope with either the growth or risk premium slope are virtually identical.

the responses of the 10-1 year expected growth differential (Panel (a)) and the corresponding risk-premium differential (Panel (c)). The results show that the positive response of the equity yield slope is primarily driven by expected dividend growth since the response of risk premia is small and insignificant. Growth accounts for roughly 90% of the immediate response of the slope of equity yields (plus 0.1% for risk premia minus -0.74% for growth translates to plus 0.84% for the yield).¹⁵ Relative to a standard deviation of about 7% for the 10-1 year expected growth differential, this response is economically large. Indeed, the shock contributes around 20% of the forecast error variance of the 10-1 year expected growth difference at horizons beyond one year (see panel (c) of Figure F.3).

In panels (b) and (c) of Figure 4, we show the responses at the 1-year horizon of these components for all strips with maturities ranging from 1 to 10 years. Whereas the response of risk premia is statistically indistinguishable from zero at all maturities, we see a positive and marginally significant response in growth for all maturities. This response ranges from 1.23% at the 1-year maturity to 0.33% at the 10-year maturity. For all maturities, these dividend growth responses translate to a contribution of about 25% to the forecast error variance at the 10-year horizon (see panel (b) of Figure F.3). In contrast, the contribution to the forecast error variance of the risk premium components is relatively modest at below 10% (panel (c) of Figure F.3).

In summary, a well-identified TFP news shock that has a positive impact on long-term consumption growth also significantly impacts the equity yield curve. Driven by an increase in expected dividend growth especially at shorter horizons, we find that the level of the equity yield curve drops, while the slope increases, after a shock. To see that the long-run shock is a quantitatively important driver of yields, we report in Figure F.7 of the Online Appendix the variance contribution of an alternative productivity shock, that is, the short-term or contemporaneous TFP shock (Figure F.8 reports the corresponding impulse responses). We

¹⁵This number is only slightly different from the on-impact response of the equity yield slope in Figure 3, which equals 0.79%. Because the risk premia and growth responses are derived from a VAR that includes lags of both risk premia and growth in the reduced-form equation, these responses will not precisely sum up to the yield response derived from a VAR that includes only lags of equity yields.

see that the variance contribution of the short-term shock is relatively small, at values often well below 10% for both the level and slope of equity yields. The fact that the long-run technological shock is relatively more important for equity – a long-term asset – is consistent with the fact that its impact on growth is more long-lasting.

In Online Appendix C, we show that the response of the equity yield slope is robust to using an alternative option-implied short-term equity yield and to restricting attention to more recent subsamples. These shorter samples are imposed by data availability, since the option-implied short-term equity yield can be measured reliably only once the underlying options market becomes sufficiently liquid. Because these samples are too short to identify the TFP news shock precisely in a structural VAR, we estimate these alternative responses using local projections.¹⁶

We next assess whether our results are specific to the choice of long-run shock. To do so, we examine impulse responses of market equity yields and their components to innovations in the expected consumption growth series of Schorfheide et al. (2018). These authors develop a nonlinear state-space model that captures the joint dynamics of consumption, dividend growth, and asset returns. Their Bayesian estimation using consumption and asset return data uncovers a small predictable component in consumption growth. We use the quarterly innovation in this component as the shock in linear projections.¹⁷ To facilitate comparison with the TFP news shock, we scale this shock so that it raises long-run consumption by 1% and include the same number of lags as in the VAR. The two shocks are positively correlated, but far from perfectly so.¹⁸ This finding is consistent with the idea that there are other primitive shocks that impact long-term consumption besides TFP news. If equity yields respond to innovations in expected consumption growth in the same way as they do to TFP news, this would strengthen our interpretation that it is TFP news' impact on growth that

¹⁶Because estimates of long-run impacts in local projections are relatively noisy, the maximum horizon we study here is ten quarters.

¹⁷We thank Dongho Song for sharing this data.

¹⁸In a regression of the innovation in expected consumption growth on contemporaneous and one- and two-quarter lagged TFP news, the coefficients are positive and marginally significant, with an R^2 of about 9%.

drives our results.

Figure 6 presents the responses of consumption (Panel (a)), as well as the market equity yield slope and its risk premium and growth components (Panels (b) to (d)). The responses are qualitatively similar to those of the TFP news shock, though somewhat stronger in magnitude. In the first year after the expected consumption growth shock, the equity yield slope rises by a statistically significant 2%. This increase is entirely accounted for by the expected-growth component, which declines significantly and reaches values below -2% , while the risk-premium slope shows essentially no response. As in the case of the TFP news shock, these effects are driven by the 1-year claim (unreported). In conclusion, major shocks to long-run consumption growth generate equity-yield responses similar to those we document for TFP news.

Finally, recall from Section 2.3 that the impulse responses of equity yields combine into positive exposures of both the market return and the realized market term premium to the long-run shock.¹⁹ If long-run risk were a major driver of an unconditionally positive market return, it should also contribute positively to the difference in average return between a long- and short-term market claim. However, the unconditional average of the realized market term premium is negative, which indicates the presence of other priced risks to which these two returns must be differentially exposed (see van Binsbergen et al., 2012; van Binsbergen and Koijen, 2017). While our primary focus is on the impact of the common long-run risk shock in different models, we also analyze unconditional moments that account for the contribution of these other shocks. Ultimately, the interplay between differential impulse responses to the long-run shock and responses to other shocks determines the equity term structure implications of the models we study.

¹⁹Because the 10-year and 1-year asset are claims to a single cash flow, a duration-based approximation should provide a reasonable estimate of the instantaneous response Δ of the realized term premium to a shock, that is: $\Delta(r_t^{10} - r_t^1) \approx -10\Delta e_{t,10} + 1\Delta e_{t,1}$. Even though these responses are derived from VARs with different lag structures and variables, this approximation works well in the data: the response of the realized term premium is about 3%, which is close to $-10 \times -0.375\% + 1 \times -1.21\%$. Our decomposition of yields into expected dividend growth and risk premium components further indicates that the realized term premium in Figure 2 is driven entirely by differential changes in the expected growth rates of the 1- and 10-year claims.

3.2 Cash versus total payout

We next examine the responses of cash and total payout to understand the economic source of the observed increase in dividend growth. If higher dividend growth reflects greater investment, how is this investment financed? Is it funded through new equity issuance (negative net repurchases) or through lower current dividends?

Panels (a) to (d) of Figure 7 present impulse responses for cash payouts, total payouts, their difference (net repurchases), and investment (real chain-weighted gross private domestic investment, following Kurmann and Otrok (2013)). Each variable is scaled by consumption, as in Davydiuk et al. (2023). The responses are from a five-variable VAR in which each payout measure is rotated in place of consumption. To maintain consistency with the production-based model discussed below, we focus on payouts for the firm as a whole, that is, the sum of equity and debt payouts.²⁰

To start, cash payouts hardly respond to the shock initially, but they increase a few years out to about 0.05% of consumption. Total payouts instead drop substantially on impact, by approximately -0.4% , and drops further over the first few quarters after the shock, to about -0.55% . The difference between cash and total payout implies a negative response of net repurchases, which troughs at about -0.6% of consumption a few quarters out. In the last panel, we see that the response of investment is almost a mirror image of net repurchases: firms increase investment in response to improved long-run growth prospects. While the on-impact response for investment is smaller than net repurchases (at 0.11% versus -0.37%), we see that the response of investment is more persistent and peaks at about 0.2% two years out. In fact, the cumulative impact of the shock converges to about 1% in absolute value for both investment and net repurchases at the 5- and 10-year horizons.²¹

These results support the interpretation that the long-run growth shock represents good

²⁰Cash payouts for equity (debt) correspond to dividends (interest payments), while total payouts equal cash payouts plus net repurchases. Our results are similar when using only equity payouts.

²¹To avoid overlap since both repurchases and investment are annual numbers, we sum the responses at annual intervals to calculate the cumulative impact.

news that raises dividend growth through higher investment, largely financed by new equity and debt issuance. Thus, investment and net repurchases are strongly negatively correlated conditional on the long-run shock. Because the shock does not immediately increase firms' cash flows (like a short-term shock would), it is perhaps unsurprising that firms must raise new capital to finance the increase in investment. This simple mechanism is central to interpreting the results from the production-based model analyzed below.

It is also useful to place these results in the context of Davydiuk et al. (2023). These authors extend the Bansal and Yaron (2004) long-run risk model to account for the empirical observation that net repurchases are more volatile than cash payouts. However, their framework assumes that the net repurchase process is uncorrelated with the long-run growth shock (see their Equation (19)), an assumption that our evidence shows to be counterfactual.

4 Market equity yields in models with exogenous dividend processes

In this section, we assess how benchmark models for the equity term structure fare in matching the impulse responses of market equity yields to a well-identified long-run growth shock.²² Specifically, we consider the Bansal and Yaron (2004, BY) model and two leading asset pricing models for the equity term structure: Lettau and Wachter (2007, LW) and Gormsen (2021), all of which specify dividend dynamics exogenously. These models feature a close analogue to the shock we study in the data and, to ensure a consistent comparison, we calibrate the long-run shock in each model to produce a 3% increase in the dividend level over a ten-year horizon (see Table II). In this way, our results are informative about how large shocks need to be for models to match the data. Throughout, we use the same parameter values as in the original studies, so that our new moments serve as an out-of-sample test. Although the

²²Model-implied responses are calculated by hitting the system with a long-run risk shock and following the response of the variables of interest from time t to time $t + s$. We compare this path to what would happen in the absence of the shock. We study both the on-impact ($s = 0$) and longer-horizon ($s > 0$) responses.

models could be reparametrized to better match certain yield-based moments, we find in unreported analyses that this improvement comes at the expense of worsening the fit for other key moments, such as the equity premium, the price-to-dividend ratio, or their volatilities.²³ Moreover, note that reparameterizing these models cannot address the distinct responses of cash and total payout.

4.1 Benchmark endowment models

In both Lettau and Wachter (2007, LW) and Gormsen (2021, G), the log aggregate dividend $d_t = \log(D_t)$ follows the process

$$\Delta d_{t+1} = \mu_g + z_t + \sigma_d \epsilon_{t+1}, \quad (5)$$

where μ_g is the unconditional mean and z_t is an AR(1)-variable driving the conditional mean of dividend growth with persistence φ_z :

$$z_{t+1} = \varphi_z z_t + \sigma_z \epsilon_{t+1}. \quad (6)$$

The vector ϵ_{t+1} contains three mutually independent normal shocks:

$$\epsilon_{t+1} = \begin{bmatrix} \epsilon_{t+1}^d \\ \epsilon_{t+1}^z \\ \epsilon_{t+1}^x \end{bmatrix}, \quad (7)$$

where ϵ_{t+1}^x is the discount rate shock, ϵ_{t+1}^d is the dividend shock, and ϵ_{t+1}^z is the long-run growth shock that is the focus of our paper. In LW, the stochastic discount factor is a function solely of the instantaneous dividend shock ϵ_{t+1}^d . All other shocks are priced only insofar as they covary with this dividend risk, see the loadings for the covariance matrix in Table

²³We report these unconditional moments for the original parameterizations of the models in Table III.

IV. Since the instantaneous dividend shock and the long-run growth shock are negatively correlated in LW, a positive long-run growth shock is accompanied by a contemporaneous decrease in dividends. Our simulations account for this correlation, similar to a generalized impulse response function.

Gormsen (2021) differs from LW in three dimensions, as summarized in Table IV. First, it assumes a stochastic discount factor with two priced risks: the instantaneous dividend and discount rate shocks, ϵ_{t+1}^d and ϵ_{t+1}^x . Both an increase in dividends (as in LW) as well as a decrease in discount rates are good news. This modification affects the behavior of equity yields by introducing more time-variation relative to LW. Second, Gormsen (2021) estimates that long-run growth shocks are negatively correlated with shocks to discount rates,²⁴ whereas LW assumes these shocks are independent. This negative correlation implies that a positive long-run shock affects asset prices not only through its immediate impact on the persistent conditional growth, z_t , but also through its impact on discount rates. This fact makes asset prices relatively more sensitive to long-run shocks in Gormsen (2021). Finally, the two models differ in the persistence of conditional growth rates, captured by the parameter φ_z . The “half-life” of the long-run growth shock is less than a year in Gormsen (2021), whereas it exceeds 20 years in LW. This stark difference in persistence affects how the term structure of equity yields responds to long-run growth shock.

In the Bansal and Yaron (2004, BY) long-run risk model, consumption growth (Δc_{t+1}) and dividend growth (Δd_{t+1}) contain a small persistent predictable component and have

²⁴Gormsen (2021) estimates the model’s parameters using an average of equity yields for four markets with maturities from one to seven years over the period from 2006 to 2019.

stochastic volatility σ_t . Dividends are levered with a leverage ratio of 3.²⁵ To be precise,

$$z_{t+1} = \varphi_z z_t + \varphi_e \sigma_t \epsilon_{t+1}^z \quad (8)$$

$$\Delta c_{t+1} = \mu_c + z_t + \sigma_t \eta_{t+1} \quad (9)$$

$$\Delta d_{t+1} = \mu_d + \phi z_t + \varphi_d \sigma_t u_{t+1} \quad (10)$$

$$\sigma_{t+1}^2 = \sigma^2 + v_1(\sigma_t^2 - \sigma^2) + \sigma_w w_{t+1}. \quad (11)$$

In this model, instantaneous consumption shocks (η_{t+1}), long-run shocks ϵ_{t+1}^z and the volatility shocks w_{t+1} all affect the innovations in the pricing kernel:²⁶

$$m_{t+1} - E_t(m_{t+1}) = \lambda_{m,\eta} \sigma_t \eta_{t+1} - \lambda_{m,e} \sigma_t \epsilon_{t+1}^z - \lambda_{m,w} \sigma_w w_{t+1}. \quad (12)$$

The conditional cash-flow growth component is more persistent in BY than in Gormsen (2021), but less so than in LW. Unlike LW and G, BY generates an unconditionally positive equity term structure slope, reflecting higher risk premia for long-maturity cash flows.

4.2 Equity yields in the data versus the models

Recall from Figure 2 that all three benchmark models generate a positive response of the realized market term premium to a long-run growth shock. However, in this section, we show that this apparent similarity in return-space masks substantial differences of model-implied responses in yield-space. To facilitate comparison, we have collected the estimated responses on-impact and at the one-year horizon for all models and data in Table V.²⁷

Figure 8 shows the response of 1- and 10-year equity yields (top row), along with their

²⁵See Table I from Bansal and Yaron (2004) for information about all model parameters.

²⁶In the model, the long-run shock is uncorrelated with other shocks. By contrast, the long-run TFP shock in the data contemporaneously affects both TFP and, consequently, consumption. This difference, however, does not account for the discrepancy between the data and the BY model. As shown in Online Appendix B, our empirical evidence is largely unchanged when we impose a zero restriction on the contemporaneous impact.

²⁷The numbers correspond to those reported in panel (f) of Figure 3 and panels (b) and (d) of Figure 5.

components: expected dividend growth (middle row) and risk premia (bottom row). We find that all models qualitatively align with the data in two respects: (i) the impact of the shock on yields is negative for short- and long-term maturities, and (ii) the decline is larger for short-term than for long-term yields. Quantitatively, however, BY and LW understate the steepening of the yield curve. In LW, the on-impact responses of the 1- and 10-year yields are -0.32% and -0.22% , respectively, while in BY they are -0.56% and -0.23% (see Table V). By contrast, the model of Gormsen (2021) produces a much larger slope response, with yields falling by -1.12% (1-year) and -0.25% (10-year)—magnitudes close to what we find in the data (-1.22% and -0.36%). We conclude that Gormsen (2021) provides a relatively good fit for the equity yield slope response.

We next examine whether the model of Gormsen (2021) matches the decomposition of yields into growth and risk premia. Panels (c) and (e) of Figure 8 reveal that while Gormsen (2021) correctly attributes the majority of the 1-year equity yield response to the growth component, it slightly overestimates the role of the risk premium component. In the model, risk premia account for more than one-third of the short-term claim response ($\frac{-0.39}{-1.12}$), whereas its relative contribution is below 5% in the data. BY and LW better match the data in terms of the relative contribution of risk premia versus growth, but they underestimate the absolute response of the growth component: the response of the growth component is about 0.30-0.46% in these models, relative to 1.2% observed in the data.

Turning to the 10-year yield, recall that its response is almost fully driven by increasing expected growth in the data. In contrast, Panels (d) and (f) of Figure 8 reveal that the three benchmark models assign most of the variation in the 10-year claim to risk premia.²⁸ Among them, Gormsen (2021) comes closest to matching the response of the 10-year yield (-0.25% in the model vs. -0.38% in the data). However, this match comes at the expense of overestimating the relative contribution of risk premia. In the model, risk premia account for

²⁸The significant effect on long-term risk premia in BY is expected, because the model is structured to have long-maturity cash flows with higher unconditional risk premia and greater variance in conditional risk premia.

nearly 100% ($\frac{-0.2506}{-0.2517}$), while in the data its contribution is negligible. Finally, the relative fit of the models is unchanged when we look at responses at the one-year horizon or even further out. This is largely because LW and BY produce overly persistent responses. In contrast, Gormsen (2021) is more similar to the data in terms of persistence.

In sum, our analysis shows that the three models differ more sharply from each other when comparing the granular response of yields and its components rather than market term premia. All models emphasize the role of growth rates in explaining yield (slope) fluctuations, aligning qualitatively with empirical data. The responses in the models of BY and LW are too small and persistent, however. Responses are larger in Gormsen (2021), but this model assigns a slightly too important role to risk premia.²⁹ This is due to the assumption that discount rate shocks are negatively correlated to long-term growth shocks. This assumption is challenged by the data, which shows minimal movement in equity risk premia after such shocks (either proxied by TFP news or the innovation in expected consumption growth).

5 Production-based asset pricing model

To better understand the origin of higher dividend growth following a long-run shock within a model framework, we must endogenize the dividend process. We study the Ai et al. (2018, ACDL) model for three reasons. First, ACDL explicitly models long-run news shocks to productivity growth, while endogenizing households' consumption and investment decisions. This allows for a direct comparison with our empirical evidence based on TFP, unlike endowment-based models where persistence is exogenously imposed in consumption and dividend dynamics. In ACDL, dividends are not simply a function of consumption but arise endogenously from the underlying production process, reflecting how labor, investment, and productivity jointly determine outcomes. Second, a reinterpretation of the model's dynamics allows us to distinguish between total and cash payouts. Specifically, while ACDL focuses

²⁹We also experimented with changing the persistence of the expected growth process in Gormsen (2021) to improve the fit, but without success. Adjusting its volatility is irrelevant, since we fix the long-run shock size to produce a 3% increase in dividends at the 10-year horizon.

on total payouts (defined as dividends plus net repurchases), the real-world dividend strips against which we match our synthetic equity yields are based on cash payouts alone. As detailed below, we will assume that new investment following the long-run growth shock is financed through net repurchases. This assumption is consistent with our empirical evidence and with the notion that the shock does not immediately translate into higher dividends. The third and last advantage of ACDL is that it endogenously produces distinct implications for the equity yields of value and growth firms. Below, we outline the general setup of the baseline ACDL model before detailing how we account for the distinction between total and cash payouts. We also describe our recalibration of some model parameters, with the full list provided in Table VI.

Before doing so, it is worth noting that there are alternative approaches to endogenizing dividends. A notable example is Belo et al. (2015, BCG), who modify dividend dynamics by distinguishing between a firm’s unlevered cash flows (EBIT) and dividends, which represent levered cash flows, and by imposing cointegration between the two. Specifically, they adapt the Bansal and Yaron (2004) framework by first specifying an EBIT process with the same functional form as BY’s dividends, and then combining it with a dynamic capital structure policy that ensures a stationary leverage ratio. Together, these features produce an endogenously determined dividend process that is internally consistent with the evolution of EBIT.

As discussed in more detail in Appendix D, however, this model fails to match the observed response of equity yields. As concluded also in BCG, a key issue is that their model does not distinguish “between cash flows paid out as cash dividends (which are the relevant cash flows for determining the prices and returns of dividend strips) and those paid out as net equity repurchases.” If the latter represent an important source of new financing for investment after a shock, making this distinction is critical.

5.1 Baseline model details

In this subsection, we summarize the key equations describing the baseline ACDL model. Readers familiar with the model, may want to skip to the next subsection.

Model setup. There are a few key items that distinguish a production-based general equilibrium model from a consumption-based endowment economy. First, there are endogenous production decisions involving labor and investment. Second, aggregate productivity is explicitly modeled, and its influence on asset prices operates through these endogenous production choices. Finally, the dividend is not assumed to be merely a function of consumption but instead depends on the underlying production process, reflecting how labor, investment, and productivity jointly determine dynamics.

Aggregate productivity. Productivity growth $\Delta a_t \equiv \log\left(\frac{A_{t+1}}{A_t}\right)$ evolves as follows:

$$\begin{aligned}
 \Delta a_{t+1} &= \mu + z_t + e^{\bar{\sigma}_a + \sigma_{a,t}} \epsilon_{t+1}^a, \\
 z_{t+1} &= \rho_z z_t + e^{\bar{\sigma}_z + \zeta_t + \sigma_{a,t}} \epsilon_{t+1}^z, \\
 \sigma_{a,t+1} &= \rho_\sigma \sigma_{a,t} + \sigma_\sigma \epsilon_{t+1}^\sigma, \\
 \zeta_t &= -\beta_{\zeta|z} z_t.
 \end{aligned} \tag{13}$$

where $[\epsilon_{a,t+1}^a, \epsilon_{t+1}^z, \epsilon_{t+1}^\sigma]$ is a vector of standard normal shocks, i.i.d. over time. The key shock for the purposes of this study is the long-run news shock, ϵ_{t+1}^z . The process $\sigma_{a,t}$ is the time-varying stochastic log-volatility for contemporaneous productivity shocks and e^{ζ_t} captures the variation in the relative volatility between long-run and short-run productivity shocks. To be precise, ζ_t links the long-run news to stochastic volatility and we find that this link is not important quantitatively for our results.

