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Stock Returns and New-Keynesian Factors*

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ABSTRACT

I propose a new multi-factor asset pricing model based on New-Keynesian monetary models. This new model provides rational explanations for the average returns of portfolios formed on the financial distress and momentum. The permanent monetary policy factor explains the negative relation between financial distress and average returns. The productivity factor captures the momentum premium. Other New-Keynesian factors also capture part of the value and industry premiums. I conclude that New-Keynesian factors play an important role in driving risk premiums in stock markets.

Keywords: Monetary Policy, New-Keynesian DSGE, Momentum, Distress Premium

JEL Classification: E32, E52, G12

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Fama and French (1996) demonstrate that their three factor model with the market excess return (R_{mrf}) and two mimicking portfolios based on market capitalization (SMB) and book-to-market (HML) can explain the average return variations across portfolios formed on many different characteristics. They interpret their two mimicking portfolios as risk factors capturing a risk premium for the relative distress of firms in the context of ICAPM. However, the Fama and French (1996) model cannot explain several anomalies. Fama and French (1996) show that their model does not explain the momentum effect of Jegadeesh and Titman (1993). Furthermore, Campbell, Hilscher, and Szilagyi (2008) report that more distressed firms have lower average returns despite their high loadings on HML than less distressed firms. They conclude that their results indicate a significant challenge to the Fama and French (1996) model.

Recently, several neoclassical factor models based on the q-theory have been proposed to explain these anomalies and provide some success. Xing (2008) shows that an investment growth factor can explain the value effect (HML), and Chen, Novy-Marx, and Zhang (2010) demonstrate that neoclassical factors can also explain part of the momentum and the financial distress premiums. These results suggest that at a minimum, an asset pricing model with macroeconomic factors is a good candidate to describing the cross-sectional variations of average stock returns. It also has a clear interpretation because the motivation of the selected factors are from equilibrium macroeconomic models.

In this paper, I add one more dimension to this literature. I show that New-Keynesian monetary factors motivated from New-Keynesian dynamic stochastic general equilibrium models (DSGE) are important to understand these anomalies. Like the neoclassical approach, New-Keynesian macroeconomic analysis has micro-foundations with rational expectations. However, New-Keynesian analysis assumes a variety of market failures and emphasizes the importance of monetary policy actions. Surprisingly, these factors have not been received deserved attention in explaining the cross-sectional asset pricing puzzles. It is well known that the stock market investors continuously watches and forms expectations about the Federal Reserve Board (Fed) decisions. It seems natural to investigate the role of these monetary factors because it seems investors in Wall Street take it for granted that the actions of the Fed have a considerable impact on stock market returns.

Several researchers have shown that monetary policy shocks affect the future risk premium. Notably, Bernanke and Kuttner (2005) find that monetary policy shocks are important for understanding the risk premium using Campbell and Ammer (1993) type decomposition. They find that unanticipated changes in monetary policy affect stock prices not so much by influencing expected dividends or the risk-free real interest rate, but rather by affecting the perceived riskiness of stocks. By employing the long-horizon regression methodology, Patelis (1997) finds that some portion of the observed predictability in excess returns in US stock market can be attributed to shifts in the monetary policy stance. Patelis relates his findings to the credit channel of monetary policy transmission (Bernanke and Gertler (1995)) and to the financial propagation mechanism (Bernanke and Gertler (1989)). By estimating a vector autoregressive (VAR) system that includes monthly equity returns, output growth, inflation, and the federal funds rate, Thorbecke (1997) finds that monetary policy shocks, measured by orthogonalized innovations in the federal funds rate, have a greater impact on smaller capitalization stocks, which is in line with the hypothesis that monetary policy affects firms' access to credit. Jensen, Mercer, and Johnson (1996) find that predictable variation in stock returns depends on monetary as well as business conditions, with expected stock returns being higher in tight money periods than in easy money periods. And business conditions could predict future stock returns only in periods of expansive monetary policy.

While there seems enough time-series evidence of the effect of monetary policy on stock returns, none of the papers investigates directly its implications on the cross-sectional anomalies of stock returns such as the value, momentum, and financial distress premiums.¹ Fama (1991) conjectures that we should relate the cross-sectional properties of expected returns to the expected returns through time. In fact, since Merton (1973)'s theoretical presentation of the ICAPM, it has been recognized that there exist state variables that capture variations in future investment opportunities, and assets' covariations with such variables should be priced in the cross-section of average returns. Campbell (1996), Brennan, Wang, and Xia (2004), and Petkova (2006) build their models based on Merton (1973) in which only factors that forecast future investment opportunities or stock returns are

¹Some empirical asset pricing studies (e.g. Hahn and Lee (2006)) using cross section of stock returns seem to interpret that significant risk price of the short term interest rate or term spread exists since it is a proxy for monetary policy.

admitted. From the time-series evidence of return forecastability of monetary policy instruments, it seems natural to investigate the effects of monetary policy on cross-sectional puzzles of stock returns.

