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Nominal rigidities, asset returns, and monetary policy ☆

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ABSTRACT

Asset-return implications of nominal price and wage rigidities are analyzed in general equilibrium. Nominal rigidities, combined with permanent productivity shocks, increase expected excess returns on production claims. This is mainly explained by consumption dynamics driven by rigidity-induced changes in employment and markups. An interest-rate monetary policy rule affects asset returns. Stronger (weaker) rule responses to inflation (output) increase expected excess returns. Policy shocks substantially increase asset-return volatility. Price rigidity heterogeneity produces cross-sectoral differences in expected returns. The model matches important macroeconomic moments and the Sharpe ratio of stock returns, but only captures a small fraction of the observed equity premium.

1. Introduction

Explaining both asset return and aggregate business cycle fluctuations in a unified framework remains an important challenge in financial economics. Standard real business cycle models imply a counterfactually low compensation for risk in asset returns, partly because production factors can be freely adjusted to reduce consumption risk.[2] This has motivated the introduction of real frictions to these models, such as investment adjustment costs and imperfect factor mobility,[3] to attenuate the households' ability to smooth consumption. In the spirit of the New Keynesian literature, we study a different friction in an equilibrium model, i.e., rigidities in nominal product prices and wages, to address (i) how these rigidities and monetary policy affect the valuation of production claims such as stocks, and (ii) how productivity and monetary policy shocks affect the return dynamics of these claims.

Exploring nominal rigidities for the analysis of asset returns is motivated first by ample evidence of their existence in United States data. For instance, Nakamura and Steinsson (2008) report a median duration of prices between 8 and 11

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[2] Campbell and Cochrane (1999) and Bansal and Yaron (2004), among others, have made significant progress in capturing asset pricing dynamics in endowment economies. These efforts are less successful in production economies as shown by Boldrin et al. (2001) and Kaltenbrunner and Lochstoer (2010), respectively.

[3] See Boldrin et al. (2001), for instance.

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months, and Barattieri et al. (2014) suggest an average wage duration between 3 and 4 quarters.[4] Second, models with nominal rigidities, such as Christiano et al. (2005) and Smets and Wouters (2007), have become the workhorse model for macroeconomic and policy analysis in central banks. These models capture important business cycle dynamics and are widely used to understand how monetary policy affects the real economy. It is then of significant importance to examine the link between monetary policy and asset returns implied by these models.[5]

The main findings in the paper are as follows. First, nominal rigidities, in combination with persistent shocks to productivity growth, improve the model's ability to generate positive and sizable expected excess returns in production claims. Second, the quantitative impact of wage rigidities on the equity premium is significantly larger than the impact of price rigidities. Third, monetary policy shocks have a large contribution to asset return volatility, but a minor effect on expected excess returns. Fourth, monetary policy rules with a greater weight on interest rate smoothing, a greater responsiveness to inflation, or a lower responsiveness to output lead to larger expected excess returns. Fifth, differences in price rigidities translate into differences in expected returns across production sectors. These differences are determined by product elasticities of substitution within and across sectors. Finally, the model calibration implies an annualized equity premium of only one percent, and a minor effect of monetary policy rules on asset returns. As in many other equilibrium models, it reflects the significant difficulty to amplify macroeconomic risk and generate enough asset return volatility.

Our production economy model has four main ingredients. First, a representative household with Epstein and Zin (1989) recursive preferences over consumption and labor. Recursive preferences disentangle the elasticity of intertemporal substitution of consumption (EIS) from risk aversion. As illustrated by Tallarini (2000), this separation is useful to keep reasonable values for the elasticity of substitution to match macroeconomic dynamics, while having values for risk aversion that match empirical Sharpe ratios of financial assets. Second, nominal rigidities are modeled in a staggered wage and price setting following Calvo (1983). The representative household provides differentiated labor types to the production sector and has monopolistic power to set wages. However, at each point of time the household can only adjust wages optimally for a fraction of labor types. Similarly, firms provide differentiated products and have monopolistic power to set their prices. At each point of time, a firm can only adjust the price optimally with some positive probability. Third, monetary policy is modeled as a Taylor (1993) policy rule to set the level of a nominal interest rate. The rule responds to current economic conditions and is affected by policy shocks. Fourth, the model incorporates permanent and transitory shocks to productivity. This shock specification is motivated by Campbell (1994), who shows that permanent and transitory shocks have different effects on optimal consumption and asset returns, and by the Alvarez and Jermann (2005) empirical evidence of a significant permanent component in the pricing kernel.

The model is calibrated to match relevant properties of quarterly U.S. data for the 1982–2008 period. Price and wage rigidity parameters are chosen to match the average duration of prices and wages in the data. Parameters describing shocks, preferences, and the monetary policy rule are calibrated to match consumption, inflation, and interest rate volatility. Risk aversion is set to match the Sharpe ratio implied by equity returns. The calibration implies an EIS of around 0.15, and a coefficient of relative risk aversion of around 16.

In the calibration, permanent productivity shocks contribute more than 96% to the risk premia in output and profit claims. This occurs despite the fact that the volatilities of the three model shocks are of comparable order of magnitude. To understand why, the pricing kernel is decomposed into short- and long-run components. Permanent productivity shocks have persistent effects that drive both components in the same direction, generating a large price for this risk. On the contrary, transitory productivity and monetary policy shocks have mean-reverting effects that drive the short- and long-run components in opposite directions, reducing their prices of risk.

In the absence of nominal rigidities, permanent productivity shocks imply a negative equity premium if the EIS is lower than one, echoing the results in Bansal and Yaron (2004) and Kaltenbrunner and Lochstoer (2010). After a negative permanent shock, output decreases. A substitution effect reduces the demand for future output claims and, hence, lowers the price of these claims. A wealth effect raises the relative price of future consumption and, hence, the price of output claims. The wealth effect dominates if the EIS is less than one, and output claims have a negative expected excess return over the risk-free rate.

In the presence of nominal rigidities, permanent productivity shocks generate a positive equity premium if the EIS is lower than one. Output dynamics are affected by the rigidities through their effects on employment and production markups. After a negative permanent shock, wages remain higher than optimal due to wage rigidities, and prices do not adjust enough to compensate for higher labor costs due to price rigidities. Employment decreases, amplifying the negative effect of the shock on output. Over time, real wages adjust towards their optimal levels, translating into higher expected future output growth. A substitution effect leads to a higher demand for claims on future output and, hence, a higher price for these claims. A wealth effect reduces the relative price of future output and lowers the price of output claims. The wealth effect dominates if the EIS is lower than one, and returns on output claims become procyclical and embed a positive risk premium. Procyclical product markups induced by the rigidities further amplify the volatility of dividend claims relative to output claims, increasing the equity premium.

[4] Blinder et al. (1998) summarize theories for the existence of price rigidities based on the nature of costs, demand, contracts, market interactions, and imperfect information. Wage rigidities are linked to the nature of labor contracts, unions, and laws.

[5] Bond returns have been analyzed extensively in the New Keynesian framework. See for instance Bekaert et al. (2010), Rudebusch and Swanson (2008, 2012) and Palomino (2012). Stock returns have been less studied in this literature.