Labor. The incorporation of endogenous labor and leisure introduces several elements that are absent in endowment-based models. First, labor contributes to the production function

alongside capital and productivity, directly influencing the marginal product of capital, which helps determine the per-unit cash flow for physical capital. Second, labor enters the stochastic discount factor via leisure, which can be seen by first defining the representative agent's value function as follows

$$V_t = \left\{ (1 - \beta) u(C_t, N_t)^{1 - \frac{1}{\psi}} + \beta \left(E_t[V_{t+1}^{1-\gamma}] \right)^{\frac{1 - \frac{1}{\psi}}{1-\gamma}} \right\}^{\frac{1}{1 - \frac{1}{\psi}}} \quad (14)$$

where C_t and N_t denote, respectively, the total consumption and total hours worked at time t . For simplicity, we consider a Cobb–Douglas aggregator for consumption and leisure:

$$u(C_t, N_t) = C_t^\sigma (1 - N_t)^{1-\sigma}. \quad (15)$$

Lastly, labor enters the standard intratemporal labor-leisure tradeoff equation through its relation to the firm's marginal product of labor.

Capital, investment, and value versus growth. ACDL incorporates different types of capital that map to value and growth firms. Specifically, production in the economy is largely based on two types of capital: physical capital and intangible capital. The “mature” physical capital stock in the model represents value firms, as value firms exhibit a high book-to-market ratio and tend to have larger stocks of physical capital. In contrast, the intangible capital stock in the model represents growth options, which are associated with low book-to-market ratios and growth firms. This framework is able to replicate the negative relationship between cash-flow duration and expected returns observed in the cross-section of value and growth firms.

For brevity, let us highlight only those equations that are relevant to the cross-sectional implications. In the model, there are physical capital firms, which can be split into those that are “mature”, \widehat{K}_t , and “young”, \bar{K}_t , and then there are also intangible capital firms, S_t .

The law of motion for mature firms, \widehat{K}_t , can be written as:

$$\widehat{K}_{t+1} = (1 - \delta) \widehat{K}_t + (1 - \delta) \phi \bar{K}_t. \quad (16)$$

where in each period, the surviving young firms $(1 - \delta)\bar{K}_t$ become mature with a constant probability ϕ , and the remaining mature firms exit at a rate of δ .

New or young firms, \bar{K}_t are created by combining physical investment goods and growth options based on a concave and constant returns-to-scale production function $G(I_t, S_t)$, with the law of motion as follows:

$$\bar{K}_{t+1} = (1 - \delta) (1 - \phi) \bar{K}_t + G(I_t, S_t). \quad (17)$$

where $G(I_t, S_t)$ is the total amount of growth options exercised at time t . Ai, Croce, and Li (2013) provide a micro-foundation for the aggregator $G(I_t, S_t)$ by modeling explicitly the competition among ideas with heterogeneous quality. The aggregator G with constant elasticity of substitution between physical investment and intangible capital takes the following form,

$$G(I, S) = \left(\nu I^{1-\frac{1}{\eta}} + (1 - \nu) S^{1-\frac{1}{\eta}} \right)^{\frac{1}{1-\frac{1}{\eta}}}, \quad (18)$$

which conforms well to the data on the cross-section of book-to-market ratios. Intangible capital is then modeled as a stock of growth options as follows:

$$S_{t+1} = [S_t - G(I_t, S_t)] \times (1 - \delta_S) + J_t, \quad (19)$$

where J_t represents intangible investments or blueprints at time t .

Following ACDL, value and growth firms are represented by firms with “mature” physical capital and intangible capital, respectively. Let q_t^k and q_t^s denote the prices of installed physical and intangible capital, respectively, and let δ_k and δ_s denote their depreciation rates.

The returns on these claims are given by

$$R_t^{\hat{K}} = \frac{\alpha \hat{A}_t \left(\frac{\hat{K}_t}{\hat{N}_t}\right)^{\alpha-1} + (1 - \delta_k)q_t^k}{q_{t-1}^k}, \quad (20)$$

$$R_t^S = \frac{\frac{1-\nu}{\nu} \left(\frac{I_t}{S_t}\right)^{\frac{1}{\eta}} + (1 - \delta_s)q_t^s}{q_{t-1}^s} \quad (21)$$

where cash flows reflect marginal products of capital and are assumed to grow with aggregate productivity. While the cash flow of the “mature” physical capital is standard, depending directly on aggregate productivity and the physical capital-to-labor ratio, the cash flow for growth firms is less conventional. It depends instead on the ratio of physical investment to intangible capital. Intuitively, this cash flow increases when the demand for growth options rises, which occurs when physical investment is higher. In parallel with the model that features three groups (young physical firms, old physical firms, and intangible firms), we sort stocks empirically into terciles based on book-to-market, with the top and bottom terciles representing value and growth, respectively.

Technological shocks and impulse responses. We study the impact of the long-run growth shock (corresponding to ϵ^z in Equation (13)) on the term structure of equity yields and their growth and risk premia components. In particular, we estimate impulse responses from the model and compare them to the impulse responses in the data (see Section 3). As with the other benchmark models, we set the magnitude of the long-run shock in ACDL to produce a 3% increase in aggregate dividends at the 10-year horizon (see Table II).

5.2 Cash versus total payout

In this subsection, we explain how we refine the notion of “dividends” relative to the baseline ACDL model by distinguishing total payouts from financial dividends (simply referred to as cash payout). This modification of ACDL provides useful discipline on the behavior of net

repurchases and how firms finance investment after a long-run growth shock.

From total payouts to cash payout. In ACDL, total payouts equal capital income net of investment,

$$\text{Total Payout}_t = Y_t - w_t N_t - I_t, \quad (22)$$

where I_t denotes total investment. By accounting identity, total payout can be decomposed into cash payout and net repurchases:

$$\text{Total Payout}_t = \text{Cash Payout}_t + \text{Net Repurchases}_t. \quad (23)$$

Combining Eqs. (22) and (23) yields:

$$\text{Cash Payout}_t = Y_t - w_t N_t - I_t - \text{Net Repurchases}_t. \quad (24)$$

To close the model without explicitly modeling optimal financing decisions, we adopt a parsimonious financing specification that characterizes how aggregate investment is reflected in payout and repurchase dynamics. Here, δ_t^* represents the economic value of depreciation, so that cash payouts correspond to operating cash flow net of economic depreciation. Investment in excess of economic depreciation is reflected in adjustments in net repurchases (equity issuance or repurchases). Specifically, we assume

$$\text{Net Repurchases}_t = -(I_t - \delta_t^*) \quad (25)$$

where $\delta_t^* \equiv \delta q_t K_t$ so that net repurchases are negative (net issuance) when investment exceeds replacement needs. Substituting (25) into (24) implies a simple expression for cash payouts:

$$\text{Cash Payout}_t = Y_t - w_t N_t - \delta_t^*. \quad (26)$$

This mapping implies that firms do not finance marginal investment by reducing cash payouts one-for-one. Instead, cash payouts are paid out of operating cash flow net of replacement investment, while equity issuance/repurchases absorb the residual financing need. Empirically, the responses of investment and net repurchases to long-run shocks are close to mirror images. Our mapping adopts this regularity in a transparent way (see discussion in Section 3.2).

Our modeling choice is also grounded in extensive evidence of a negative relationship between investment and net repurchases (e.g., Chen and Wang, 2012; Almeida et al., 2016; Wang et al., 2021; Kroen, 2021). We provide novel evidence that this negative relationship holds specifically in response to long-run risk shocks. While Davydiuk et al. (2023) find that unconditional total payouts and repurchases are acyclical, our focus on conditional moments resolves this apparent tension. The data suggest that while long-run growth shocks induce countercyclical repurchases, other aggregate shocks likely drive the unconditional acyclicity observed in the broader sample.

Importantly, the implied steady-state magnitudes are also plausible: the model’s steady-state ratios of net repurchases to consumption (-0.01) and total payout to consumption (0.02) fall within one standard error of historical averages.³⁰

Mechanism. In the baseline ACDL model (with total payouts), investment falls on impact due to a wealth effect and then rises as news materializes; the subsequent investment surge pushes total payouts below trend for several periods, generating counterfactual increases in short-horizon equity yields. By contrast, with cash payouts defined as $Y_t - w_t N_t - \delta_t^*$, investment no longer depresses near-term payouts. One can also show $Y_t - w_t N_t - \delta_t^* = \alpha Y_t - \delta q_t K_t = (\text{MPK}_t - \delta q_t) \cdot K_t$, and cash flow per unit of capital equals the marginal product net of depreciation. Thus, cash payouts rise with productivity and labor, which ends up lowering short-horizon equity yields on impact of a long-run shock.

³⁰Alternative specifications, such as modeling net repurchases solely as a function of total investment, yield similar dynamics but a counterfactually large steady-state ratio of net repurchases to consumption.

5.3 Equity yields and payout in the data versus the modified ACDL model

Figure 8 reports the ACDL model-implied responses of 1- and 10-year equity yields for the market. We also report the expected dividend growth and risk premium (expected excess hold-to-maturity return) components of these yields. ACDL aligns with the observed data in two key aspects (i) the impact of the shock on yields is negative for short- and long-term maturities and (ii) the short-term yield experiences a larger drop than the long-term yield. To be precise, ACDL generates an impact on the 1- and 10-year yield of -1.25% and -0.4%, which is close to what we see in the data (-1.22% and -0.36%). Also consistent with the data, ACDL attributes the yield decrease almost entirely to a 1.20% rise in the 1-year expected growth (versus 1.21% in the data). Just like in the data, the responses of the risk premium components of 1- and 10-year yields are small in ACDL. Overall, in terms of the decomposition of short and long-maturity market equity yields and the relatively large contribution of growth versus risk premia, ACDL matches the data quite well. One discrepancy is that the effects decay a bit faster in ACDL than in the data, but note that we have not explicitly targeted persistence in the calibration.

Circling back to the model-implied response of realized term premia in Panel B of Figure 2, we conclude that the modified ACDL model matches the realized market term premium response in Section 2.3 for the right reasons: it captures, at least approximately, the response of each underlying component of this return. Quantitatively, the equity yield fit for ACDL is similar to Gormsen (2021) and better than BY and LW. Qualitatively, one could argue that the fit of ACDL is even slightly better than Gormsen (2021), as ACDL attributes virtually the entire response of yields to changes in expected growth, consistent with the data.

We next study the distinction between cash and total payout, a dimension that cannot be addressed in the benchmark models with exogenous dividend processes and is ignored in the baseline ACDL specification. Figure 9 shows that the modified ACDL specification reproduces the opposite-signed responses of cash and total payout observed in the data. Furthermore,

the model closely matches the sustained increase in cash payout. The fit for total payout is poorer, both qualitatively and quantitatively. In the data, total payout drops by about 0.5% (of consumption) over the first year and mean-reverts quickly. In the model, total payout shows a persistent decline that reaches -0.1% at long horizons. We conclude that the modified ACDL model fails to match the volatility of total payout (about 5% unconditionally in the data versus 1% in the model) as well as the persistence of its response to the long-run shock. Aside from this, the model matches other dynamics (of market equity yields, its components, and cash payout) rather well.

6 Cross-sectional implications: Value versus growth

Studying the response of value and growth yields to a long-run shock is of interest because it speaks to two strands of the literature. One strand – often building on the Gordon growth model ($D/P = r - g$) – argues that duration helps to explain the value premium, that is, the higher average returns earned by high book-to-market firms with low expected dividend growth (see, e.g., Lettau and Wachter, 2007, 2011; Croce et al., 2015; Gonçalves, 2021; Gormsen and Lazarus, 2023). The key to such an explanation is that long-duration assets earn lower returns. At the same time, another strand of the literature (Parker and Julliard, 2005; Hansen et al., 2008; Li and Zhang, 2017; He and Leippold, 2020) has argued that long-run risk – measured using consumption data rather than exogenous TFP news shocks – is key in shaping the relative riskiness of value and growth assets.

6.1 Value vs. growth responses in the data

Figures 10 and 11 report the responses of equity yields for growth and value, respectively.³¹ First, we see that the impulse response of the level and slope of the equity yield curve for growth closely mirrors that of the market: the level declines while the slope steepens, driven

³¹Table VII presents all the relevant point estimates.

by a sharper fall in short-term yields. Quantitatively, however, the response for growth is more than 50% larger. For instance, at the 1-year horizon, the 10-1 year equity yield slope increases by 1.62% for growth, compared to 0.95% for the market. This finding is consistent with the idea that growth firms have longer-duration investments than the average firm, which makes them more sensitive to long-run technology shocks. Similar to the market, the responses of the growth portfolio are primarily driven by expected dividend growth rather than risk premia, which remain relatively small at all maturities and horizons. For instance, the expected dividend growth slope drops by -1.88% (versus -1.03% for the market) at the 1-year horizon.

While the response of the value portfolio aligns qualitatively with the market and growth portfolios at horizons beyond a few quarters, its short-term response is strikingly different. Specifically, the equity yield slope for value falls on impact by an economically large -0.77% , which is almost entirely driven by an increase in the 1-year yield. This rise in the 1-year yield for value is roughly equally influenced by a rise in short-term risk premia (0.35%) and a decline in expected short-term growth (-0.48%). Despite the on-impact response of the 1-year yield being so different for value and growth, we show in Figure F.9 that the response of the realized value-minus-growth term premium (defined in Equation (4)) is small and insignificant at about -0.7% , well below the response of the realized market term premium.³² This finding suggests again that examining realized term premia alone is less effective in differentiating models than studying granular equity yield responses.

Returning to the yield dynamics, note that the short-term response of value to the TFP news shock is (i) relatively imprecisely estimated (standard errors are roughly twice as large for value than for growth and the market) and (ii) transient. At longer horizons, the responses of all yields and yield components are consistent in sign between value and growth. Indeed, Figure 12 shows that the response of all equity yields for value stocks are negative at the 1-year horizon, with short-term yields falling more than long-term yields – similar to the

³²As discussed in Appendix A, this response follows from the respective yield changes as follows: $\Delta(r_{V,t}^{10} - r_{V,t}^1) - \Delta(r_{G,t}^{10} - r_{G,t}^1) \approx (-10\Delta e_{V,t,10} + 1\Delta e_{V,t,1}) - (-10\Delta e_{G,t,10} + 1\Delta e_{G,t,1}) \approx -0.7$.

pattern observed for growth stocks and the market. The responses for value are smaller, however. For example, the response of the 1-year claim for value is -0.6% at the 1-year horizon, compared to -2% for growth. Another key difference is that risk premia play a larger role in driving the response of equity yields for value stocks. For instance, the response of the 10-year equity yield for value is -0.22% , and this response is predominantly driven by a risk-premium component of about -0.14% . In contrast, these numbers are -0.40% and -0.04% for the growth portfolio.

Panels (e) and (f) of Figure 6 show that the stronger response of the growth portfolio remains robust when we use the expected consumption growth series of Schorfheide et al. (2018) as an alternative proxy for the long-run risk shock. Interestingly, in this case, the short-run response of the value yield slope is also positive, as it is for the market and growth portfolios. This finding casts additional doubt on the anomalous finding that this response is negative in the case of TFP news. Overall, the main takeaway is that the yields and expected dividend growth of the growth portfolio are more exposed to long-run risk shocks than those of the value portfolio. We next examine whether models with a long-run shock can replicate these differential exposures.

6.2 Value vs. growth responses in models

6.2.a The modified Ai et al. (2018) production-based model

Recall the distinction between mature physical capital “value” firms and intangible capital “growth” firms in ACDL. Figure 13 displays the model-implied impulse responses for the equity yields of these two types of firms. Starting with growth, ACDL generates a response that is qualitatively similar to the market but quantitatively stronger, as observed in the data. The model-implied increase in the slope exceeds 1.5% at horizons up to 1 year, mostly due to a large drop in the yield of the 1-year claim, exactly as observed in the data. Similar to the data, the model attributes nearly all of this response to a large increase of over 2% in the expected growth component of the 1-year claim. Overall, ACDL closely matches the

responses of growth firms, just as it does for the market.

ACDL also matches the fact that the response of value firms is qualitatively similar to growth, but weaker. To see this, let us focus on the responses at the 1-year horizon, which are – as we discussed above – relatively precisely estimated and robust. ACDL generates a smaller response of the value yield slope than for growth, with the yield on the 1-year (10-year) claim dropping by -0.75% (-0.34%) in the model, compared to -0.6% (-0.22%) in the data. These drops are largely attributed to increases in expected growth, as risk premia hardly respond, exactly as observed see in the data. Figure F.9 further shows that ACDL matches the data in that the response of the realized value-minus-growth term premium is small, well below the response of the realized market term premium (see Figure F.1). Having studied the individual yields that drive this response, it is clear that this match is due to the model generating a relatively large and negative impact of the long-run shock on the yield of the 1-year claim of growth firms.

We now examine the mechanism through which ACDL matches the responses of value and growth across these various dimensions. To understand why the value firm’s yields and expected growth component responds less, note that the dividend is driven by the marginal product of mature physical capital. The marginal product of mature physical capital is determined by three items: (1) exposure to aggregate productivity, (2) total labor, and (3) the stock of mature physical capital. Following a positive long-run news shock to productivity, total labor persistently increases. This, combined with the direct boost from higher productivity, drives up the marginal product of capital, $MPK = \alpha \hat{A}_t \left(\frac{\hat{K}_t}{\hat{N}_t} \right)^{\alpha-1}$. However, these effects are dampened by the subsequent rise in capital, which leads to the value firm’s cash flow growth and yields responding less.

For growth firms, dividends depend on intangible capital’s marginal product, which is a function of the physical investment to intangible capital ratio, I_t/S_t . The intuition is that producing a unit of new firms requires combining physical investment demand with the supply of growth options (intangible capital) through the CES aggregator $G(I_t, S_t)$, defined

in Equation (18). When a positive long-run productivity news shock occurs, the demand for growth options increases but their supply does not keep pace. This imbalance raises both the likelihood that these growth options will be exercised and the payoff from doing so. Since intangible capital, S_t , evolves as $S_{t+1} = (S_t - G(I_t, S_t))(1 - \delta_s) + J_t$ it is inherently more volatile. Its level is influenced by fluctuations in intangible investment, J_t , and the stochastic exercise of options, $G(I_t, S_t)$. As a result, growth firms' dividends exhibit a stronger response than those of value firms over the first ten years following the shock.

In conclusion, ACDL matches the data quite well in terms of the cross-sectional behavior of equity yields in response to news shocks. The model effectively emphasizes the importance of expected growth in accounting for fluctuations in equity yields at horizons beyond a few quarters after the shock.

6.2.b Models with exogenous dividend processes

Unlike ACDL, none of the three benchmark equity term structure models endogenously generates cross-sectional variation in impulse responses. For LW and G, a standard way to generate a cross-section would be to impose the deterministic dividend share processes of LW. As we discuss in Appendix E, this approach fails to generate cross-sectional variation in impulse responses to shocks. Intuitively, the firm-specific component, driving the entire variation in equity yields of value versus growth firms, is fully determined by the ratio of future dividend shares. Since these dividend shares are deterministic, they are orthogonal to the shocks in the model. As a result, value and growth firms respond to a long-run shock in the same way as the aggregate market portfolio, which is counterfactual.

While BY does not differentiate between value and growth portfolios, Breugem et al. (2024) extend the long-run risk framework to generate a value premium. They do so by assuming that value firms have a stronger payout exposure to long-run shocks than growth firms, which makes the former riskier. We apply their approach to specify the additional exposure of value versus growth firms to the long-run shock to the model of BY. We report

the impulse responses in Figure F.10. Perhaps unsurprisingly, we see that this specification implies that the equity yields of value firms are relatively more sensitive to the long-run shock, which is counterfactual.³³

In all, compared to the benchmark models, ACDL provides a more useful explanation for the differential responses of value and growth yields. That said, Table III shows that the unconditional value premium is relatively small in ACDL, at 0.88%. Given that ACDL successfully captures many aspects of the responses of value and growth yields to a long-run growth shock, this modest value premium suggests that additional risks, absent from the model, likely contribute meaningfully to the value premium observed in the data. Identifying these risks represents an interesting avenue for future research. Conversely, while the benchmark models generate a larger value premium, this result does not reflect an accurate assessment of the differential exposure of value and growth firms to the long-run risk shock.

7 Conclusion

What are the fundamental macroeconomic drivers of asset prices? We address this important question by studying how total factor productivity (TFP) news shocks impact the equity term structure. Since TFP news shocks map directly to the long-run growth shocks featured in asset pricing models, we use these impulse responses as new moments to evaluate competing theories. We analyze two key sets of quantities regarding the equity term structure. The long history of equity yields constructed in Giglio et al. (2024) allows us to decompose responses of short- and long-term claims on the market, value, and growth portfolios into cash flow and discount rate components. The dataset of Davydiuk et al. (2023) allows us to study the distinct response of cash and total firm payout, which speaks to the important role of investment in shaping the equity term structure.

Our empirical analysis reveals four interesting facts. First, TFP news shocks significantly

³³If we were to apply the same specification to the models of Lettau and Wachter (2007) and Gormsen (2021), we would reach the same conclusion.

affect the equity yield curve, notably by steepening its slope—a pattern that is also present for shocks to expected consumption growth, reinforcing the view that our documented dynamics are central to production- and consumption-based asset pricing models. Second, this steepening is driven primarily by increased expected dividend growth for shorter-term claims, rather than changes in risk premia. Third, cash and total payout respond with opposite sign to the shock, indicating that the increase in dividend growth is due to investments that are financed by new capital issuance (rather than a reduction in current dividend). Fourth, equity yields of growth firms respond more strongly than those of value firms, highlighting substantial cross-sectional differences.

We compare these responses to theoretical predictions from four models: the long-run risk model of Bansal and Yaron (2004), the affine term-structure models of Lettau and Wachter (2007) and Gormsen (2021), and the production-based general equilibrium model of Ai et al. (2018, ACDL). All four models generate testable implications for equity yields, but ACDL additionally generates endogenously cross-sectional dynamics and, with an empirically motivated modification of the payout process, allows us to distinguish between cash payouts and total firm payouts. Although each model qualitatively accounts for Facts 1 and 2, ACDL performs on par with Gormsen (2021) in matching these facts quantitatively. Moreover, ACDL uniquely captures Facts 3 and 4, both qualitatively and along several dimensions quantitatively.

In sum, we show that new moments derived from impulse responses to a long-run growth shock are useful to distinguish asset pricing models. Our macro-finance approach is complementary to existing work which primarily focuses on a model’s ability to match a variety of unconditional and conditional moments concerning the equity term structure.