In the current study, I develop an ICAPM based on a New-Keynesian model. The model says that the expected excess return on a portfolio is described by the sensitivity of its return to the market portfolio (R_{mrf}) and innovations in the New-Keynesian factors I extract from the New-Keynesian DSGE model. This new model explain the average returns of portfolios formed on the book-to-market ratio, financial distress, and momentum. Particularly, I show that the permanent monetary policy factor explains the negative relation between financial distress and average returns. The productivity factor captures the price momentum premium. I also present evidence that the temporary monetary policy shock and the investment technology shock explain part of risk premium.

Lewellen, Nagel, and Shanken (2006) criticize most of empirical asset pricing models because they only explain the value premium but not any part of the risk premium in other dimensions. Based on their recommendations, I include momentum, financially constrained portfolios, and industry portfolios to validate the proposed New-Keynesian factors. The New-Keynesian factor pricing model is capable of explaining the cross-section of the Fama-French 25 size and B/M sorted portfolios ($R^2=76\%$), 30 portfolios composed of 10 earning momentum portfolios sorted on standardized unexpected earning (SUE), 10 price momentum portfolios, and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability ($R^2=77\%$). While the proposed New-Keynesian factors model has a limited success in driving out the HML and explaining the earning momentum, these results with New-Keynesian factors are sufficiently encouraging to warrant further empirical investigation. At a minimum, my evidence shows that the New-Keynesian factor model is possible to shed new light on understanding the puzzling risk premium in stock markets.

The rest of the paper is organized as follows. Section I presents briefly the structural New-Keynesian model employed in this study. Section II outlines the empirical methods used to extract structural shocks from the given models. Section III presents the data and discusses the cross-sectional results of the New-Keynesian factor

models for portfolios formed on size and book-to-market ratio, price or earning momentum, financial distress, and industry. Section IV summarizes the main findings and concludes.

I. Models

This section discusses the models to be estimated; the first subsection briefly explains a multi-factor asset pricing model implied by New-Keynesian equilibrium models and the second subsection presents a Keynesian DSGE model employed to identify New-Keynesian factors used in this paper.

A. The Pricing Kernel implied by New-Keynesian macro models

Without imposing any theoretical structure, the fundamental existence theorem of Harrison and Kreps (1979) states that, in the absence of arbitrage, there exists a positive stochastic discount factor, or pricing kernel, M_{t+1} , such that, for any traded asset with a gross return at time t of $R_{i,t+1}$, the following equation holds:

$$1 = E_t[M_{t+1}(R_{i,t+1})] \quad (1)$$

where E_t denotes the expectation operator conditional on information available at time t .

Standard New-Keynesian macro models employ the following external habit specification in utility function built on Fuhrer (2000).²

$$E_t \sum_{s=t}^{\infty} \psi^{s-t} U(C_s; F_s) = E_t \sum_{s=t}^{\infty} \psi^{s-t} \left[\frac{F_s C_s^{1-\sigma} - 1}{1-\sigma} \right]$$

²I closely follow the representation given in Bekaert, Cho, and Moreno (2005). Refer to the first nine chapters in Woodford (2003) for more detailed explanations.

where C_s is the composite index of consumption, F_s represents an aggregate demand shifting factor and usually denotes as $H_s G_s$ where H_s is an external habit level and G_s is a preference shock.; ψ denotes the subject discount factor and σ is the inverse of the intertemporal elasticity of consumption.

Bekaert, Cho, and Moreno (2005) derive the pricing kernel implied by Fuhrer (2000) assuming standard log-normality and simple three-equation New-Keynesian model:

$$m_{t+1} = \ln \psi - \sigma y_{t+1} + (\sigma + \eta) y_t - (g_{t+1} - g_t) - \pi_{t+1} \quad (2)$$

where $m_{t+1} = \ln(M_{t+1})$, y_{t+1} is detrended log output, $g_{t+1} = \ln(G_{t+1})$ and π_{t+1} is the inflation rate.

They express (2) in terms of the structural shocks in the economy.

$$m_{t+1} = -i_t - \frac{1}{2} \Lambda' D \Lambda - \Lambda' \varepsilon_{t+1} \quad (3)$$

where Λ' is a vector of prices of risks entirely restricted by the structural parameters of New-Keynesian models and D is the covariance matrix of structural shocks.