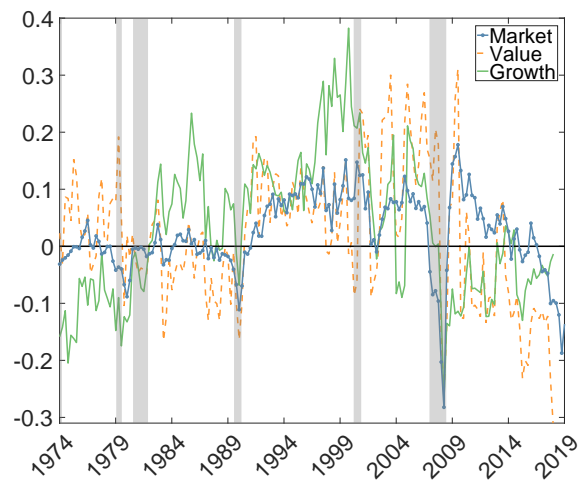
References

- Ai, H., Croce, M. M., Diercks, A. M., Li, K., 2018. News Shocks and the Production-Based Term Structure of Equity Returns. *The Review of Financial Studies* 31, 2423–2467.
- Ai, H., Croce, M. M., Li, K., 2013. Toward a quantitative general equilibrium asset pricing model with intangible capital. *The Review of Financial Studies* 26, 491–530.
- Almeida, H., Fos, V., Kronlund, M., 2016. The real effects of share repurchases. *Journal of Financial Economics* 119, 168–185.
- Bansal, R., Miller, S., Song, D., Yaron, A., 2021. The term structure of equity risk premia. *Journal of Financial Economics* 142, 1209–1228.
- Bansal, R., Yaron, A., 2004. Risks for the long run: A potential resolution of asset pricing puzzles. *The Journal of Finance* 59, 1481–1509.
- Barsky, R. B., Sims, E. R., 2011. News shocks and business cycles. *Journal of Monetary Economics* 58, 273–289.
- Beaudry, P., Portier, F., 2004. An exploration into Pigou’s theory of cycles. *Journal of Monetary Economics* 51, 1183 – 1216.
- Belo, F., Collin-Dufresne, P., Goldstein, R., 2015. Dividend dynamics and the term structure of dividend strips. *Journal of Finance* 70, 1115–1160.
- Belo, F., Lin, X., Yang, F., 2019. External equity financing shocks, financial flows, and asset prices. *The Review of Financial Studies* 32, 3500–3543.
- Boguth, O., Carlson, M., Fisher, A., Simutin, M., 2023a. The term structure of equity risk premia: Levered noise and new estimates. *Review of Finance* 27, 1155–1182.
- Boguth, O., Carlson, M., Fisher, A., Simutin, M., 2023b. The term structure of equity risk premia: Levered noise and new estimates. *Review of Finance* 27, 1155–1182.
- Borovička, J., Hansen, L., 2014. Examining macroeconomic models through the lens of asset pricing. *Journal of Econometrics* 183, 67–90.
- Bretscher, L., Malkhozov, A., Tamoni, A., 2021. Expectations and aggregate risk. *Journal of Monetary Economics* 123, 91–108.
- Breugem, M., Colonnello, S., Marfè, R., Zucchi, F., 2024. Dynamic equity slope. Working Paper .

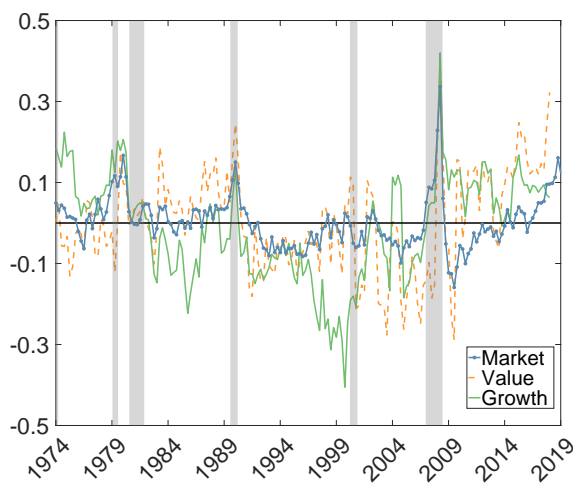
- Cascaldi-Garcia, D., 2022. Pandemic priors. International Finance Discussion Paper. Board of Governors of the Federal Reserve System .
- Cassella, S., Golez, B., Gulen, H., Kelly, P., 2023. Horizon bias and the term structure of equity returns. *The Review of Financial Studies* 36, 1253–1288.
- Chen, S.-S., Wang, Y., 2012. Financial constraints and share repurchases. *Journal of Financial Economics* 105, 311–331.
- Croce, M. M., Lettau, M., Ludvigson, S. C., 2015. Investor information, long-run risk, and the term structure of equity. *The Review of Financial Studies* 28, 706–742.
- Davydiuk, T., Richard, S., Shaliastovich, I., Yaron, A., 2023. How risky are US corporate assets? *The Journal of Finance* 78, 141–208.
- Giglio, S., Kelly, B., Kozak, S., 2024. Equity term structures without dividend strips data. *The Journal of Finance* 79, 4143–4196.
- Golez, B., Jackwerth, J., 2024. Holding period effects in dividend strip returns. *The Review of Financial Studies* 37, 3188–3215.
- Golez, B., Matthies, B., 2021. Monetary policy and the equity term structure. Working Paper 27266, National Bureau of Economic Research.
- Gonçalves, A. S., 2021. The short duration premium. *Journal of Financial Economics* 141, 919–945.
- Gormsen, N. J., 2021. Time variation of the equity term structure. *The Journal of Finance* 76, 1959–1999.
- Gormsen, N. J., Lazarus, E., 2023. Duration-driven returns. *The Journal of Finance* 78, 1393–1447.
- Hansen, L. P., Heaton, J. C., Li, N., 2008. Consumption strikes back? measuring long-run risk. *Journal of Political Economy* 116, 260–302.
- He, Y., Leippold, M., 2020. Short-run risk, business cycle, and the value premium. *Journal of Economic Dynamics and Control* 120, 103993.
- Jordà, Ò., 2005. Estimation and inference of impulse responses by local projections. *American Economic Review* 95, 161–182.
- Kroen, T., 2021. Payout policy reform and investor horizons. Available at SSRN 3824978 .

- Kurmann, A., Otrok, C., 2013. News shocks and the slope of the term structure of interest rates. *American Economic Review* 103, 2612–32.
- Kurmann, A., Sims, E., 2020. Revisions in utilization-adjusted TFP and robust identification of news shocks. *The Review of Economics and Statistics* 0, 1–45.
- Kydland, F. E., Prescott, E. C., 1982. Time to build and aggregate fluctuations. *Econometrica: Journal of the Econometric Society* pp. 1345–1370.
- Lettau, M., Wachter, J. A., 2007. Why Is Long-Horizon Equity Less Risky? A Duration-Based Explanation of the Value Premium. *Journal of Finance* 62, 55–92.
- Lettau, M., Wachter, J. A., 2011. The term structures of equity and interest rates. *Journal of Financial Economics* 101, 90–113.
- Li, J., Zhang, H. H., 2017. Short-run and long-run consumption risks, dividend processes, and asset returns. *The Review of Financial Studies* 30, 588–630.
- Parker, J. A., Julliard, C., 2005. Consumption Risk and the Cross Section of Expected Returns. *Journal of Political Economy* 113, 185–222.
- Ramey, V. A., 2016. Macroeconomic shocks and their propagation. *Handbook of macroeconomics* 2, 71–162.
- Schorfheide, F., Song, D., Yaron, A., 2018. Identifying long-run risks: A Bayesian mixed-frequency approach. *Econometrica* 86, 617–654.
- Sims, C. A., 1980. Macroeconomics and reality. *Econometrica: Journal of the Econometric Society* pp. 1–48.
- van Binsbergen, J., Brandt, M., Koijen, R., 2012. On the timing and pricing of dividends. *American Economic Review* 102, 1596–1618.
- van Binsbergen, J., Hueskes, W., Koijen, R., Vrugt, E., 2013. Equity yields. *Journal of Financial Economics* 110, 503–519.
- van Binsbergen, J. H., Koijen, R. S., 2017. The term structure of returns: Facts and theory. *Journal of Financial Economics* 124, 1–21.
- Wang, Z., Yin, Q. E., Yu, L., 2021. Real effects of share repurchases legalization on corporate behaviors. *Journal of Financial Economics* 140, 197–219.
- Weber, M., 2018. Cash flow duration and the term structure of equity returns. *Journal of Financial Economics* 128, 486–503.

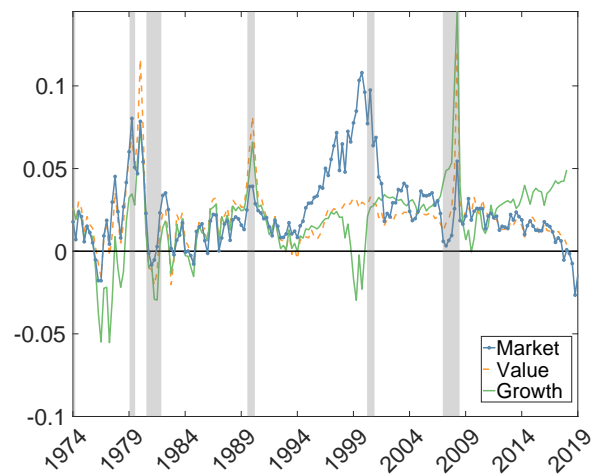
Figures



(a) Slope: 10-1 year equity yield



(b) Slope: 10-1 year expected growth



(c) Slope: 10-1 year risk premium

Figure 1. The Equity Yield Slope and its Growth and Risk Premium Components

We plot in Panel (a) the difference between the 10- and 1-year equity yields for the market as well as the value and growth portfolios. We plot the expected growth and risk premium components of the equity yield slope in Panels (b) and (c), respectively. The sample period runs from September 1974 to December 2019. Shaded areas are NBER recessions.

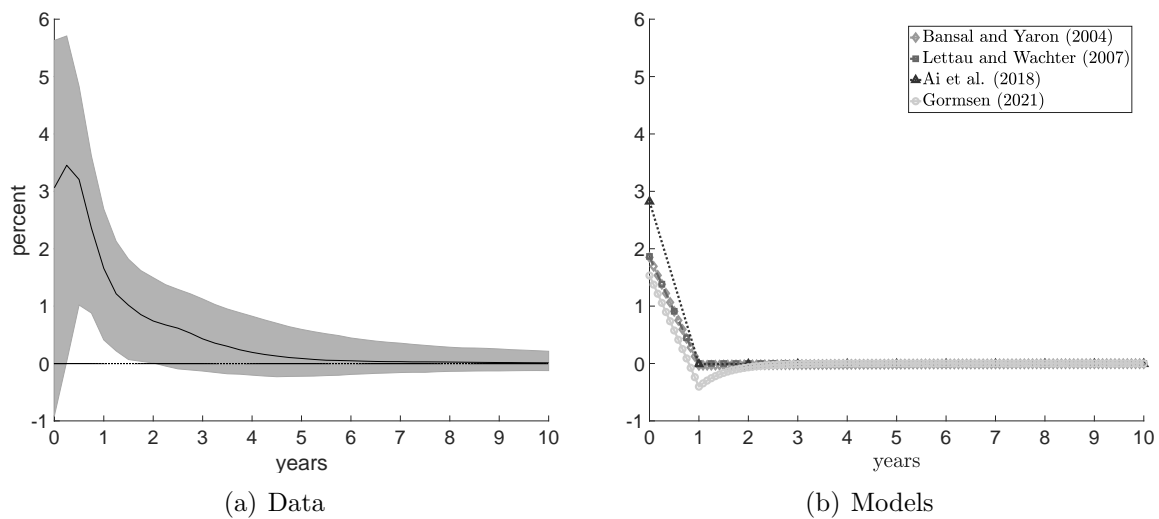


Figure 2. Realized Equity Term Premium in Data and Models

Panels A shows the response of the realized market term premium (the difference in return between the long- and short-term claim, $r_t^{10} - r_t^1$) to the long-run TFP shock in the data. Panel B shows the impulse response in four models that feature (a close equivalent of) the long-run growth shock: the Bansal and Yaron (2004) long-run risk model, two reference asset pricing models for the equity term structure: Lettau and Wachter (2007) and (Gormsen, 2021), and the Ai et al. (2018) production-based model. We describe these models in Sections 4 and 5.

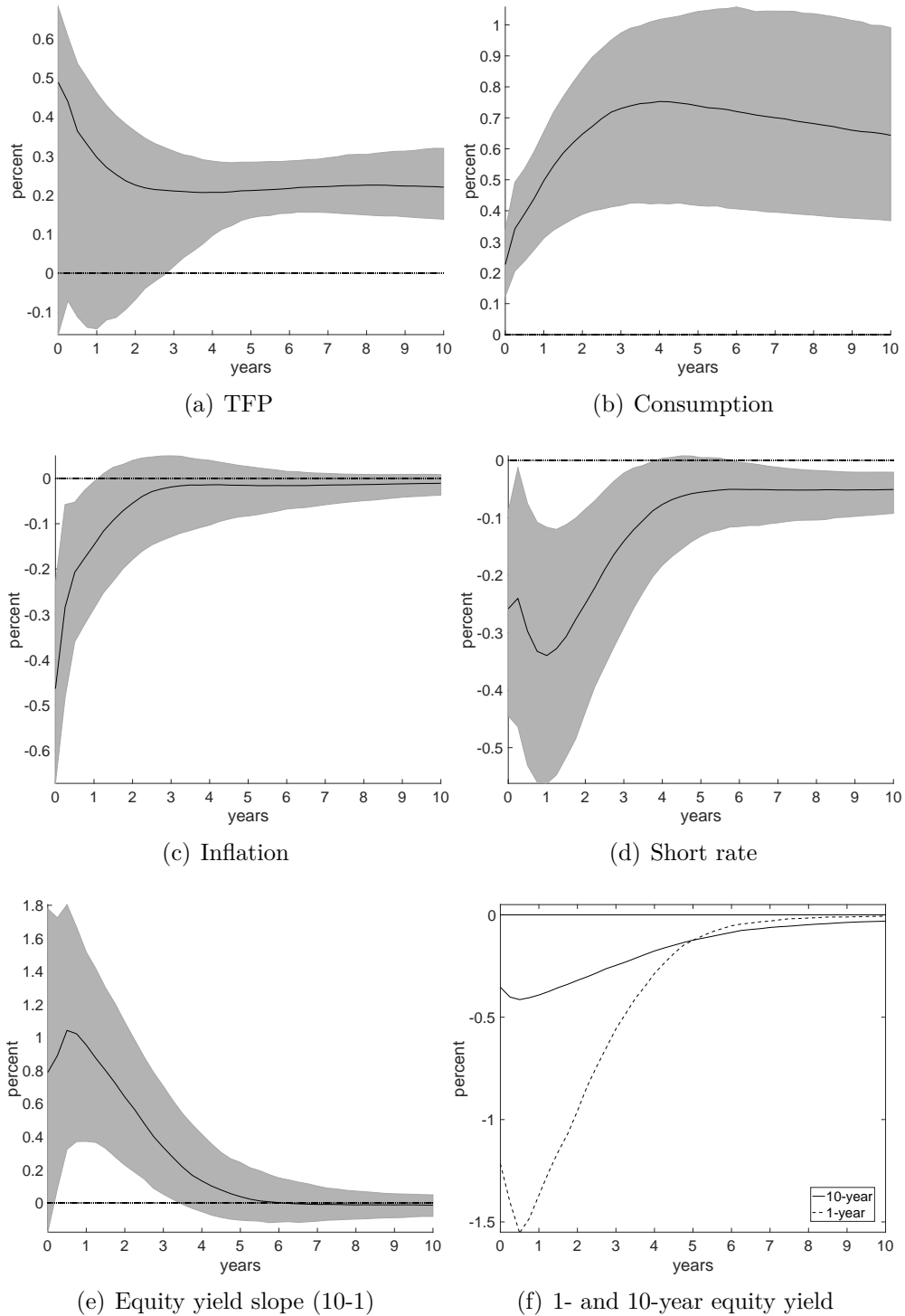
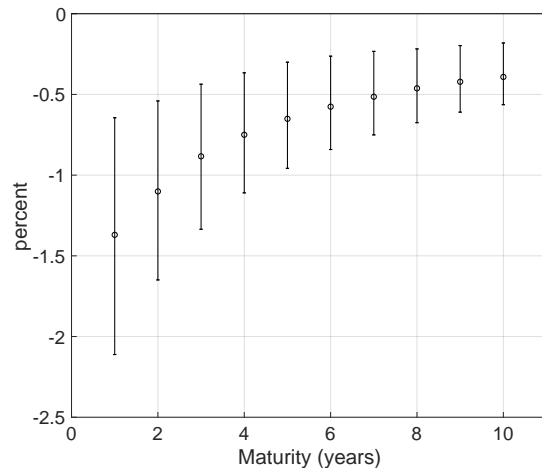
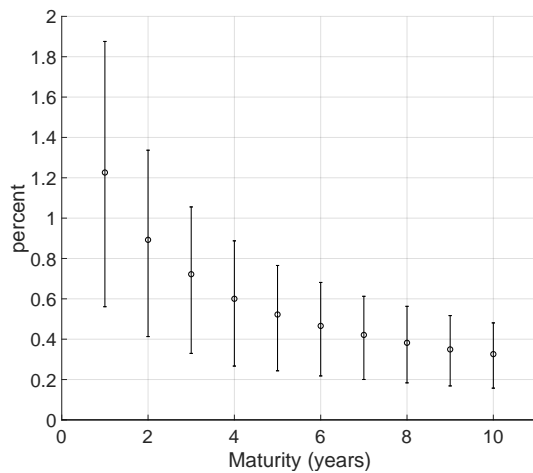


Figure 3. Impulse Responses to a News Shock

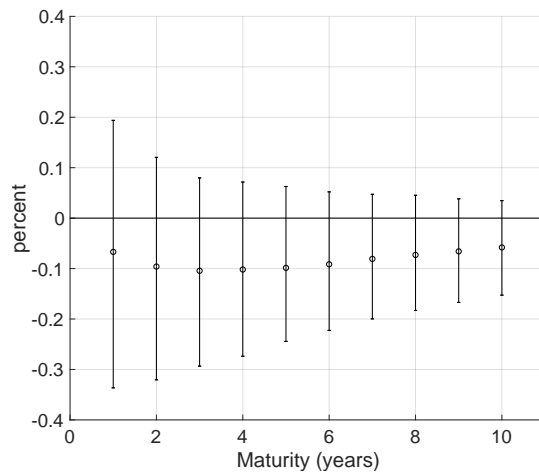
The TFP news shock is identified from a structural VAR as in Kurmann and Sims (2020), with the 10-minus-1 year equity yield slope substituted in place of the term spread. Solid black lines are the median estimates for the VAR estimated with the 2020 vintage of adjusted TFP. The gray bands correspond to the 16–84 percentile bootstrapped confidence intervals. Panels (a) to (e) report the impulse response function for the five variables included in the VAR. Panel (f) shows the response of the 1 and 10 year yield separately. The sample period runs from September 1974 to December 2019.



(a) Equity yield



(b) Expected growth



(c) Risk premium

Figure 4. Equity Yield Responses to a News Shock at the 1-Year Horizon.

The figure shows the response of equity yields, expected growth, and risk premia for claims with maturities from 1 to 10 years to a TFP news shock at the 1-year horizon. The responses of expected growth and risk premia are derived from a VAR that includes both these variables. Each dot represents the median estimate from the VAR and whiskers correspond to the 16–84 percentile bootstrapped confidence intervals. The sample period runs from September 1974 to December 2019.

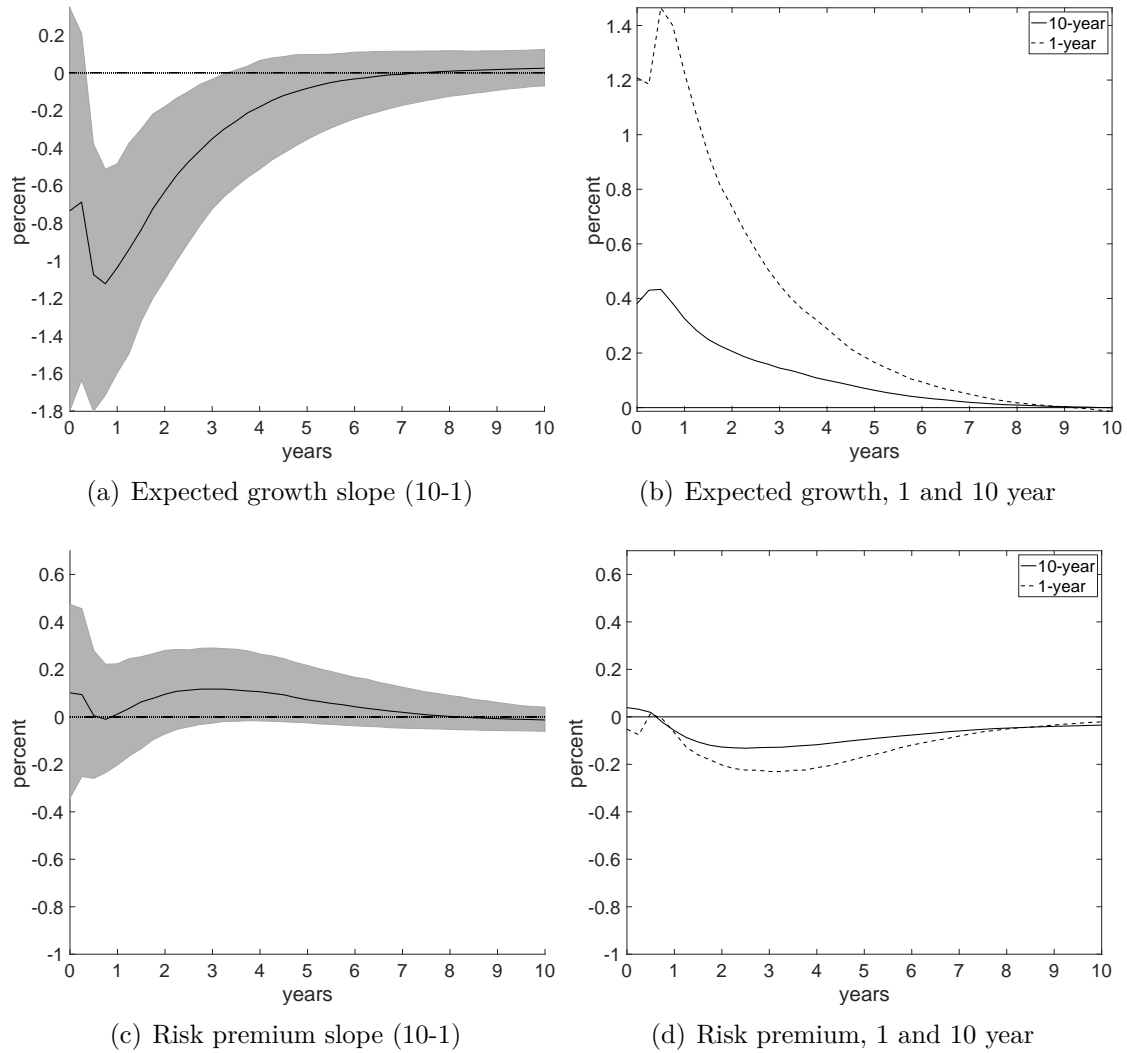
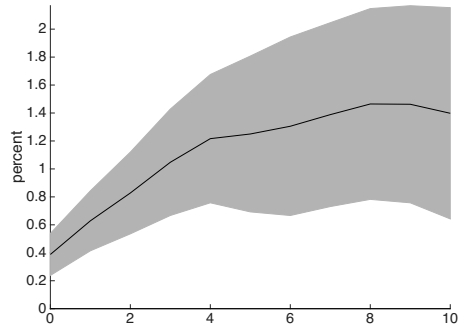
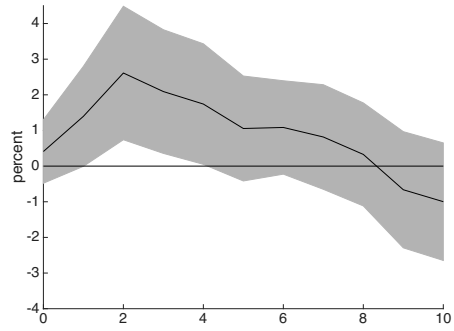


Figure 5. Impulse Responses of Expected Growth and Risk Premium Components

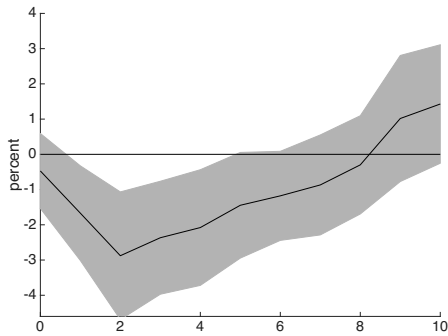
The TFP news shock is identified as in Kurmann and Sims (2020), with the 10-1 year maturity difference in expected growth and risk premia included into the VAR (in place of the yield spread). Solid black lines are the median estimates and the gray bands correspond to the 16–84 percentile bootstrapped confidence intervals. Panels (b) and (d) report separately the response of the 1 and 10 year equity yield components. The sample period runs from September 1974 to December 2019.



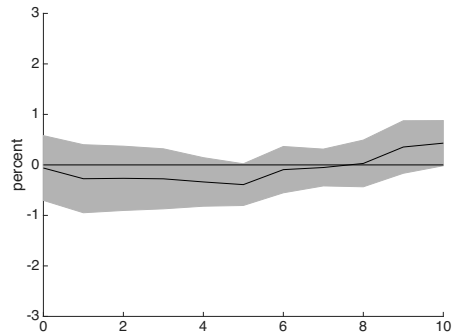
(a) Consumption



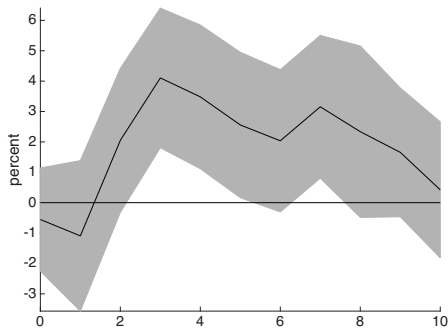
(b) Equity yield slope (10-1)



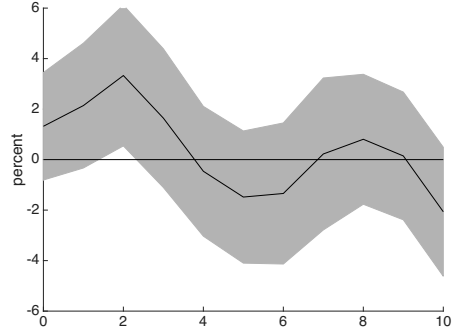
(c) Expected Growth slope (10-1)



(d) Risk premium slope (10-1)



(e) Equity yield slope (10-1): Growth



(f) Equity yield slope (10-1): Value

Figure 6. Responses to the Schorfheide et al. (2018) Long run Shock

The long-run growth shock correspond to the innovation in the persistent consumption component in the Schorfheide et al. (2018) model. The long-run growth shock is then used in local projections to obtain the impulse response functions. The local projection includes the constant, the shock and the lags of the dependent variable (except for Panel (c) and (d) where we use lags of the market slope, rather than its individual components)). We use the same number of lags as in the VAR. Panel (a) reports the impulse response function for consumption. Panel (b)-(d) show the response for the market equity yield slope and its components. Panel (e) and (f) report the impulse response function for the 10-1 year equity yield slope for growth and value firms, respectively.

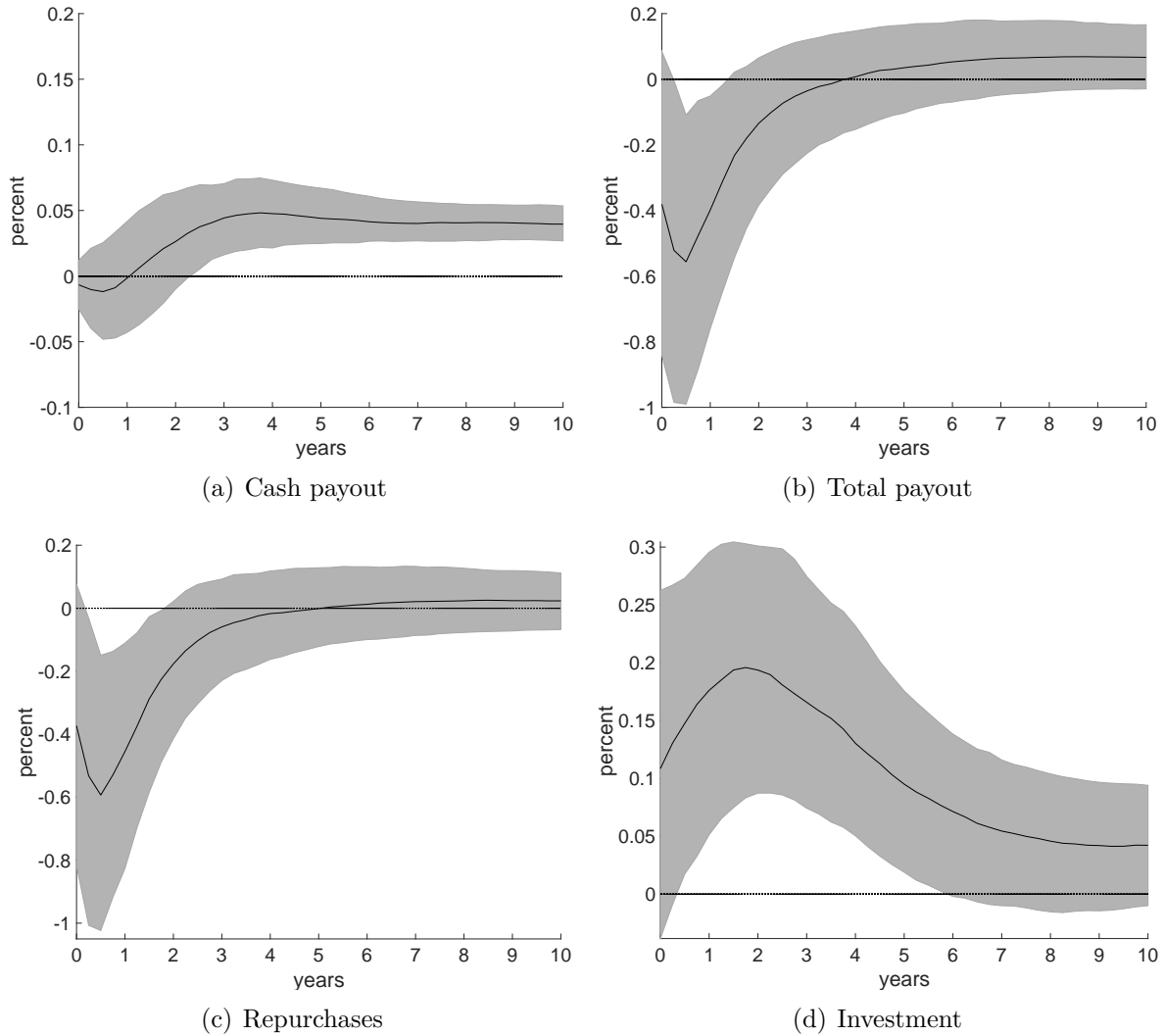


Figure 7. Responses of Components of Total Payout and Investment.

Panels (a) to (d) present impulse responses to the long-run TFP news shock for cash payout, total payout, net repurchases, and investment – all scaled by consumption. Investment is real chain-weighted gross private domestic investment, whereas all other variables are taken from Davydiuk et al. (2023). These responses are derived from a five-variable VAR, where each variable is substituted in place of consumption.

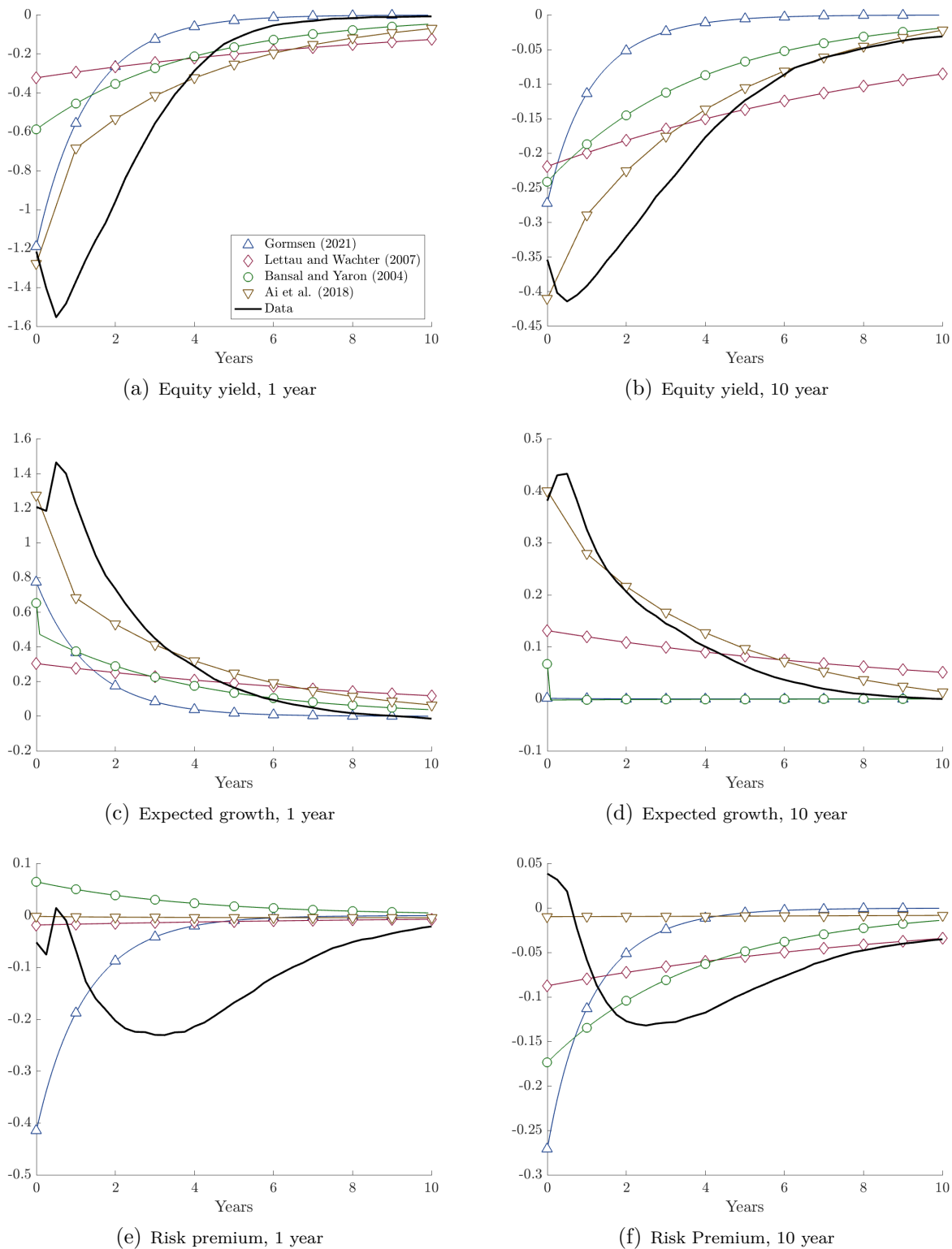


Figure 8. Responses to a Long-Run Shock in Models versus Data

This figure shows the impulse responses (up to 10 years after the long-run productivity shock) for model-implied equity yields as well as their expected growth and risk premium components. To accommodate comparison, we also report the estimated impulse responses in the data. We focus on the 1- and 10-year maturity claim for the aggregate dividend strip.

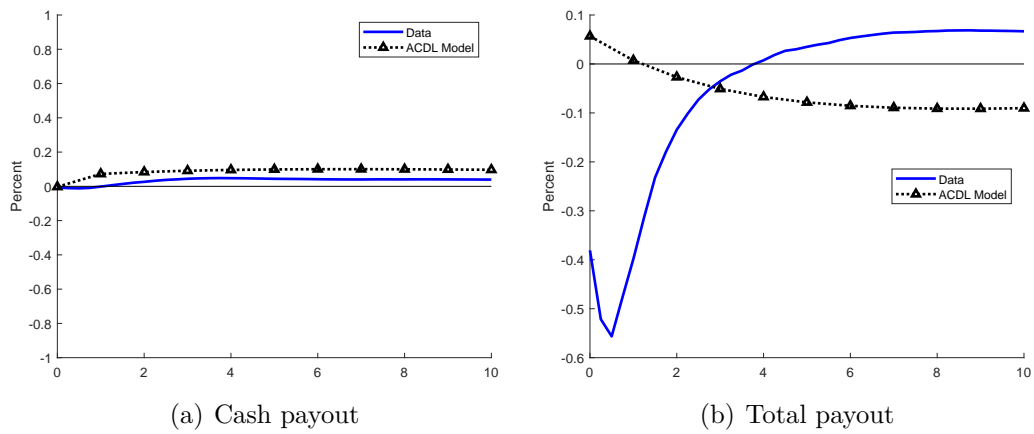


Figure 9. Responses of Cash and Total Payout in the Model and Data.

Panels (a) and (b) present impulse responses of cash and total payout to the long-run shock in the data as well as in the modified Ai et al. (2018) model. The responses in the data are derived from a five-variable VAR, where cash and total payout replace consumption. Both series are sourced from Davydiuk et al. (2023) and scaled by consumption.

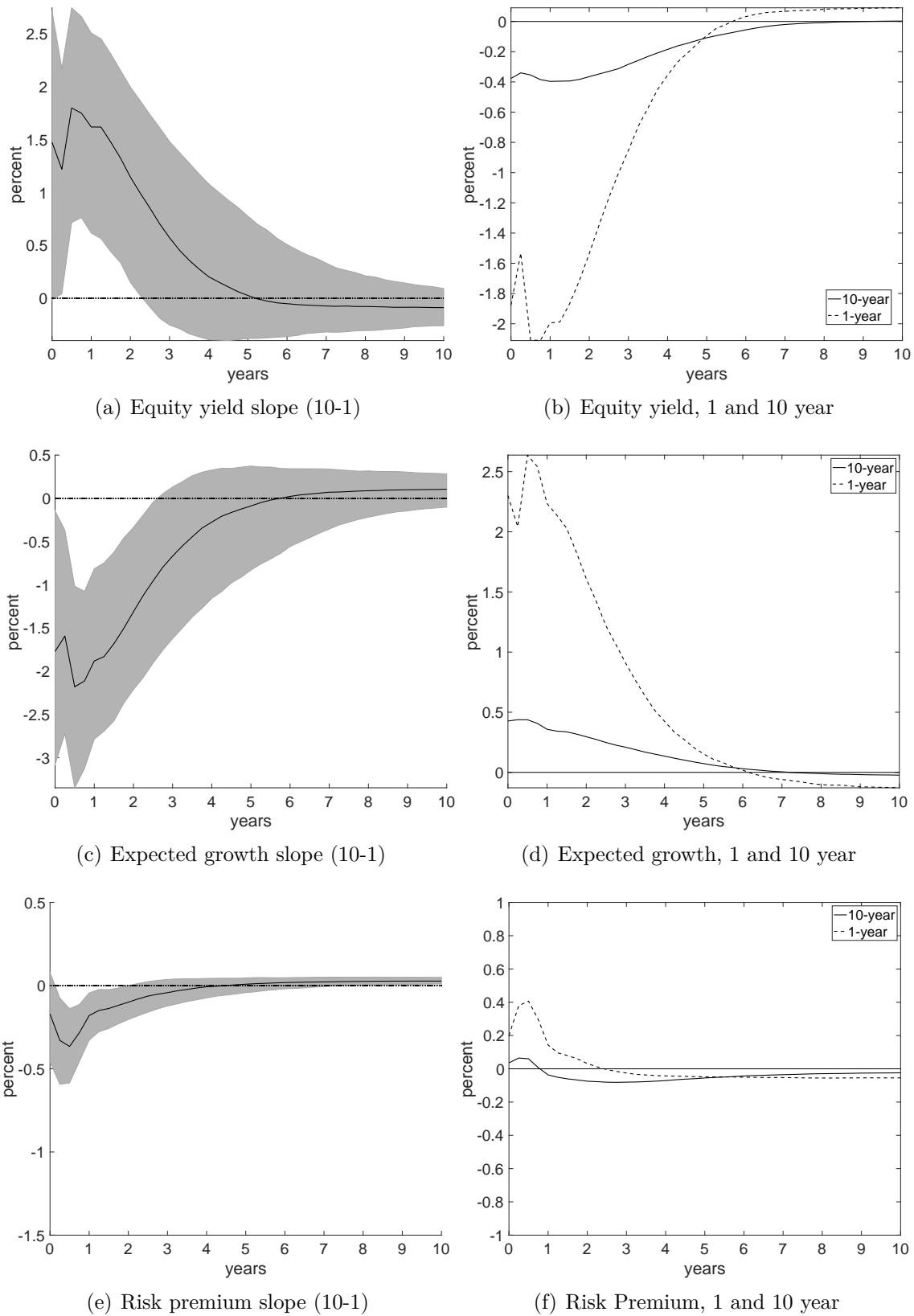
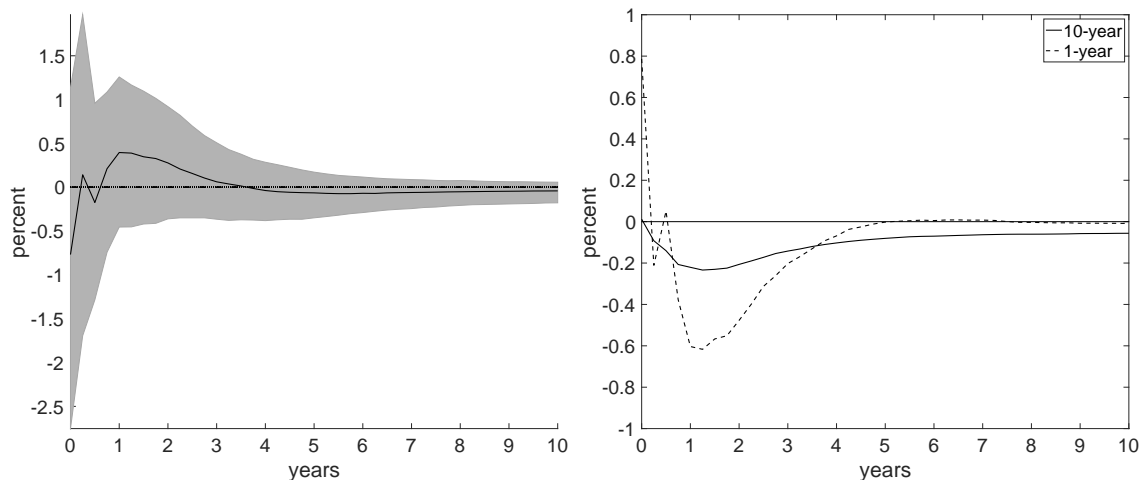
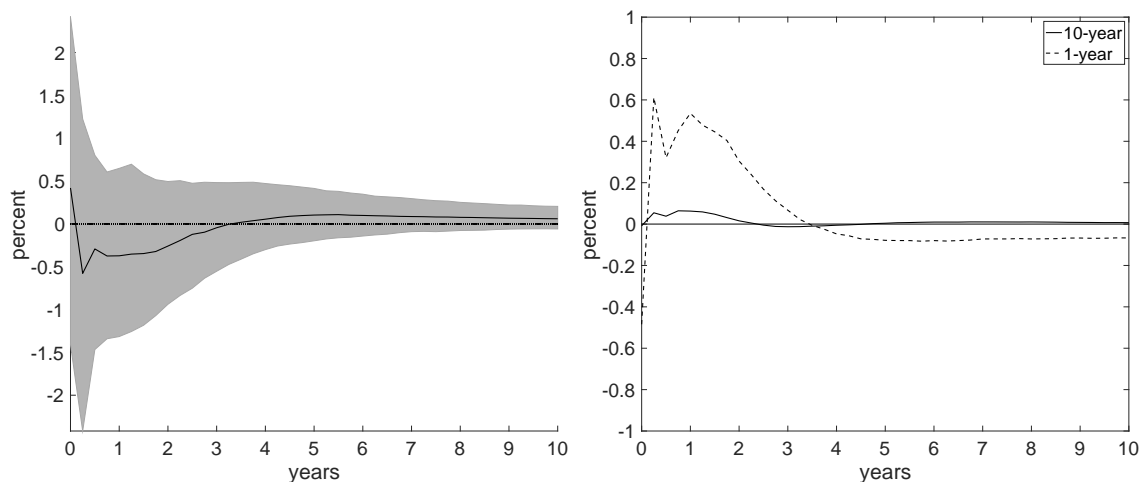


Figure 10. Responses to a News Shock for Growth Firms. Focusing on the equity yield of growth firms, this figure presents the impulse responses of the 10-1 year equity yield slope (and its growth and risk premium components) to a TFP news shock. Solid black lines are the median estimates and the gray bands correspond to the 16–84 percentile bootstrapped confidence intervals. On the right, we present the response of the 1- and 10-year claims separately. The sample period runs from September 1974 to December 2019.