The pricing kernel (3) is a linear combination of structural shocks to the overall economy. Following Cochrane (2001), I can interpret (3) as an example of the ICAPMs. In this way, any New-Keynesian model can be expressed as an asset pricing model. However, this pricing kernel assumes constant risk premium. Bekaert, Cho, and Moreno (2005) articulate that without either heteroscedasticity of structural shocks or time-varying market price of risk, their model essentially imposes that expectation hypothesis holds in bond market. In such a case, ICAPM implication would be seriously challenged since time-varying risk premium implied by ICAPM is inconsistent with this type of New-Keynesian pricing kernel.

One possible remedy is to adapt the external habit specification of Fuhrer (2000) to that of Campbell and Cochrane (1999) and develop a pricing kernel with time-varying risk aversion. Since time-varying risk aversion is emphasized in the finance literature, this extension would be beneficial for explaining asset pricing facts.

However, the real challenge behind this scenario is to develop IS model consistent with this new utility function in order to explain the stylized facts in monetary economics before it is implemented in asset market research. In fact, Lettau and Uhlig (2000) find that in a production economy with Campbell and Cochrane's external habit preference, individuals' consumption and labor market decisions are counterfactual to their actual business cycle dynamics.

Another suggestion would be introducing heteroscedasticity in the pricing kernel and structural shocks. While this specification naturally allows time-varying risk premium, typical log-linearization of New-Keynesian models is not valid anymore. At least second order approximation of the models should be employed to estimate the models. Unfortunately, an estimation of second-order approximated New-Keynesian models with likelihood-based methods and particle filter have not been ripen in the literature because of computational difficulties. Some steps in this direction have begun to be taken only recently.³ The common practice is to estimate the log-linearized economy and plug the estimates into the second-order approximation.

The easiest but perhaps ad-hoc solution of the problem is recently implemented by Rudebusch and Wu (2004) and Hordahl, Tristani, and Vestin (2006) when they jointly estimate macro models and term structure of yields. They simply ignore pricing kernel implications of their IS equations and set them exogenously. Similar ad-hoc approaches are employed in the empirical finance literature frequently. For example, Campbell (1996)'s ICAPM is derived under constant risk premium. Strictly speaking, simple pricing kernel form implied by the homoskedastic vector autoregression(VAR) pricing model recommended by Campbell (1996) is inconsistent since it does not have any mechanism to generate time-varying risk premium. However, actual implementation of Campbell ICAPM is usually done in the homoskedastic VAR. Recently, Petkova (2006) implements this homoskedastic VAR to extract state variables and argue that her five factor "ICAPM" model is better than Fama-French three factor model to explain the value premium.⁴

³Refer to An (2006) for bayesian estimation of this type of models.

⁴Zhang (2005) also adopts this ad-hoc approach and imposes directly time-varying risk prices on the pricing kernel.

There seems to be trade-off between developing complex models to estimate tightly restricted models and estimating inconsistent but plausible mechanisms to extract economic state variables. Even though it seems possible to modify the pricing framework in (3) using one of the two approaches with time-varying price of risk or heteroscedasticity, I defer these attempts to future work. Instead, I extract the innovations of state variables from New-Keynesian models and augment them with the market excess return (R_{mrf}). I interpret these innovations as approximate ICAPM factors.

Usual ICAPM intuition suggests that state variables should forecast the changing investment opportunity set in that economy. In this sense, reasonably identified state variables from New-Keynesian models are natural candidates since impulse response analysis implied by these models show that each shock explains the future course of the economy consistent with the stylized facts in monetary economics. I assume the following general model for the unconditional expected excess returns on assets:

$$E(R_i) = \gamma_M \beta_{i,M} + \sum (\gamma_{u(k)}) \beta_{i,u(k)}, \forall i \quad (4)$$

where $E(R_i)$ is the excess return of asset i , γ_M is the market risk premium, and $\gamma_{u(k)}$ is the price of risk for innovations in New-Keynesian factors k . The betas are the slope coefficients from the return-generating process

$$R_{it} = \alpha_i + \beta_{i,M} R_{M,t} + \sum (\beta_{i,u(k)}) u(k)_t + \varepsilon_{i,t}, \forall i \quad (5)$$

where R_{it} is the return on asset i in excess of the risk-free rate, $R_{M,t}$ is the excess return on the market portfolio, and $u(k)_t$ is the innovation to New-Keynesian factor k at the end of period t .

B. New-Keynesian Factors

In this paper, I use De Graeve (2006) as a baseline New-Keynesian DSGE model to extract New-Keynesian factors. A series of papers proposed by Smets and Wouters (e.g. Smets and Wouters (2003)) incorporate a number

of real and nominal frictions to explain the persistence in the macro-economic data. Their New-Keynesian models have become a standard approach in monetary policy literature since they can explain many stylized facts in monetary economics.⁵ However, they have an exogenous ad-hoc mechanism to impose capital market imperfection.