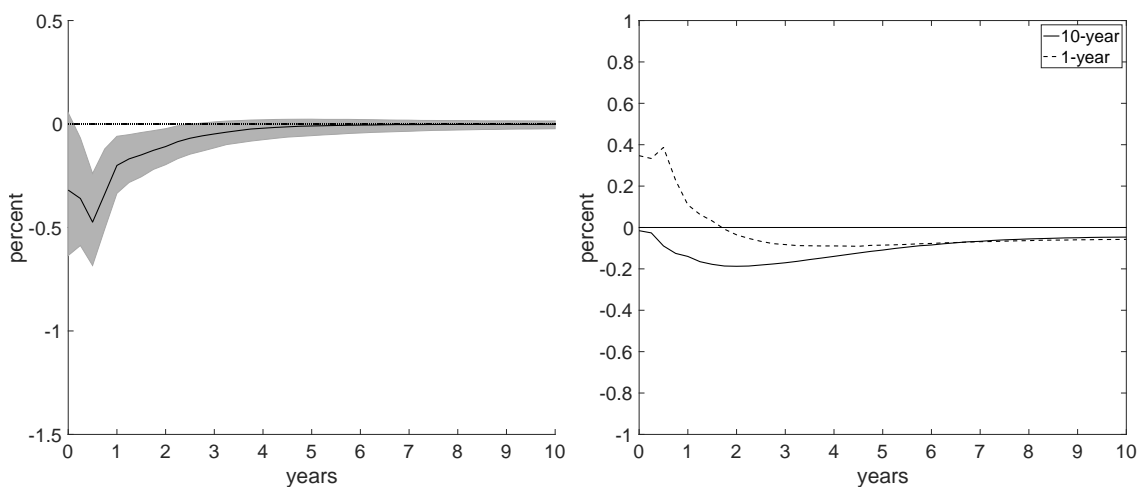
(a) Equity yield slope (10-1)

(b) Equity yield, 1 and 10 year



(c) Expected growth slope (10-1)

(d) Expected growth, 1 and 10 year



(e) Risk premium slope (10-1)

(f) Risk Premium, 1 and 10 year

Figure 11. Responses to a News Shock for Value Firms. This figure is identical to Figure 10 above, except that we now present the impulse responses for value firms.

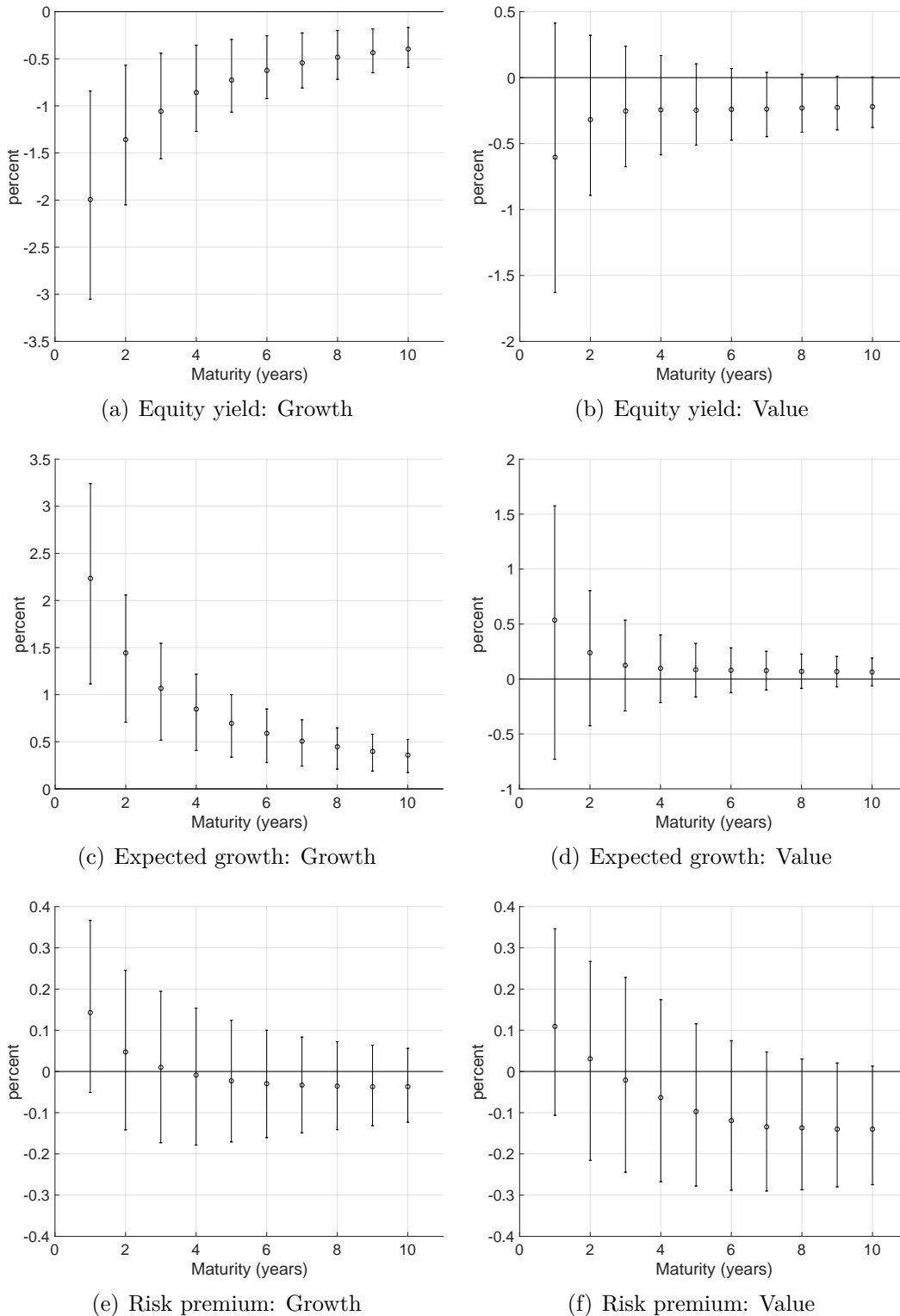
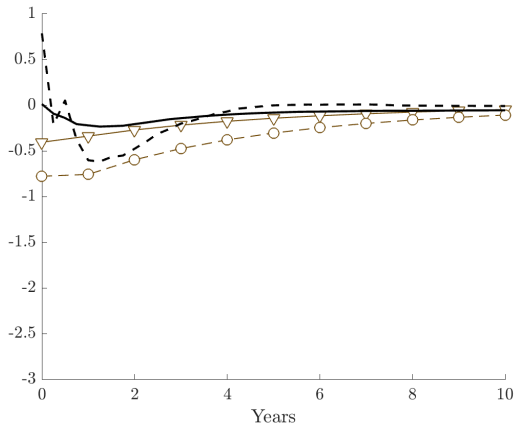
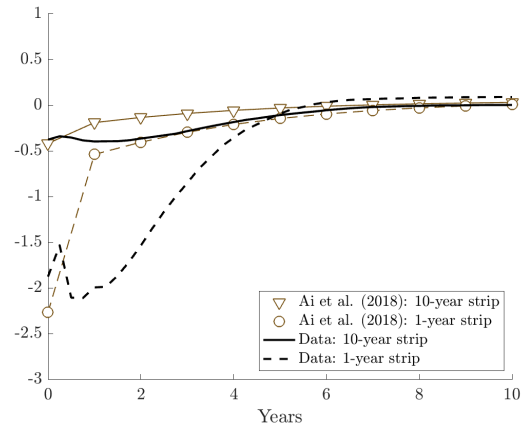


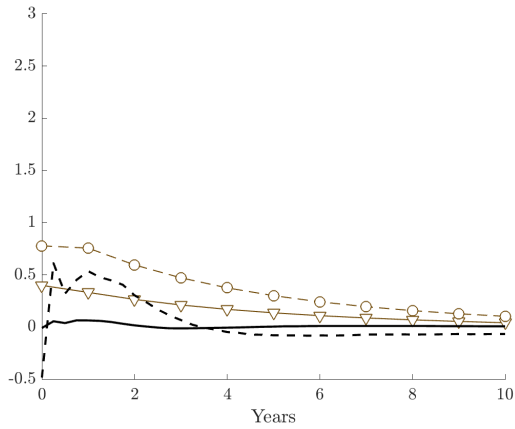
Figure 12. Value and Growth Responses to a News Shock at the 1-Year Horizon. This figure shows the 1-year horizon response of equity yields as well as its expected growth and risk premium components for claims with maturities from 1 to 10 years to a TFP news shock. The responses of expected growth and risk premia are derived from a VAR that includes both of these variables. Each dot represents the median estimate from the VAR and whiskers correspond to the 16–84 percentile bootstrapped confidence intervals. The panels in the left and right columns are for the growth and value portfolios, respectively. The sample period runs from September 1974 to December 2019.



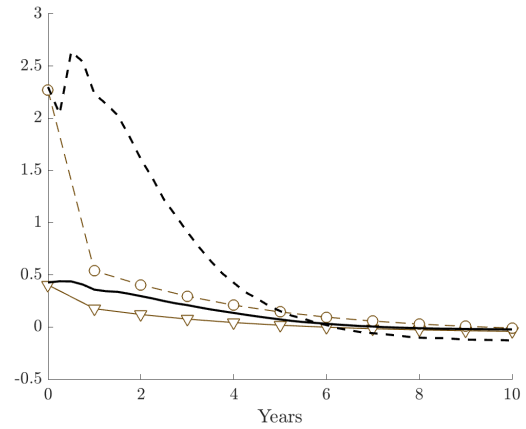
(a) Equity yield: Value



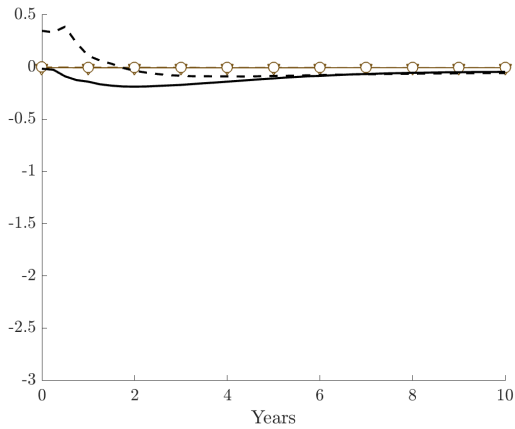
(b) Equity yield: Growth



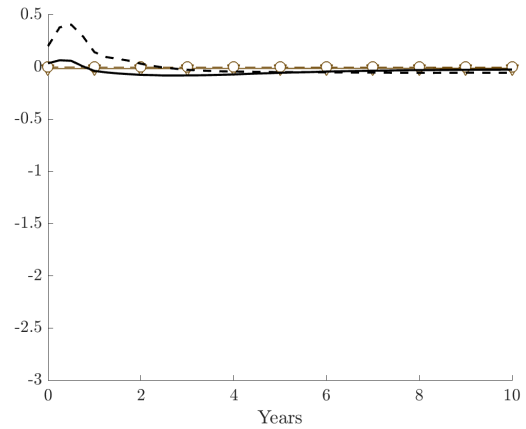
(c) Expected growth: Value



(d) Expected growth: Growth



(e) Risk premium: Value



(f) Risk premium: Growth

Figure 13. Responses of the Value and Growth Portfolios to a Long-Run Shock in the Ai, Croce, Diercks, and Li (2018) Model versus Data. This figure presents impulse responses for the value and growth portfolios in the model and data. Following Ai et al. (2018), the cash flows of value firms correspond to those from mature physical capital, while the cash flows of growth firms correspond to those from intangible capital or growth options, as defined in Equations (20) and (21) in Section 5.

Tables

	1-Year claim		10-Year claim			Slope (10-1)					
$e_{t,1}$	$rp_{t,1}$	$eg_{t,1}$	$-2 \times Cov$	$e_{t,10}$	$rp_{t,10}$	$eg_{t,10}$	$-2 \times Cov$	$e_{t,10} - e_{t,1}$	$rp_{t,10} - rp_{t,1}$	$eg_{t,10} - eg_{t,1}$	$-2 \times Cov$
Panel A: Variance contribution											
Market	0.0085	0.0014	0.0009	0.0014	0.0006	0.0004	0.0004	0.0042	0.0005	0.0038	-0.0001
Value	0.0184	0.0015	-0.0014	0.0012	0.0010	0.0003	-0.0001	0.0143	0.0003	0.0148	-0.0009
Growth	0.0226	0.0013	-0.0020	0.0010	0.0003	0.0006	0.0001	0.0150	0.0005	0.0167	-0.0022
Panel B: Variance contribution as a fraction of $e_{t,\bullet}$											
Market	1	0.17	0.10	1	0.39	0.31	0.29	1	0.12	0.91	-0.03
Value	1	0.08	-0.08	1	0.83	0.23	-0.06	1	0.02	1.04	-0.06
Growth	1	0.06	-0.09	1	0.26	0.61	0.13	1	0.04	1.11	-0.14

Table I. Variance decomposition
 We present variance decompositions for the 1, 10, and 10-1 year equity yields $e_{t,\bullet}$, split into risk premia $rp_{t,\bullet}$ and expected growth $eg_{t,\bullet}$, for the market, value, and growth portfolios.

Horizon (in years)	Consumption (c)			Dividends (d)
	1	3	10	10
Ai et al. (2018)	0.015%	0.099%	0.498%	2.960%
Lettau and Wachter (2007)	0.344%	1.009%	3.054%	3.054%
Gormsen (2021)	1.200%	2.168%	3.034%	3.034%
Bansal and Yaron (2004)	0.208%	0.559%	0.999%	2.997%

Table II. The Response of Consumption and Dividends to a Long-Run Growth Shock

This table reports the impulse responses of consumption and dividends to a long-run growth shock. In each model, we choose the size of the shock such that it leads to an increase in the future 10-year log dividend level of about 3%. With a leverage ratio of 3 (assumed in Bansal and Yaron (2004)), this corresponds to a 1% increase in the 10-year log consumption level. Lettau and Wachter (2007) and Gormsen (2021) do not consider leverage in their setup, implying that consumption equals dividends. In Ai et al. (2018) the dividends are levered by a factor of 2.

	(1) Bansal and Yaron (2004) (2004)	(2) Gormsen (2021) (2021)	(3) Lettau and Wachter (2007) (2007)	(4) Ai et al. (2018) (2018)
$E(\Delta c)$	0.0180	—	—	0.0189
$\sigma(\Delta c)$	0.0323	—	—	0.0172
$E(p - d)$	2.8578	4.1100	2.7856	4.6142
$\sigma(p - d)$	0.2435	0.2131	0.3892	0.2686
$E(\Delta d)$	0.0184	0.0240	0.0228	0.0201
$\sigma(\Delta d)$	0.1324	0.0991	0.1438	0.1107
$E(R_M - R_f)$	0.0572	0.0198	0.0932	0.0539
$E(R_V - R_G)$	0.0663	0.0001	0.0413	0.0088

Table III. Simulated Moments

To simulate from Bansal and Yaron (2004), we run 1,000 simulations each with 840 monthly observations. We follow Gormsen (2021) and run 10,000 simulations of 100 years from his model. In this model, we impose the exogenous dividend share processes of Lettau and Wachter (2007), simulating data for 200 firms, to find the value premium. For Lettau and Wachter (2007), we simulate 50,000 quarters of data from their model. For Ai et al. (2018), we run 100 simulations with 10,000 annual observations. We display the mean and the standard deviation for consumption growth (Δc), the log value of the price to dividend ratio ($p - d$) and dividend growth (Δd). We also report the market risk premium and value premium. Returns, consumption, dividends, and price ratios are aggregated to an annual frequency.

	Lettau and Wachter (2007)	Gormsen (2021)
Loadings for Covariance Matrix	$\begin{bmatrix} \sigma_d \\ \sigma_z \\ \sigma_x \end{bmatrix} = \begin{bmatrix} 14.48 & 0 & 0 \\ -0.26 & 0.18 & 0 \\ 0 & 0 & 24 \end{bmatrix}$	$\begin{bmatrix} \sigma_d \\ \sigma_z \\ \sigma_x \end{bmatrix} = \begin{bmatrix} 10 & 0 & 0 \\ -0.63 & 0.76 & 0 \\ 0 & -10.36 & 43.47 \end{bmatrix}$
Persistence parameter (φ_z)	0.91	0.476
Stochastic discount factor	One priced shock: $m_{t+1} = -r^f - \frac{1}{2}x_t^2 - x_t\sigma_d\epsilon_{d,t+1}$	Two priced shocks: $m_{t+1} = -r^f - \frac{1}{2}(x_d^2 + x_x^2) - x_d\frac{\sigma_d}{ \sigma_d }\epsilon_{t+1} + x_x\frac{\sigma_x}{ \sigma_x }\epsilon_{t+1}$

Table IV. Model Specifications

This table summarizes the differences in the parameterizations of the models in Lettau and Wachter (2007) and Gormsen (2021). Parameter values are from Table IV in Lettau and Wachter (2007) and Table X in Gormsen (2021). We annualize the AR(1) coefficient in Gormsen (2021), φ_z^{12} , to make it comparable to Lettau and Wachter (2007). Volatility parameters are also annualized.

Maturity:	Equity Yield			Expected Growth			Risk Premium		
	1-year $e_{t,1}$	10-year $e_{t,10}$	Slope $e_{t,10} - e_{t,1}$	1-year $eg_{t,1}$	10-year $eg_{t,10}$	Slope $eg_{t,10} - eg_{t,1}$	1-year $rp_{t,1}$	10-year $rp_{t,10}$	Slope $rp_{t,10} - rp_{t,1}$
Data									
On-impact	-1.2158	-0.3537	0.7887	1.2081	0.3812	-0.7356	-0.0517	0.0388	0.1013
One-year horizon	-1.3699	-0.3917	0.9543	1.2261	0.3259	-1.0381	-0.0669	-0.0581	0.0117
Lettau and Wachter (2007)									
On-impact	-0.3225	-0.2188	0.1037	0.3043	0.1315	-0.1728	-0.0182	-0.0873	-0.0691
One-year horizon	-0.2935	-0.1991	0.0944	0.2769	0.1197	-0.1572	-0.0166	-0.0794	-0.0628
Gormsen (2021)									
On-impact	-1.1154	-0.2517	0.8637	0.7275	0.0011	-0.7264	-0.3879	-0.2506	0.1373
One-year horizon	-0.5223	-0.1060	0.4163	0.3462	0.0005	-0.3457	-0.1760	-0.1054	0.0706
Bansal and Yaron (2004)									
On-impact	-0.5635	-0.2310	0.3325	0.4628	-0.0021	-0.4648	-0.1007	-0.2331	-0.1323
One-year horizon	-0.4368	-0.1791	0.2578	0.3587	-0.0016	-0.3603	-0.0781	-0.1807	-0.1026
Ai et al. (2018)									
On-impact	-1.2771	-0.4100	0.8671	1.2754	0.4004	-0.8750	-0.0017	-0.0095	-0.0079
One-year horizon	-0.6849	-0.2889	0.3959	0.6824	0.2795	-0.4029	-0.0025	-0.0095	-0.0070

Table V. Responses of Market Equity Yields to a Long-Run Growth Shock

This table displays responses on-impact and at the one-year horizon for the equity yield of the 1, 10, and 10-1 year maturity claims as well as their expected growth and risk premium components. The first rows presents our VAR estimates from the data; the remaining rows are for the models.

Preference parameters			Learning parameters		
Risk aversion	γ	10	Percentage share of firms trans. to full info	ϕ	0.7
Intertemporal elasticity of substitution	ψ	2	Productivity exposure of firms with full info	λ^*	6
Discount factor	β	0.98	Diffusion of information: cointegration speed	ρ_s	0.96
Leisure weight	o	0.33			
Technology parameters			Common productivity parameters		
Capital share	α	0.3	Average growth rate	$\lambda^* \mu$	0.02
Deprec. rate of phys. and intang. cap.	δ	12.0%	Volatility of short-run risk	$\lambda^* \exp(\sigma_a)$	1.69%
Weight on physical investment in G	ν	92.5%	Relative volatility of long-run risk	$\frac{\exp(\sigma_x)}{\exp(\sigma_a)}$	0.09
Elasticity of substitution in G	η	12	Autocorrelation of expected growth	ρ_x	0.965

Table VI. Ai et al. (2018) Model Specification

The parameters correspond to the main specification used to match the estimated time series of the term structure slope in Figure 5 of Ai et al. (2018), with the exception of the productivity parameters. These parameters are calibrated to ensure consistency with the moments of the three benchmark models we study in Section 4.

	Equity Yield			Expected Growth			Risk Premium		
	1-year $e_{t,1}$	10-year $e_{t,10}$	Slope $e_{t,10} - e_{t,1}$	1-year $egt,1$	10-year $egt,10$	Slope $egt,10 - egt,1$	1-year $rpt,1$	10-year $rpt,10$	Slope $rpt,10 - rpt,1$
Maturity:									
Data									
<i>On-impact:</i>									
Growth	-1.8768	-0.3769	1.4739	2.3004	0.4267	-1.7715	0.1996	0.0356	-0.1709
Value	0.7868	0.0118	-0.7675	-0.4843	-0.0085	0.4194	0.3470	-0.0155	-0.3193
<i>One-year Horizon:</i>									
Growth	-1.9946	-0.3966	1.6191	2.2342	0.3582	-1.8824	0.1429	-0.0368	-0.1798
Value	-0.6034	-0.2206	0.3962	0.5352	0.0627	-0.3727	0.1094	-0.1399	-0.2002
Ai et al. (2018)									
<i>On-impact:</i>									
Growth	-2.2686	-0.4187	1.8500	2.2678	0.4034	-1.8643	-0.0009	-0.0152	-0.0144
Value	-0.7779	-0.4057	0.3722	0.7777	0.3990	-0.3788	-0.0001	-0.0067	-0.0065
<i>One-year Horizon:</i>									
Growth	-0.5384	-0.1906	0.3479	0.5374	0.1757	-0.3618	-0.0010	-0.0149	-0.0139
Value	-0.7575	-0.3383	0.4191	0.7559	0.3316	-0.4244	-0.0015	-0.0067	-0.0052

Table VII. Responses of Equity Yields to a Long-Run Growth Shock for Value and Growth Firms

This table displays responses on-impact and at the one-year horizon for the equity yield of the 1, 10, and 10-1 year maturity claims for value and growth firms. We also report the responses of the expected growth and risk premium components of these yields. We present these responses in the data as well as in the model of Ai et al. (2018).