De Graeve (2006) extends the Smets and Wouter model with a plausible endogenous mechanism to generate capital market imperfection. In his model, entrepreneurs buy the capital stock K_{t+1} from capital goods producers at a given price Q_t with either internal funds (net worth, N_{t+1}) and bank loans. Entrepreneurs cannot borrow at the risk-less rate because of the asymmetric information between the financial intermediary and entrepreneurs. Therefore, the bank should pay a state verification cost for monitoring entrepreneurs. In equilibrium, entrepreneurs borrow up to the point where the expected return to capital equals the cost of external finance. Following Bernanke, Gertler, and Gilchrist (1999), he assumes that the premium over the risk-free rate required by the financial intermediary is a negative function of the amount of collateralized net worth. De Graeve (2006) argues that the external finance premium is given by:

$$E_t \hat{R}_{t+1}^K = -\varepsilon E_t [\hat{N}_{t+1} - \hat{Q}_t - \hat{K}_{t+1}] + \bar{R}_t \quad (6)$$

where ε measures the elasticity of the external finance premium to variations in entrepreneurial financial health or collateral ($E_t [\hat{N}_{t+1} - \hat{Q}_t - \hat{K}_{t+1}]$), measured by net worth relative to capital expenditures. De Graeve finds that his measure of the external finance premium is closely related to readily available qualitative proxies of the premium such as credit standards (Lown and Morgan (2006)), and his model performs better than the Smets and Wouter model from Bayesian hypothesis tests.

From this model, we can recover the following nine structural shocks; the total factor productivity shocks (GE_A), the preference shocks (GE_B), the government spending shocks (GE_G), the shocks to investment technology (GE_I), the labor demand shocks (GE_L), the permanent monetary policy shock (GE_PIE_BAR), the

⁵Refer to Smets and Wouters (2006) in order to fully understand micro-foundations of this model.

price mark-up shocks (GETA_P), the temporary monetary policy shocks (GETA_R), the wage mark-up shocks (GETA_W). While I put the details in the Appendix, I explain how to recover two monetary policy shocks from this model.

The monetary policy rule follows a generalized Taylor rule by gradually responding to deviations of lagged inflation from an inflation objective and the lagged output gap. This reaction mechanism contains two monetary policy shocks: a temporary i.i.d. monetary policy shock(η_t^R) and a persistent monetary shock for changes in inflation target($\hat{\pi}_t - \bar{\pi}_t$).

$$\begin{aligned} \hat{R}_t^n = & \rho \hat{R}_{t-1}^n + (1 - \rho) \{ \bar{\pi}_t + r_\pi (\hat{\pi}_t - \bar{\pi}_t) + r_Y (\hat{Y}_t - \hat{Y}_t^P) \} + r_{\Delta\pi} (\hat{\pi}_t - \bar{\pi}_{t-1}) \\ & + r_{\Delta Y} (\hat{Y}_t - \hat{Y}_t^P - (\hat{Y}_{t-1} - \hat{Y}_{t-1}^P)) + \eta_t^R \end{aligned} \quad (7)$$

where \hat{R}_t^n is the federal funds rate, $\bar{\pi}_t$ is the inflation target set by the central bank and potential output(\hat{Y}_t^P) is defined as the level of output that would prevail under flexible price and wages in the absence of cost-push shocks and in frictionless credit market equilibrium. Finally \hat{Y}_t is the actual real GDP and $\hat{\pi}_t$ is the actual inflation rate.

Two crucial monetary transmission mechanisms have been suggested through which stock prices respond to monetary news. The first is the interest rate channel, which relates to economic activity primarily through consumption and investment because a cut in the borrowing cost should raise the quantity of funds demanded for investment and promotes the current over future consumption, which leads to an increase in economic activity. The second mechanism is the credit channel under the capital market imperfection assumption. When credit markets are tight, unanticipated monetary easing reduces the external finance premium which is a wedge between the external financing by issuing equity or debt and the internal financing by retaining earnings. Bernanke and Gertler (1989) argue that the effect of the capital market imperfection are largest in recessions, when weak balance sheets lead to higher costs of external finance, resulting in lower investment demand and reduced economic activity.

For empirical implementations, I select five structural shocks as New-Keynesian factors based on the previous researches and my research purpose; I choose two monetary policy shocks to investigate the main issue of this paper. And I also choose the shocks to investment technology (GE_I), the total factor productivity shocks (GE_A), the price mark-up shocks (GETA_P) for the following reasons.

First, Papanikolaou (2010) shows that investment-specific technological change is a systematic risk factor, which explains the value puzzle. He finds that the investment-specific shock carries a negative premium and the value of assets in place relative to the value of growth opportunities has a negative correlation with the shock. As a result, growth stocks have positive betas and lower expected returns because they do well if there are real investment opportunities, and the marginal value of wealth is high. While he uses a portfolio approach to construct a factor-mimicking portfolio, I recover the investment technology shocks directly from the New-Keynesian model.