Online Appendix

A Impulse Response of Returns

To calculate the impulse response of returns to shocks in the models, we need to take a stand on when the shock hits. For instance, if the shock hits at the end of an annual period, the return of a 1-year claim will be unaffected. This is unattractive for our purposes, because we find significant on-impact responses of equity yields in the data that are closely connected to returns. Therefore, we will assume the shock hits at the beginning of the period and we effectively compute an instantaneous return for horizon $s = 0$. To be precise, the instantaneous gross return on the n -year claim equals:

$$R_{t+\epsilon}^n = \frac{P_{t+\epsilon, n-\epsilon}(\text{with shock})}{P_{t, n}(\text{without shock})} = \frac{D_{t+\epsilon} e^{-(n-\epsilon)e_{t+\epsilon, n-\epsilon}}}{D_t e^{-ne_{t, n}}}. \quad (\text{A.1})$$

In logs, we have

$$r_{t+\epsilon}^n = \log\left(\frac{D_{t+\epsilon}}{D_t}\right) - (n-\epsilon)e_{t+\epsilon, n-\epsilon} + ne_{t, n}, \quad (\text{A.2})$$

such that, for instance, the realized term premium equals:

$$r_{t+\epsilon}^{10} - r_{t+\epsilon}^1 = -(10-\epsilon)e_{t+\epsilon, 10-\epsilon} + 10e_{t, 10} + (1-\epsilon)e_{t+\epsilon, 1-\epsilon} - e_{t, 1}. \quad (\text{A.3})$$

In the limit, when $\epsilon \rightarrow 0$,

$$\lim_{\epsilon \rightarrow 0} r_{t+\epsilon}^{10} - r_{t+\epsilon}^1 = -10 \times (e_{t, 10}(\text{with shock}) - e_{t, 10}(\text{w/o shock})) + \quad (\text{A.4})$$

$$1 \times (e_{t, 1}(\text{with shock}) - e_{t, 1}(\text{w/o shock})). \quad (\text{A.5})$$

Thus, in the models, the on-impact response of the realized term premium to a shock is equal to $-10 \times$ the response of the 10 year yield plus $1 \times$ the response of the 1 year yield. This relation holds approximately for our structural VARs in the data. For horizons $s > 0$, the return is simply an annual return.

B Robustness: Alternative Identification Scheme

Figure B.1 compares the impulse responses of our main variables TFP, the 10-minus-1 year equity yield slope, and the 1- and 10-year equity yields when using the original identification scheme of Barsky and Sims (2011), rather than the Kurmann and Sims (2020) approach that serves as our benchmark. Although the two identification strategies are conceptually similar, they differ in two key respects. First, Kurmann and Sims (2020) identify the shock that maximizes the forecast error variance (FEV) share of adjusted TFP at a long horizon ($H = 80$ quarters), whereas Barsky and Sims (2011) maximize the sum of FEV shares from the impact period onward. Second, Kurmann and Sims (2020) do not impose a zero restriction on the contemporaneous response of TFP, allowing measured productivity to react immediately to the shock, unlike Barsky and Sims (2011), who impose such a restriction.

Overall, we observe very similar dynamics and magnitudes across the two identification schemes. We adopt the Kurmann and Sims (2020) approach as our benchmark, because (i) the focus on a longer horizon reduces the potential bias arising from cyclical mismeasurement of utilization and therefore technology and (ii) it does not require imposing assumptions about whether true technology responds to the shock with a lag.

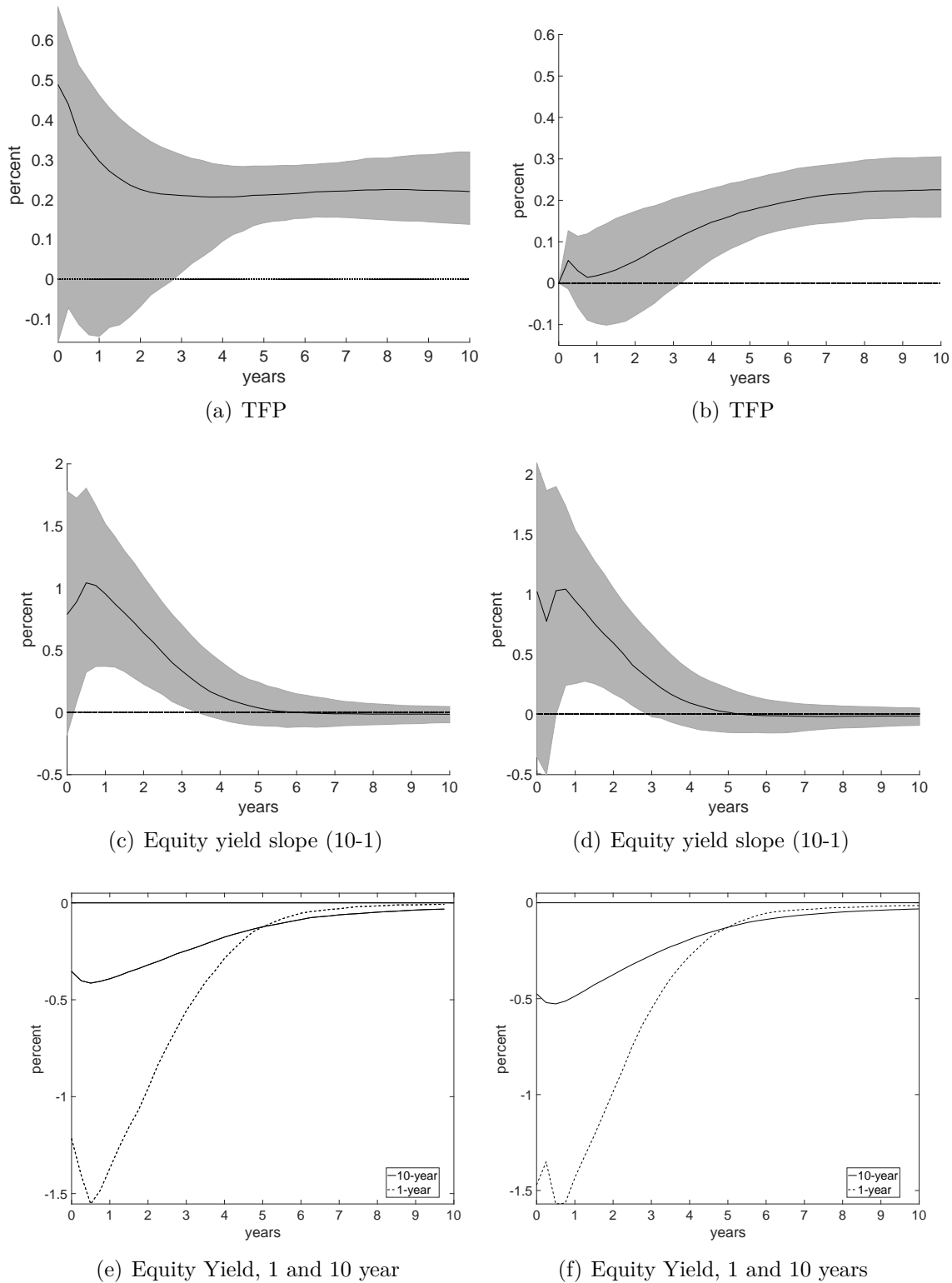


Figure B.1. Impulse Responses to a News Shock

We report impulse responses estimated from a VAR using the 2020 vintage of adjusted TFP. Panels (a), (c), and (e) display responses of TFP, the 10-minus-1 year equity yield slope, and the 1- and 10-year equity yields to a TFP news shock using the identification of Kurmann and Sims (2020). Panels (b), (d), and (f) show the corresponding responses using the identification of Barsky and Sims (2011). The sample period is September 1974 to December 2019.

C Robustness: Option-Implied Equity Yield

The equity yields from Giglio et al. (2024) are implied by a rich affine model of equity prices, dividends, returns and their dynamics. The model parameters are estimated in-sample using GMM and a large cross-section of equity portfolios. Using the model and the estimated parameters, the authors price dividend strips of the aggregate market index. These prices turn out to match quite well with traded dividend forward prices. Even so, one may wonder how overfitting and estimation error impact our results. To address this issue, we now study the impulse response of an option-implied equity yield to the TFP news shock. This alternative short-term equity yield is derived from option prices following the approach of van Binsbergen et al. (2012). Although this alternative also suffers from estimation error, it is unlikely that these errors (coming from a different market and estimation method) would bias our results in exactly the same way as the model-implied yields.³⁴

We define this alternative short-term equity yield as follows using the replication data from Cassella et al. (2023):

$$e_{t,Short}^{Option} = \frac{1}{1.5} \log \left(\frac{D_t}{P_{t,n}/1.5} \right), \quad (C.1)$$

where D_t is the dividend in the current year (as in equation (1)) and $P_{t,n}$ is the short-term strip price, which is estimated as the median implied dividend by all put-call pairs with a maturity of about 1.5 years. Since options with maturities much longer than a few years are very illiquid, we do not have an equivalent long-term equity yield from option markets. For that reason, we use the long-term equity yield from Giglio et al. (2024) to define an alternative measure of the slope: $e_{t,10} - e_{t,Short}^{Option}$. Because the option data is sparse and the option market illiquid pre-2004 (see, e.g., Golez and Jackwerth, 2024), we do not re-estimate our VAR over the shorter sample for which we have a reliable option-implied equity yield. Rather, we now estimate impulse responses using local linear projections (Jordà, 2005) of equity yields on the TFP news shock (as identified from the structural VAR estimated over the full sample from 1975). These projections control for the same number lags of the same variables included in the VAR studied above.³⁵ Figure C.1 presents the results.

The first row of the figure confirms that our conclusions based on model-implied equity yields are robust to using local linear projections. The impulse responses are very similar to those in Figure 3 when estimated over the full sample. The second row shows qualitatively

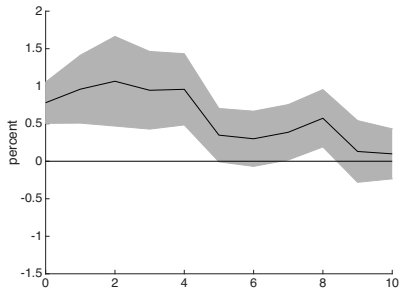
³⁴Prominent sources of estimation error for option-implied equity yields are illiquidity and the proxy for short-term interest rates (see, e.g., Boguth et al., 2023b; Golez and Jackwerth, 2024).

³⁵The confidence bands are calculated using Newey-West standard errors with number of lags equal to the forecast horizon.

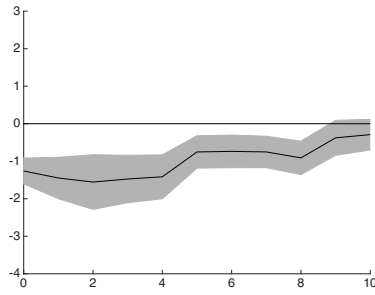
similar but quantitatively stronger effects when the projection is restricted to the post-2004 subsample,³⁶ with the short-term yield and the slope responding by about -2.5% and 2%, respectively, in the first year after the shock. As expected, the estimates are somewhat noisier, reflecting the loss of roughly two-thirds of the sample. The third row reports results that are both qualitatively and quantitatively similar to those in the second row when we replace the short-term yield with its option-implied counterpart $e_{t,Short}^{Option}$. Overall, our main finding—a relatively large drop in the short-term equity yield following a TFP news shock—proves robust both to using option-implied yields and to focusing on the more recent subsample.

³⁶We exclude earlier years when option markets were relatively illiquid and option-implied yields are likely noisier.

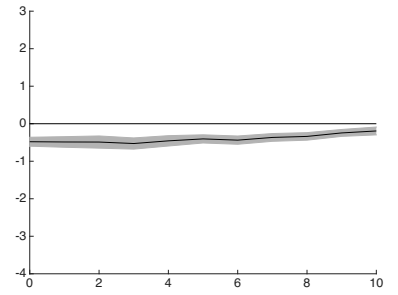
Model-implied equity yields (Full sample)



(a) Equity yield slope (10-1)

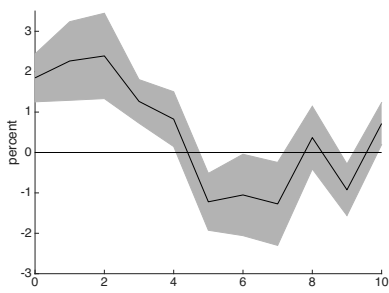


(b) Equity yield, 1 year

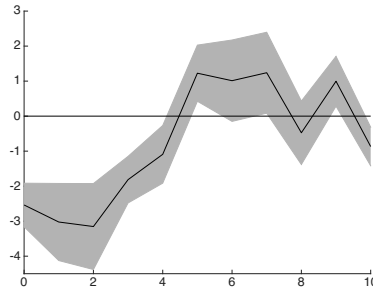


(c) Equity yield, 10 year

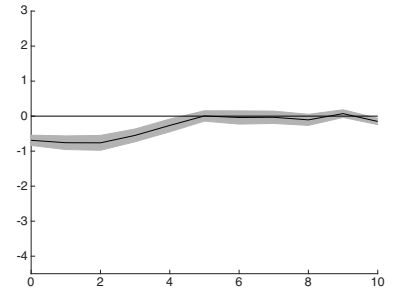
Model-implied equity yields (Recent sample)



(d) Equity yield slope (10-1)

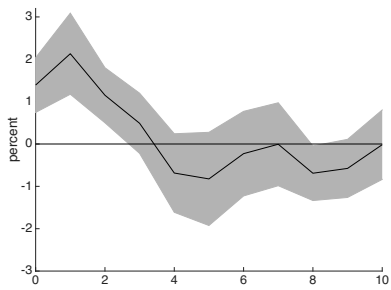


(e) Equity yield, 1 year

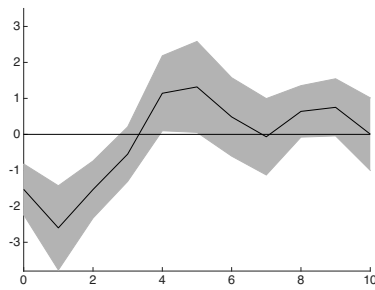


(f) Equity yield, 10 year

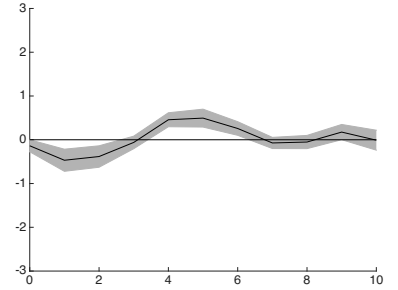
Option-implied short yield (Recent sample)



(g) Equity yield slope (10-1)



(h) Equity yield, 1 year



(i) Equity yield, 10 year

Figure C.1. Responses to a News Shock using Option-Implied Yields and in Subsamples

The TFP news shock is identified as in Kurmann and Sims (2020), with the 10-1 year equity yield slope substituted into the VAR in place of the term spread. The news shock is then used in local projections to obtain the impulse response functions. The local projection includes the same number of lags and same control variables as in the VAR. Panels (a) to (f) use the model-implied equity yields from Giglio et al. (2024) for both the 1 and 10 year maturity. The bottom row of panels replace the 1-year yield with the option-implied short-term yield from Cassella et al. (2023).

D The model of Belo et al. (2015)

In this appendix, we discuss results for the extension of the Bansal and Yaron (2004, BY) studied in Belo et al. (2015, BCG).

D.1 Model setup

BCG modify dividend dynamics by distinguishing between a firm's unleveraged cash flows (EBIT) and dividends, which represent leveraged cash flows, and by imposing cointegration between dividends and EBIT.³⁷ Specifically, they adapt the BY model by first specifying an EBIT process Δy_t with the same functional form as BY's dividends, and then combining it with a dynamic capital structure policy that generates a stationary leverage ratio. Together, these elements generate an endogenously determined dividend process that is internally consistent with the EBIT process.

In particular, BCG assume that at each date t the firm issues riskless debt maturing at $t + 1$, with present value

$$B(l_t, y_t, x_t, \sigma_t) \approx e^{l_t} V(y_t, x_t, \sigma_t),$$

where l_t is the leverage of the firm and $V(y_t, x_t, \sigma_t)$ is the enterprise value. Given that debt is riskless, dividends D_{t+1} are

$$D_{t+1} = B(l_{t+1}, y_{t+1}, x_{t+1}, \sigma_{t+1}) - e^{r_f(x_t, \sigma_t)} B(l_t, y_t, x_t, \sigma_t) + e^{y_{t+1}}. \quad (\text{D.1})$$

Equation (D.1) specifies that dividends are the residual cash flow remaining after combining EBIT ($e^{y_{t+1}}$) and net debt issuance, newly issued debt ($B(l_{t+1}, y_{t+1}, x_{t+1}, \sigma_{t+1})$) minus outflows from maturing debt ($e^{r_f(x_t, \sigma_t)} B(l_t, y_t, x_t, \sigma_t)$). Finally, BCG choose the dynamics of log-leverage so that (i) it is mean-reverting, and (ii) in the continuous time limit of the model, bond issuances are locally deterministic:

$$l_{t+1} = \bar{l} + \rho_l (l_t - \bar{l}) + \rho_{lx} x_t + \rho_{l\sigma} (\sigma_t^2 - \bar{\sigma}^2) - \nu_{yc} \sigma_t \tilde{\epsilon}_{c,t+1} - \nu_y \sigma_t \tilde{\epsilon}_{y,t+1} - U_x \nu_x \sigma_t \tilde{\epsilon}_{x,t+1} - U_\sigma \nu_\sigma \tilde{\epsilon}_{\sigma,t+1}. \quad (\text{D.2})$$

The shock coefficients are formulated to offset the diffusion terms in the enterprise value process, ultimately rendering the resultant debt locally risk-free. This specification implies that the term structure of dividend volatility is downward sloping and that the volatility of dividends at long horizons approaches the volatility of EBIT.

³⁷BY capture leverage by assuming that dividends are more exposed than consumption to shocks in expected growth rates. However, their model does not ensure stationarity of the dividend/consumption ratio.

D.2 Model Mechanism and the Response of Equity Yields

Figure D.1 shows that a favourable long-run growth (x_t) shock, has an immediate negative impact on leverage of about -1.5 percentage points. After, debt levels rise gradually, as firms start to issue new debt to push leverage back toward its steady state. Because dividends are directly tied to debt issuance, this process effectively translates long-run gains in fundamentals into immediate dividends. Equity prices reflect both current and future dividends. When firms use new leverage to finance payouts, the immediate increase in current dividends is larger than the response of future dividends (see right panel in Figure D.1). As a result, near-term dividends rise disproportionately relative to equity value, which leads to an increase in equity yields.

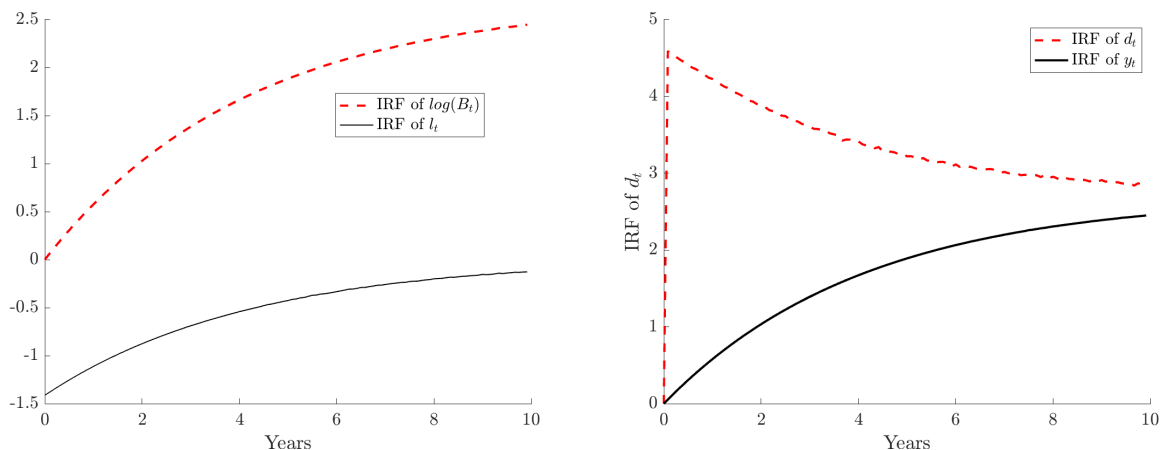
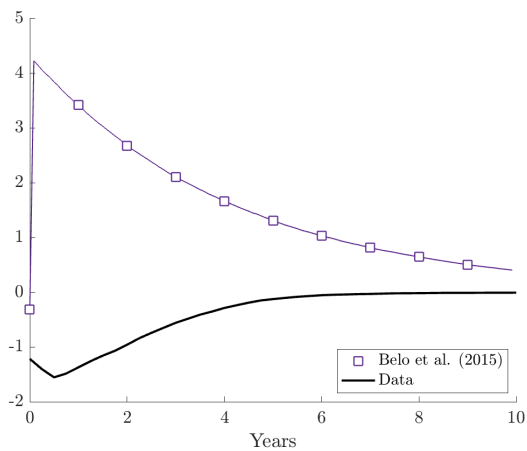


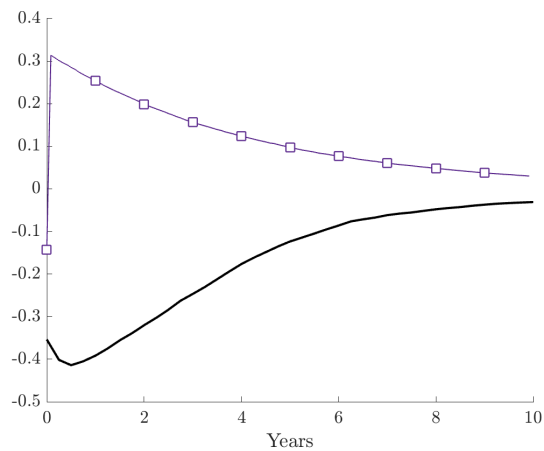
Figure D.1. Responses to a Long-Run Shock in Belo et al. (2015)

We report median impulse responses up to 10 years after a long-run productivity shock in the model of Belo et al. (2015). The left panel reports the responses of the log-value of debt ($\log(B_t)$) and the leverage ratio (l_t), while the right panel shows the responses of the log-value of dividends (d_t) and EBIT (y_t).