Second, Vassalou and Apedjinou (2003) argue that an aggregate measure of corporate innovation, which is similar in nature to total factor productivity (TFP) can explain a substantial proportion of the time-series variation in price momentum strategies. Recently, Liu and Zhang (2008) show that the growth rate of industrial production is a priced risk factor, which explains more than half of momentum profits. Arguably, the innovations on the total factor productivity (Solow residuals) would be a major factor to explain the growth rate of industrial production. Based on these papers, I select the total factor productivity shocks as a systematic risk factor.

Finally, I choose the price-markup shocks as a risk factor. This shock is identified in the Phillips curve equation, which relates inflation to expected inflation and the output gap (the deviation of output from potential). With the typical monopolistic competition assumption in New-Keynesian models, price is a markup over marginal cost, and this could be time-varying. Because of the markup shock, the central bank faces a tradeoff between stabilizing inflation and stabilizing output. One example of time-varying mark-up would be oil price shocks from an oil cartel, OPEC. However, the source of this shock is not yet fully understood. For example, the increase in oil prices could work like a shock in total factor productivity, which complements the productivity factor. Or it could be a proxy for some fundamental shocks with the price-adjustment process. Recently, Bekaert

and Engstrom (2010) show that high expected inflation coincide with periods of heightened uncertainty about real economic growth and unusually high risk aversion. Perhaps, the price mark-up shock such as the increase in oil price could imply higher uncertainty about the future economy, and it would request hedging demands for certain stock portfolios.

II. Econometric Approach

In this section, I present a simple Bayesian framework for estimating and evaluating a version of ICAPM based on the state variables estimated from a New-Keynesian model.

First, I express the joint density of all the parameters by:⁶

$$f(\lambda, \beta, \sigma_v^2, \sigma_e^2, X|R, M)$$

where λ denotes the price vector of risks; β is the risk vector (betas); σ_v^2 and σ_e^2 will be defined later; X is a vector of state variables (New Keynesian factors); R is a vector of portfolio returns; M is a vector of macro variables.

I assume that structural shocks (X) are identified only from New-Keynesian models with macro variables but not from stock market returns. This assumption might not be innocuous since the Federal Reserve may react to movements in asset price returns (e.g. Rigobon and Sack (2003)). However, the reaction of the Fed on stock market behavior might not be too big. For example, Bernanke and Gertler (1999) augment an otherwise conventional Taylor rule with the lag of asset price returns and find that the Fed does not react to the stock market. They argue that the Fed with inflation target objective should respond only to inflation component of stock market volatility. Since inflation rate itself is included in estimation of New-Keynesian models, adding stock market variables would not be that much important for estimation results.

Furthermore, empirical asset pricing studies using macro-variables typically assume that state variables extracted from some macro-models are exogenous to the stock market. For example, Thorbecke (1997) include stock return as most endogenous variables in his structural VAR to investigate the time-series relationship between monetary policy shock and stock returns. This joint density can now be decomposed as $f(\lambda, \beta, \sigma_v^2, \sigma_e^2|X, R)f(X|M)$. Based on this decomposition, I first estimate New-Keynesian factors without stock market data ($f(X|M)$) with

⁶I suppress structural parameters in New-Keynesian models since these parameters are not primary concerns.

Bayesian methods.⁷ Specifically, I use the DYNARE package to estimate the Linearized DSGE models.⁸ The Bayesian estimation methodology in DYNARE package contains the following steps. First, the linearized rational expectations model is solved with the generalized Schur decomposition method, which leads to results in a state equation in the predetermined state variables. Second, the model is written in the state space form by adding a measurement equation that links the observable variables to the vector of state variables. Third, the likelihood function is derived using the Kalman filter. Finally, after the posterior density is formed by combining the likelihood function with a prior distribution over the parameters, a Random-Walk Metropolis algorithm is utilized to generate draws from the posterior distribution of parameters.

As a proposal density for this Random-Walk Metropolis, DYNARE estimates the posterior mode with Sims' "*cminwel*" function and the inverse of the Hessian is computed at that posterior mode. Since it is well known that the posterior distribution of each parameter is asymptotically normal, a Gaussian approximation around the posterior mode and a scaled asymptotic covariance matrix is used as the proposal distribution. And the scale parameters are chosen to obtain approximately 35 % acceptance rate. After the burn-in periods of 1 million Gibbs iterations, I save posterior means or medians of New-Keynesian factors (structural shocks).⁹

The innovations derived from the New-Keynesian model are risk factors in addition to the excess return of the market portfolio. Based on the ICAPM interpretation of the New-Keynesian factors, I interpret an asset's exposures to these risk factors as important determinants of its average return. To test this specification, I use the Fama and MacBeth (1973) procedure. I use this approach because the excess returns on the test assets commonly chosen in empirical work often exhibit high contemporaneous correlations, and this can make some of the numerical calculations of the standard GMM approach unstable for a large cross-section of assets typically with small span of data set as in this paper (Lettau and Ludvigson (2001)).