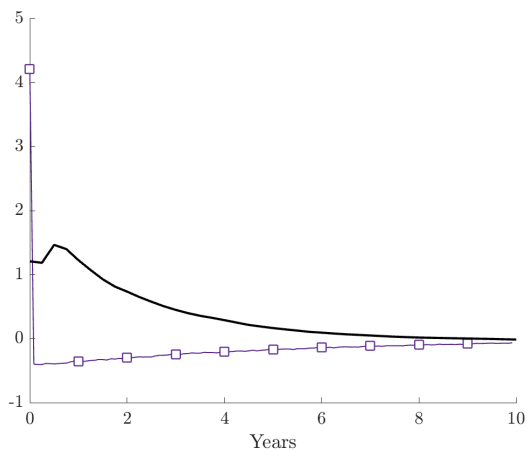
This increase in equity yields contrasts sharply with the endowment economies in Section 4, where dividends are specified exogenously, as well as with what we find in the data. To see this, Figure D.2 shows that following a positive long-run shock, equity yields increase in BCG while they decrease in the data, reflecting higher dividends financed through debt issuance in the model. Expected growth rises only briefly before falling as future dividends decline, again quite different from the persistent positive impact on dividend growth that we see in the data. Finally, risk premia counterfactually increase in BCG, especially for the short-term claim that is subject to a relatively large leverage effect (because the maturity of all debt in the model is one period). We conclude that the BCG model generates equity yield dynamics at odds with observed patterns.



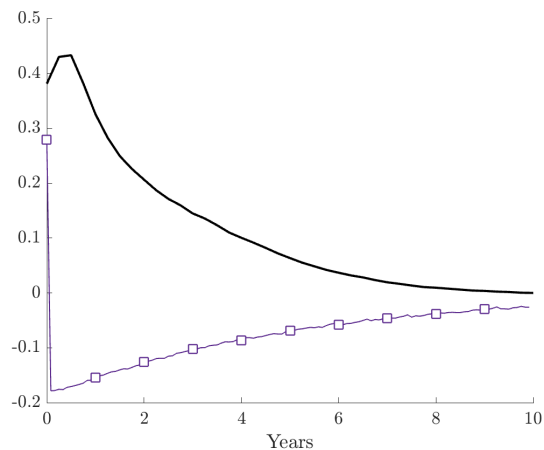
(a) Equity yield, 1 year



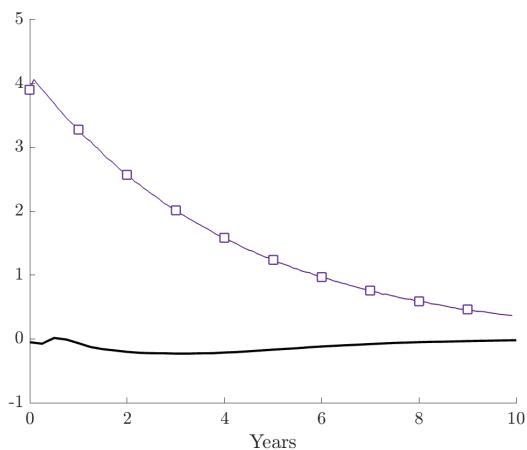
(b) Equity yield, 10 year



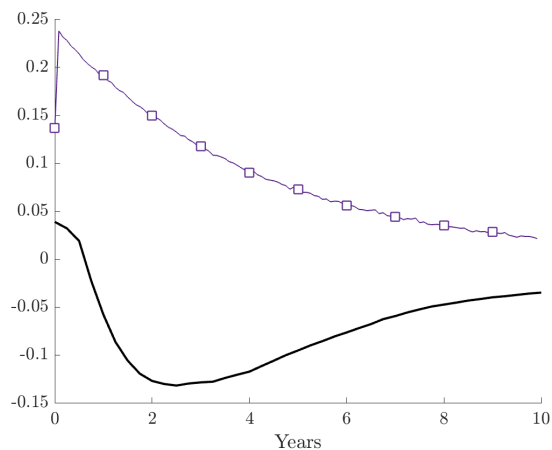
(c) Expected growth, 1 year



(d) Expected growth, 10 year



(e) Risk premium, 1 year



(f) Risk premium, 10 year

Figure D.2. Responses to a Long-Run Shock in Models versus Data

This figure shows the impulse response function (up to 10 years after the long-run productivity shock) of the model-implied equity yields, expected growth rates and risk premia for the aggregate dividend strip with a 10-year (red solid lines) and a 1-year maturity (red dashed lines) from Belo et al. (2015). For an easier comparison, we also report the estimated impulse responses from the VAR model, represented by black solid lines for the 10-year maturity and black dashed lines for the 1-year maturity.

E Exogenous Dividend Share Processes in Lettau and Wachter (2007)

Firm-level price-dividend ratios for individual dividend strips are given by the ratio of dividend shares times the price-to-dividend ratio of strips of the aggregate market:

$$\frac{P_{t,n}^i}{D_t^i} = \frac{s_{t,n}^i}{s_t^i} \times \frac{P_{t,n}}{D_t}. \quad (\text{E.1})$$

Using this insight, Lettau and Wachter (2007) define value (growth) as an equal-weighted portfolio of those firms in the highest (lowest) decile of dividend-to-price ratios, $\frac{P_t^i}{D_t^i}$. They rebalance these portfolios each year and study realized returns observed over the year after portfolios are formed.

Firm-level equity yields: The implied equity yield for firm i can be decomposed into the aggregate market equity yield plus the component describing the ratio of dividend shares.

$$e_{t,n}^i = \frac{1}{n} \log \left(\frac{D_t^i}{P_{t,n}^i} \right) = \underbrace{\frac{1}{n} \log \left(\frac{D_t^i}{P_{t,n}^i} \right)}_{\text{the aggregate component}} + \underbrace{\frac{1}{n} \log \left(\frac{s_t^i}{s_{t,n}^i} \right)}_{\text{the firm-specific component}}. \quad (\text{E.2})$$

Figure E.1 quantifies the impact of the heterogeneity in firm lifecycle on the implied equity yields of individual firms. To generate this figure, we use the same growth parameter values as in Lettau and Wachter (2007). Firms at the beginning of their lifecycle (in Stage 1 and 2) are characterized by growing future dividend shares and reach relatively lower equity yields. In contrast, firms in Stage 3 and 4 of the life cycle have decreasing future dividend shares, which increases their equity yields, relative to the aggregate market. We see that firms in the beginning of their lifecycle have yields that are up to 20% lower than market yields, due to the high expected growth of their dividend shares.

The impact of a long-run shock on value versus growth firms: The firm-specific component from Equation (E.2), which is driving the entire variation in equity yields of value and growth firms is fully determined by the ratio of dividend shares. This dividend share process proposed by Lettau and Wachter (2007) is deterministic and orthogonal to long-run (or any other) shocks in the model. This means that the entire response of yields of value and growth firms is fully driven by the impact of the long-run (or any other) shock on the aggregate component. As a result, any model that uses the Lettau and Wachter (2007)

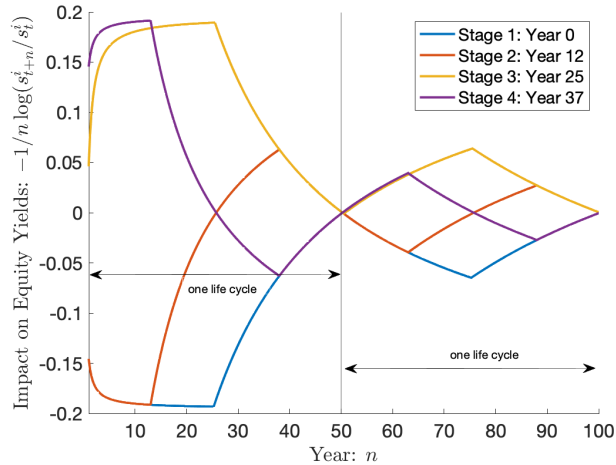


Figure E.1. Heterogeneity of Equity Yields Over the Firm's Lifecycle

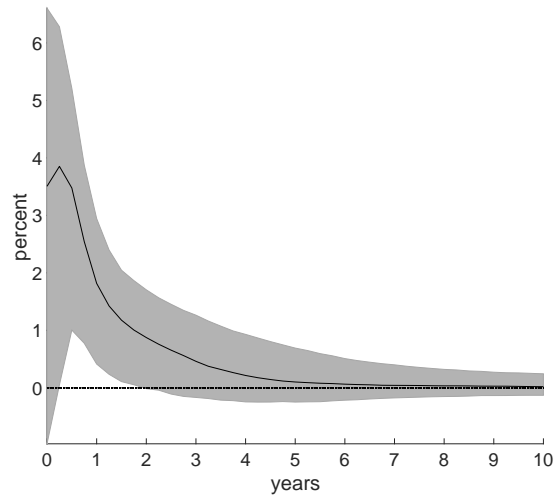
The figure shows the firm-specific component, $\frac{1}{n} \log \left(\frac{s_t^i}{s_{t+n}^i} \right)$, that drives the heterogeneity in equity yields of individual firms in Lettau and Wachter (2007). We show four firms in different stages of their lifecycle. Their lifecycle length is 50 years. Stage 1 refers to a newly-born firm (in Year 0). A Stage 2 firm is a firm in the middle of its dividend share growth period. Stage 3 refers to a firm which has reached the highest level of dividend share and is expected to shrink in future. Lastly, a Stage 4 firm is a firm in the middle of its shrinking period.

specification of value and growth firms will produce zero cross-sectional variation in firm impulse responses to (long-run) shocks.

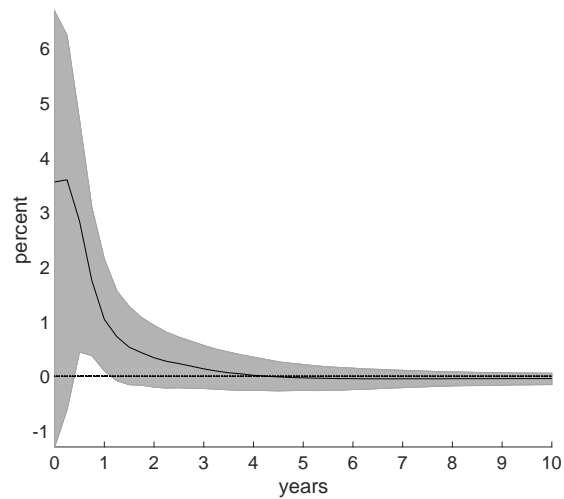
To see this in more detail, note that impulse responses in models are calculated by comparing the dynamics of each variable after a long-run shock with its dynamics from a steady state. Intuitively, this means that impulse responses are the difference between a variable's path with and without a long-run risk shock. The share of the market dividend earned by a firm changes deterministically over the lifecycle, first increasing to a maximum share and then decreasing to a minimum share, after which the lifecycle repeats. In the Lettau and Wachter (2007) setup, each firm is simply a portfolio of market dividend strips and this is what generates the unconditional value premium. In the absence of the shock, market risk premia vary with maturity but are the same for all firms. Although risk premia change when the shock hits, they remain the same for all firms. Hence, the impulse responses for the risk premium component of equity yields are the same for value and growth firms in the model. Now let us consider the growth component. At the beginning of their lifecycle, growth firms exhibit yields that are up to 20% lower than market yields, due to the high expected growth of their dividend shares. In the absence of a shock, the level of expected growth varies across maturities and also between value and growth. However, when the shock hits, the marginal effect on expected growth at each maturity is the same for value and

growth because the impulse response function effectively nets out the deterministic changes imposed through the dividend share process, as depicted in Figure E.1. In other words, like risk premia, the responses of the expected growth components are also identical between value and growth. In turn, this results in equity yields of value and growth firms responding identically to the long-run growth shock.

F Supplementary Tables and Figures



(a) Market return minus 1-year claim: $r_t - r_t^1$



(b) Market return: r_t

Figure F.1. Responses to a News Shock for Alternative Market Term Premia.

This figure is analogous to Figure 2, but now we present responses in the data for an alternative definition of the realized term premium based on the total market return, $r_t - r_t^1$, as well as for the market return in isolation, r_t .

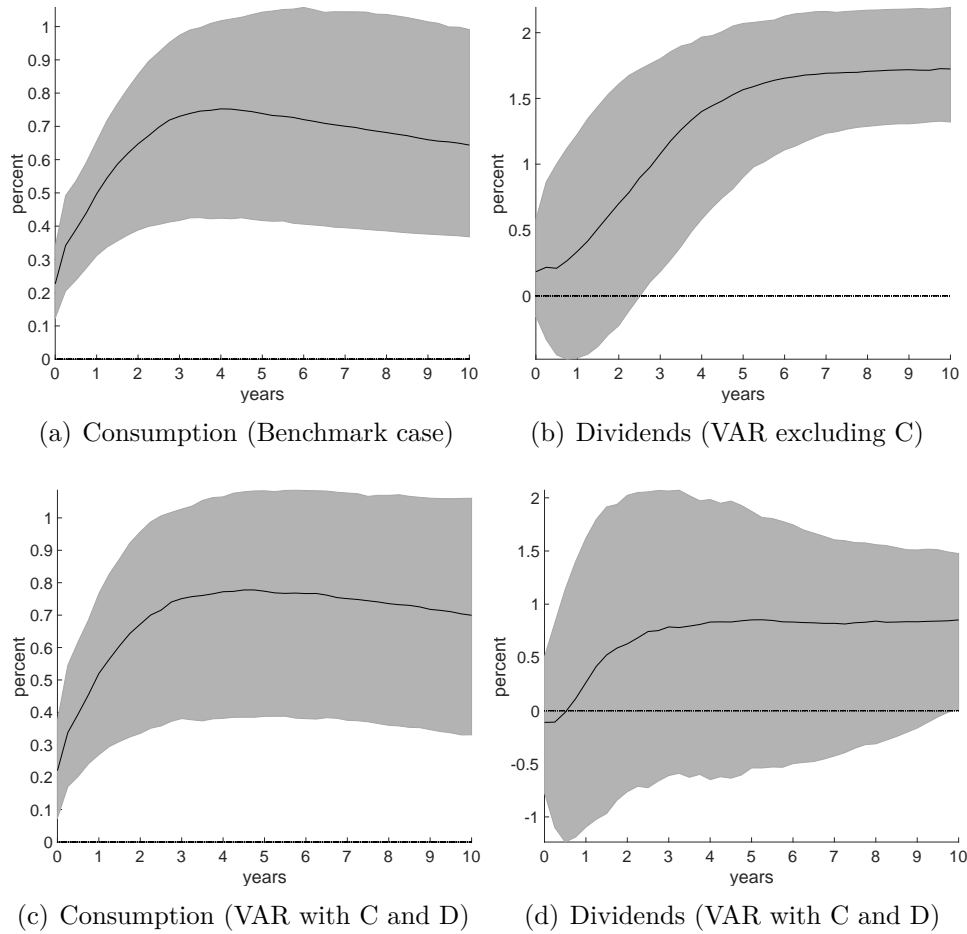


Figure F.2. Impulse Responses of Consumption and Dividends to a News Shock

The news shock is identified as in Kurmann and Sims (2020). The VAR features TFP, Consumption (C) and / or Dividends (D), Inflation, Short Rate and Equity Yields. Solid black lines are the median estimates for the VAR estimated with the 2020 vintage of adjusted TFP. The gray bands correspond to the 16–84 bootstrapped confidence intervals. Sample is 1974/09–2019/12. We see that a TFP news shock impacts dividends more than consumption at its peak (Panel (b) versus (a)). The response of dividends is poorly estimated when both consumption and dividends are included, however (Panel (d) versus (b)), potentially due to collinearity issues.

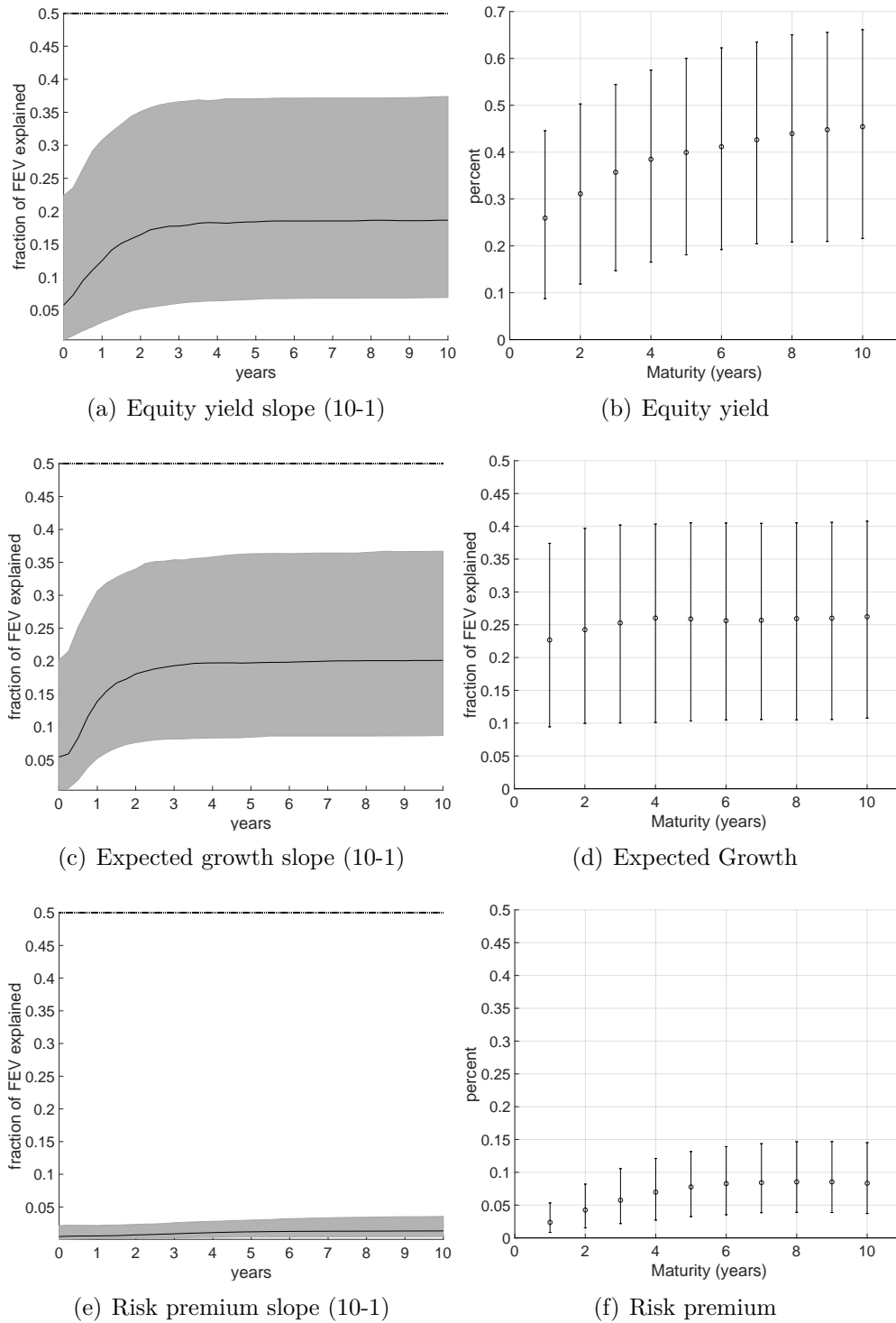
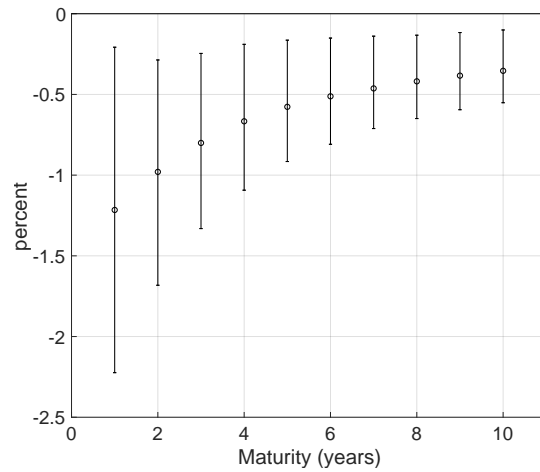
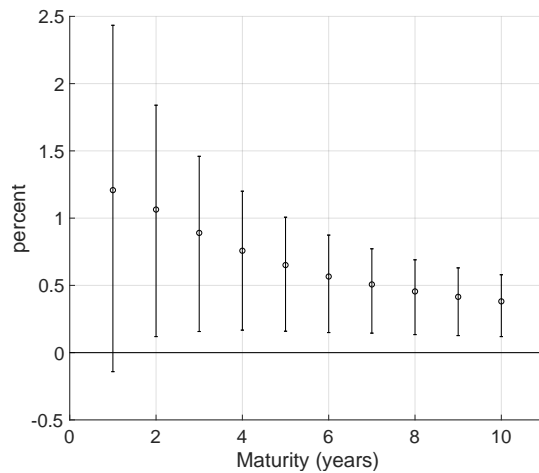


Figure F.3. Forecast Error Variance Decomposition for a News Shock

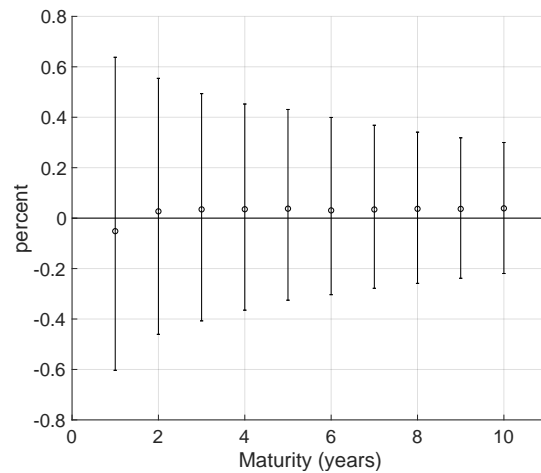
The TFP news shock is identified as in Kurmann and Sims (2020), with the 10-1 year equity yield slope (or its growth and risk premium components) substituted into the VAR in place of the term spread. Solid black lines are the median estimates for the VAR estimated with the 2020 vintage of adjusted TFP. The gray bands correspond to the 16–84 percentile bootstrapped confidence intervals. The left panels present the FEVD for the slope for horizons up to 10 years. The right panels present the FEVD at the $h = 40$ quarter horizon from a VAR that includes as last variable the equity yield for maturities from 1 to 10 years. The sample period runs from September 1974 to December 2019.