⁷Several researchers(e.g.An and Schorfheide (2005)) criticize classical MLE with "dilemma of absurd parameter estimates" when applying MLE to DSGE models and argue that Bayesian methods often produce more acceptable parameter estimates combining prior information from micro-economic studies.

⁸To estimate New-Keynesian models I employ DYNARE version 4.0.4, by S. Adjemian, M. Juillard and O.Kamenik.

⁹Instead, I can generate a distribution of New-Keynesian factors after the burn-in periods, and for each series of factors, I can compute posterior distributions of the betas and risk prices with the usual Fama-Macbeth two-step regressions. Because both approaches produce qualitatively same results, I report only empirical results using posterior means of New-Keynesian factors.

First, I specify a multiple time-series regression that provides estimates of the assets' loadings (betas) with respect to the market return and the innovations in the New-Keynesian factors. As in Lettau and Ludvigson (2001), the full-sample loadings, which are the independent variables in the second stage cross-sectional regressions, are computed in one multiple time-series regression. More precisely, I examine the following time-series regression for each portfolio:

$$R_{i,t} = \alpha_i + \beta_{i,M} R_{M,t} + (\beta_{i,\hat{u}^I}) \hat{u}_t^I + (\beta_{i,\hat{u}^{PM}}) \hat{u}_t^{PM} + (\beta_{i,\hat{u}^{TM}}) \hat{u}_t^{TM} + (\beta_{i,\hat{u}^M}) \hat{u}_t^M + (\beta_{i,\hat{u}^{pro}}) \hat{u}_t^{pro} + \varepsilon_{i,t}, \forall i. \quad (8)$$

where $R_{i,t}$ is the return on asset i in excess of the risk-free rate, $R_{M,t}$ is the excess return on the market portfolio. u^I stands for the investment technology shocks, u^{PM} for the permanent monetary policy shocks, u^{TM} for the temporary monetary policy shocks, u^M for the price mark-up shocks, and u^{pro} for the productivity shocks, respectively at the end of period t . Pagan (1984) show that the least squares estimates of the parameters' standard errors will be correct when the generated regressor represents the unanticipated part of a certain variable as in this paper.¹⁰

The second step of the Fama-MacBeth procedure involves relating the average excess returns of all assets to their exposures to the risk factors in the model. I specify the cross-sectional relation;

$$R_{i,t} = \gamma_0 + \gamma_M \hat{\beta}_{i,M} + (\gamma_{\hat{u}^I}) \hat{\beta}_{i,\hat{u}^I} + (\gamma_{\hat{u}^{PM}}) \hat{\beta}_{i,\hat{u}^{PM}} + (\gamma_{\hat{u}^{TM}}) \hat{\beta}_{i,\hat{u}^{TM}} + (\gamma_{\hat{u}^M}) \hat{\beta}_{i,\hat{u}^M} + (\gamma_{\hat{u}^{pro}}) \hat{\beta}_{i,\hat{u}^{pro}} + e_{i,t}, \forall t \quad (9)$$

where the $\hat{\beta}$ terms stand for exposures to the corresponding factor, γ terms represent the prices of risk for innovations in each New-Keynesian factor. If assets' loadings with respect to the risk factors are important determinants of average returns, then the γ terms should be significant. To better evaluate the performance of the New-Keynesian model, I also estimate and report results for the simple unconditional CAPM, the Fama-French

¹⁰If the innovation terms are noisy proxies for the true shocks in the state variables, then the estimates of the factor loadings in the above regression will be biased downward. So, the betas from this time-series regression would be conservative in the sense that these estimates would bias the results against finding a relation between the innovations and asset returns.

three-factor model. The first-stage and second stage regressions for the Fama-French model are specified as follows.

$$R_{i,t} = \alpha_i + \beta_{i,M}R_{M,t} + (\beta_{i,HML})R_{HML,t} + (\beta_{i,SMB})R_{SMB,t} + \varepsilon_{i,t}, \forall i. \quad (10)$$

$$R_{i,t} = \gamma_0 + \gamma_M \hat{\beta}_{i,M} + \gamma_{HML} \hat{\beta}_{i,HML} + \gamma_{SMB} \hat{\beta}_{i,SMB} + e_{i,t}, \forall t \quad (11)$$

Estimated betas from the first-stage regressions are subsequently used as independent variables in the second-stage cross-sectional regression for all time periods. Hence, the risk premium estimates in the second-stage regression are subject to an errors-in-variables bias. To correct for this problem, I adjust the standard errors from the second stage regressions as proposed in Shanken (1992). However, I also report the Fama-MacBeth standard errors since Jagannathan and Wang (1998) show that with conditional heteroskedasticity, the standard errors produced by the Fama-MacBeth procedure do not necessarily overstate the precision of the risk premium estimates.