(a) Equity Yield



(b) Expected Growth



(c) Risk premium

Figure F.4. On-impact Responses to a News Shock

The figure shows the instantaneous response of equity yields, expected growth, and risk premia for maturities from 1 to 10 years to a news shock. The responses of expected growth and risk premia are derived from a VAR that includes both these variables. Each dot represents the median estimate from the VAR and whiskers correspond to the 16–84 percentile bootstrapped confidence intervals. The sample period runs from September 1974 to December 2019.

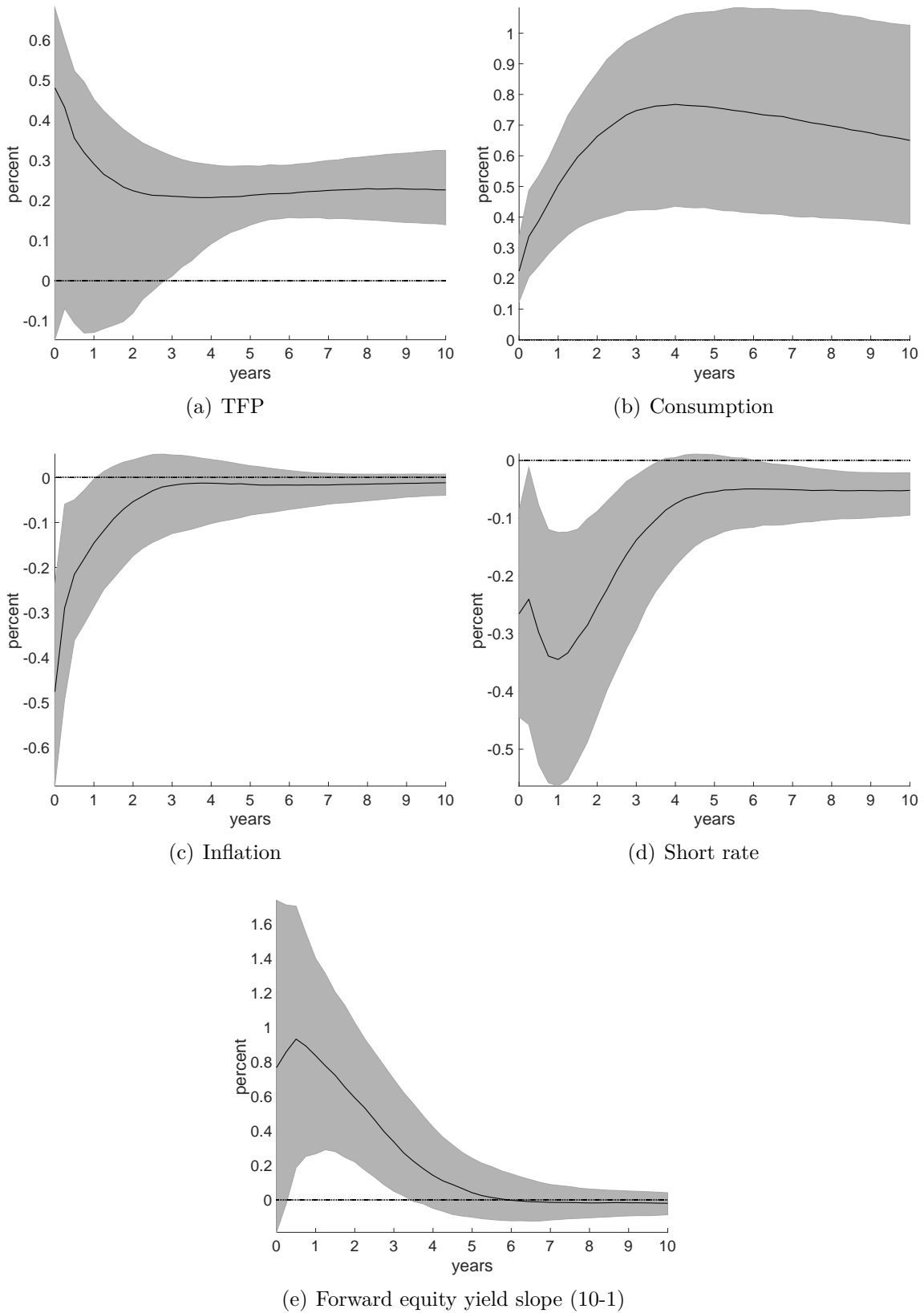


Figure F.5. Impulse Responses to a News Shock: Slope of Forward Equity Yields: This figure is analogous to Figure 3 of the paper, but now we use the 10-1 year forward equity yield slope (i.e., the equity yield adjusted for nominally risk-free government bond rates).

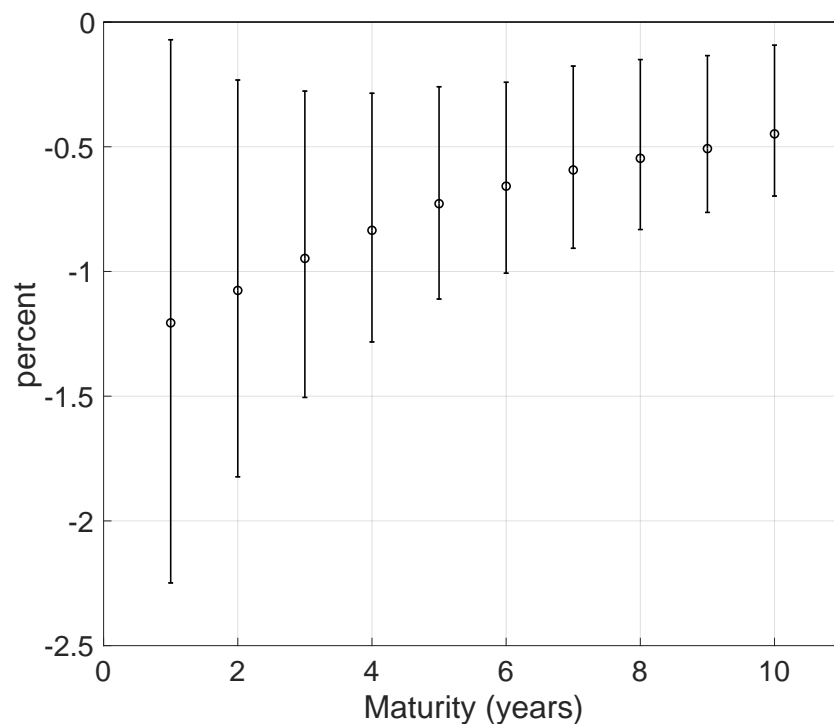


Figure F.6. On-impact Responses of Forward Equity Yields to a News Shock This figure is analogous to Figure F.4 but uses forward equity yields.

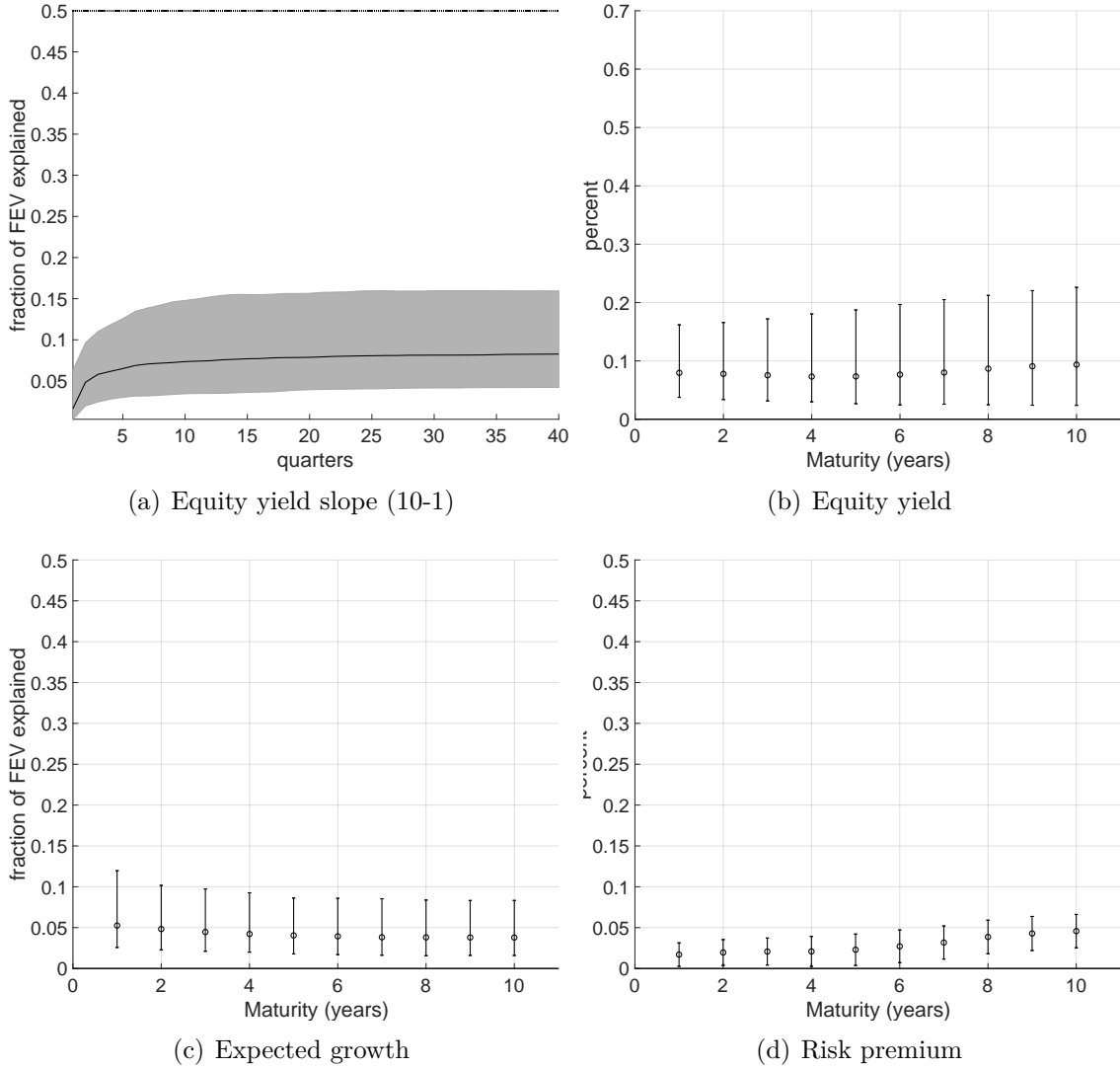


Figure F.7. Forecast Error Variance Decomposition for the Contemporaneous TFP Shock
 The shock is identified through a Choleski decomposition with TFP ordered first in the VAR. Solid black lines are the median estimates for the VAR estimated with the 2020 vintage of adjusted TFP. The gray bands correspond to the 16–84 bootstrapped confidence intervals. Panels (b)–(d) present the forecast error variance decomposition at horizon $h = 40$ quarters.

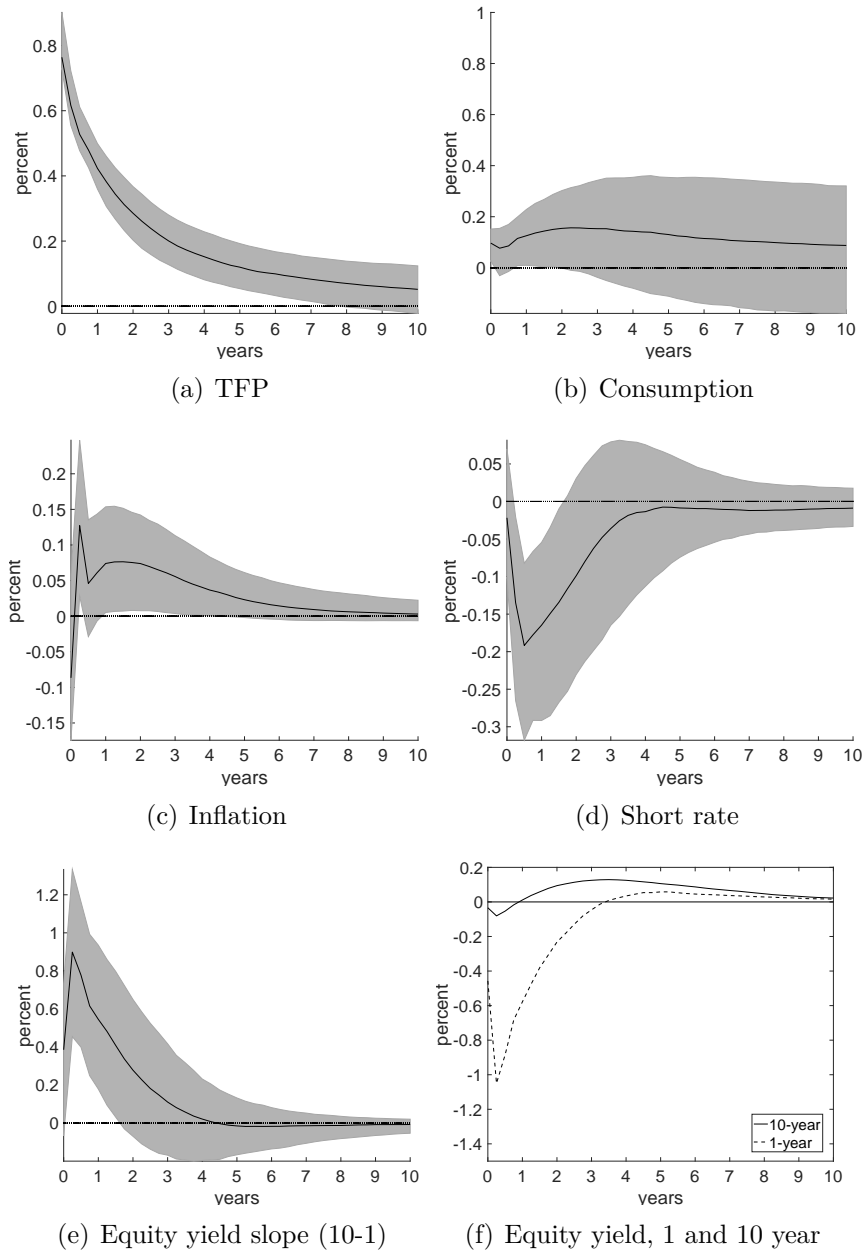


Figure F.8. Impulse Responses to a Contemporaneous TFP Shock

The shock is identified through a Choleski decomposition with TFP ordered first in the VAR. Solid black lines are the median estimates for the VAR estimated with the 2020 vintage of adjusted TFP. The gray bands correspond to the 16–84 percentile bootstrapped confidence intervals. Panels (a) to (e) report the impulse response function for the five variables included in the VAR. Panel (f) shows the response of the 1 and 10 year yield separately. The sample period runs from September 1974 to December 2019.

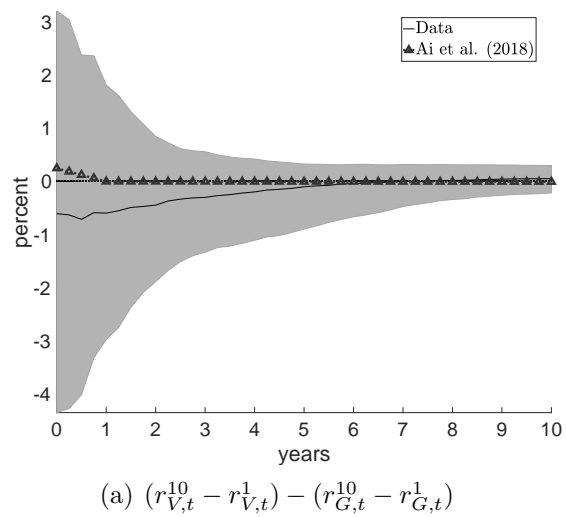
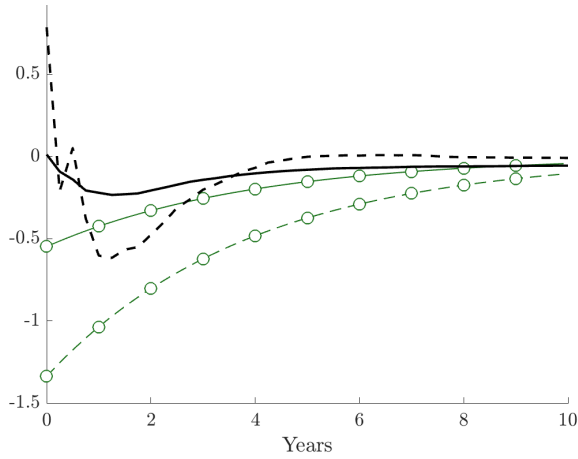
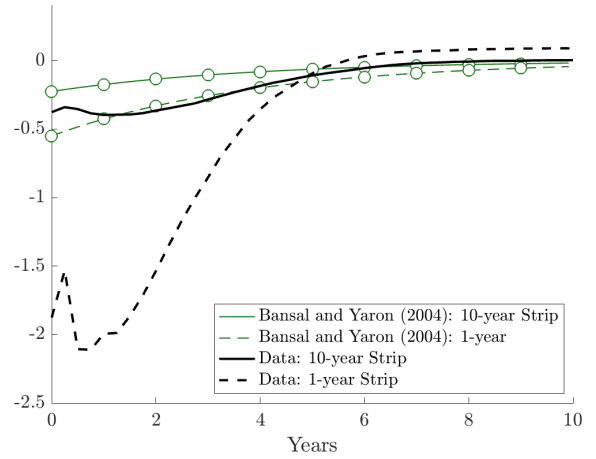


Figure F.9. Realized Value-Minus-Growth Term Premium

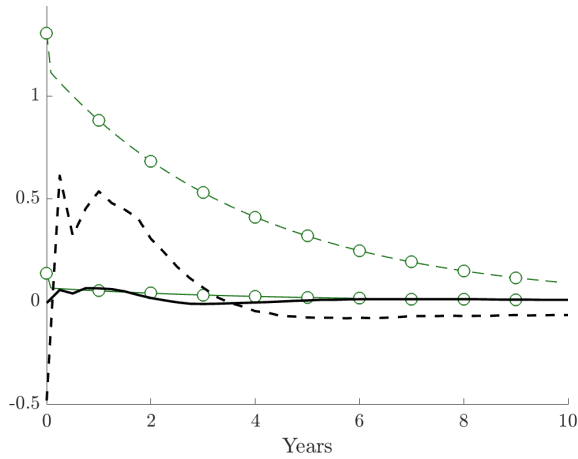
We present the response of the realized value-minus-growth term premium observed in the data (solid black lines representing the median estimates from the VAR model) as well as from the Ai et al. (2018) model (line with triangles).



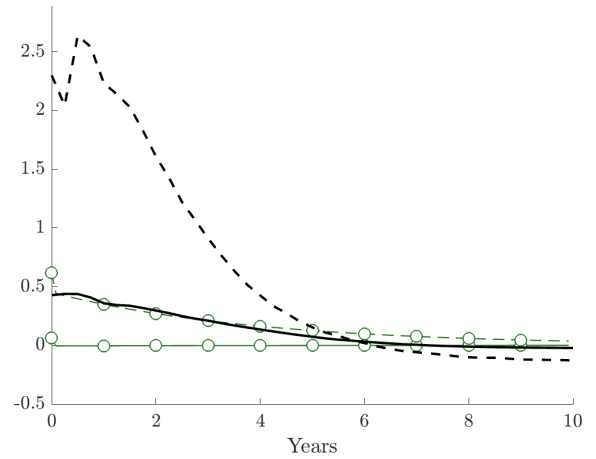
(a) Equity yield: Value



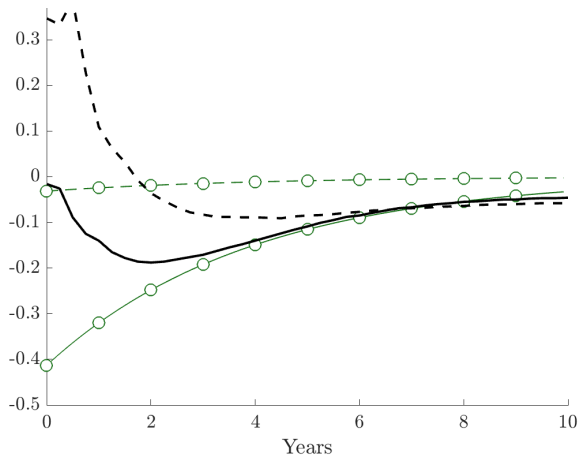
(b) Equity yields: Growth



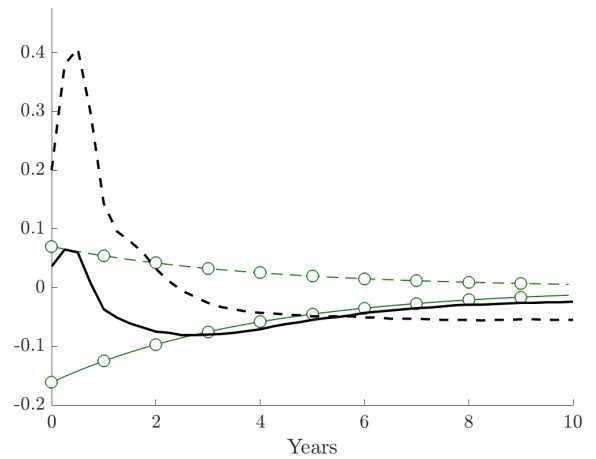
(c) Expected growth: Value



(d) Expected growth: Growth



(e) Risk premium: Value



(f) Risk premium: Growth

Figure F.10. Responses of the Value and Growth Portfolios to a Long-Run Shock in the Bansal and Yaron (2004) Model versus Data

This figure is similar to Figure 8, but presents results for the value and growth portfolios that we define using the definition of cross-sectional payouts in Breugem et al. (2024) and applied to the model of Bansal and Yaron (2004, see Section 6.2.b for more detail).