To judge the goodness of fit of the empirical models, I use the cross-sectional R^2 measure employed first by Jagannathan and Wang (1996). This R^2 shows the fraction of cross-sectional variation in average returns that is explained by the model. This measure is calculated as

$$R^2 = \frac{\sigma_C^2(\bar{R}) - \sigma_C^2(\bar{e})}{\sigma_C^2(\bar{R})} \quad (12)$$

where σ_C^2 represents the in-sample cross-sectional variance, \bar{R} is a vector of average excess returns, and \bar{e} stands for the vector of average residuals in the cross-sectional regressions. I also report the root mean square of pricing errors (α) in the cross-sectional regressions (RMSE) as another intuitive diagnostic to compare the models. I use $\sqrt{\frac{1}{N}\alpha'\alpha}$ for all the models. This simple RMSE could be more informative against Hansen-Jagannathan(HJ) distance measure if the original portfolios were primary concerns and the second moment matrix of the test assets is quite close to singular since the HJ distance places too much weight on pricing near-riskless portfolios rather

than pricing the original assets. In fact, Lewellen, Nagel, and Shanken (2006) suggest that Fama-French 25 size and B/M sorted portfolios have essentially three degree of freedom.

III. Data and Empirical Results

A. Data

In order to estimate New-Keynesian factors, I use quarterly time-series of real GDP, consumption, investment, real wages, hours worked, price(GDP deflator), and the short-term interest rate of Smets and Wouters (2006) from the first quarter of 1947 to the last quarter of 2004.¹¹ Nominal variables are first deflated by the GDP-deflator and aggregate real variables are expressed in per capita terms. All variables except for hours, inflation and the interest rate are linearly detrended. Following Smets and Wouters (2006) and De Graeve (2006), I estimate De Graeve's model using full sample data.

To explain the cross-section of stock returns, I use the estimated New-Keynesian factors from 1980:Q4 to 2004:Q4. I choose this sample period for the following reasons. Kim and Nelson (1999) and McConnell and Perez-Quiros (2000) show that US output volatility had declined substantially in the early 1980s. This so-called "Great Moderation" has been associated with the improved rule-based monetary policy. For example, Clarida, Gali, and Gertler (1999) estimate a forward looking version of the Taylor rule and find that the response of Federal Reserve to changes in inflation had been increased significantly during the Volcker and Greenspan period since 1980. Arguably, the monetary policy shocks before this period were not that effective.

I also do not attempt to include the latest financial crisis period in my analysis. Since August 2007, the Federal Reserve had eased monetary policy aggressively, lowering the federal funds rate target to zero in December 2008. After the federal funds rate target reached the zero lower bound, the Federal Reserve expanded its purchases of financial assets in order to inject liquidity directly into the economy. The explosive growth of base money in the

¹¹I thank De Graeve for sharing his DYNARE programs and data set. Refer to the data appendix of Smets and Wouters (2006) for details.

US since September 2008 seems to suggest that the main instrument of US monetary policy has changed from a Taylor rule type interest-rate policy to the unconventional policy so-called "quantitative easing." In total, the size of the Federal Reserve's balance sheet grew by over 1 trillion dollars. The Federal Reserve even has legal authorization to pay interest on reserves now.

This dramatic change in monetary policy implementation requests new ingredients for New-Keynesian models. For example, Gertler and Karadi (2010) extend Smets and Wouters model by incorporating a central bank equipped with a mechanism to intervene in credit markets directly during crises, and show how this intervention could be effective to lessen liquidity problems during financial crises. Perhaps, to fully understand the effectiveness of monetary policy shocks for all periods including the crisis period, Markov-switching type of New-Keynesian models would be required (Foerster (2010)). While it is certainly interesting to see how monetary policy during the crisis period affects financial markets differently and effectively, I defer this important issue to the future studies. Here I focus on establishing the link between conventional monetary policy and the cross-section of stock returns during the normal times.

In cross-sectional analysis, I use, as test assets, the returns on Fama-French 25 portfolios sorted by size and book-to-market, 30 industry portfolios, 10 earning momentum sorted on standardized unexpected earning (SUE), 10 price momentum, and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability. Monthly portfolio returns on 25 size and book-to-market portfolios and 30 industry portfolios, and the Fama-French three-factors -the returns of the market portfolio(R_{mrf}), HML, and SMB are downloaded from French's website and transformed into quarterly series. Finally, the returns on 10 earning momentum sorted on standardized unexpected earning (SUE), 10 price momentum, and 10 financial distress portfolios are downloaded from Long Chen's website and transformed into quarterly series.

B. Estimation of New-Keynesian Model

The Bayesian approach facilitates the incorporation of prior information from other macro as well as micro studies. This prior distribution describes the available information prior to observing the data used in the estimation. The observed data is then used to update the prior, via Bayes theorem, to the posterior distribution of the parameters. However, Bayesian analysis is often criticized for its subjectivity bias from prior selections.

For the estimation of De Graeve (2006), I follow his selections of prior distributions.¹² but I experiment with several choices of non-informative priors to minimize biases caused by the selection of prior distribution. For example, with DYNARE, I can check whether posterior modes are uniquely identifiable with given prior density and likelihood function. I set the variance of prior density as large as possible if unique mode is identified. For the estimation of New-Keynesian models, however, informative priors seem to be indispensable. several researchers(e.g.An and Schorfheide (2005)) criticize maximum likelihood estimation (MLE) with "dilemma of absurd parameter estimates" when applying the MLE to DSGE models and argue that Bayesian methods often produce more acceptable parameter estimates.

In Bayesian analysis, monitoring the convergence of parameters is critical since without it, we are not sure whether estimated parameters can be considered as a valid sample from the posterior distribution. Therefore, in order to ensure convergence, I do several checks. First, I simulate samples from each New-Keynesian model at least 200,000 draws from five different chains and after discarding 50 % of them in each chain as burn-in replications, I calculate the convergence diagnostics of Brooks and Gelman (1998) offered in DYNARE package. I find every parameter converged with this statistics. When I also draw one long chain of 1,000,000 draws from each model with 500,000 as burn-in periods, I obtain similar results.

After extensive checks, I find that all of the parameter estimates are similar to those presented in De Graeve (2006),¹³ Here I just report the estimated structural shocks (New-Keynesian factors) omitted in the tables of

¹²I refer to his paper for details on his prior selections.

¹³I don't report qualitatively same parameter estimates. Refer to the tables in his paper for details.

De Graeve (2006). Table I and Figure 1 reports the sample statistics and patterns of estimated structural shocks from De Graeve's model.

C. Cross-sectional implications of New-Keynesian models

In this section, I examine the pricing performance of the full set of state variables from New-Keynesian models over the period from 1980:Q1 to 2004:Q4. As indicated in the previous section, I choose the price mark-up shock (Price-Markup), permanent shock to inflation target (Monetary1), temporary monetary shock (Monetary2), productivity shock (Productivity) and a shock to investment technology(Investment).¹⁴ These state variables derived from New-Keynesian models are systematic risk factors in the pricing model. The objective is to test whether assets' loadings with respect to these risk factors are important determinants of its average returns.

C.1. The Value Premium

Table II reports the posterior modes of coefficients, standard errors and the degrees of freedom-adjusted R^2 of Jagannathan and Wang (1996) and the RMSE for the cross-sectional regressions using the excess returns on 25 portfolios sorted by book-to-market and size.

First, the CAPM performs poorly in pricing this cross-section, generating the insignificant but negative price of risk on the market portfolio with low R^2 (32%). The Fama-French three-factor model performs significantly better, with the lower mean square of pricing errors (RMSE) and higher R^2 . Including the New-Keynesian factors in the CAPM improves the performance of the models. The ICAPM with New-Keynesian factors performs slightly better with the RMSE equal to 0.0036 vs. 0.0045, and with the adjusted R^2 equal to 0.76 vs 0.68 for the Fama-French model, respectively. Loadings on the temporary monetary factor have significant negative prices of risk; this result is robust to the errors-in-variables (Shanken) correction with a corresponding t-statistics of -1.87. Consistent with Papanikolaou (2010), the investment technology shock has a negative price of risk but with the

¹⁴This shock corresponds to 85% of the external finance premium using variance decomposition reported in the table 4 of De Graeve (2006)

errors in variable correction, it is not significant. Loadings on the permanent monetary factor present also mixed results with insignificant t-statistics after the Shanken correction. The price market-up and productivity shock do not have significant prices of risk.

Hahn and Lee (2006) argue that the size and value premiums are compensation for higher exposure to the risks related to changing credit market conditions and interest rates(monetary policy). They argue that small-sized and high book-to-market firms would be more vulnerable to worsening credit market conditions and higher interest rates since small firms tend to be young, poorly collateralized, and have limited access to external capital markets (Gertler and Gilchrist (1994)) and high book-to-market firms tend to have high financial leverage and cash flow problems. However, there is some controversy over the interpretation of Hahn and Lee (2006)'s findings since they use a imperfect proxy such as term spreads and default spreads. My empirical results suggest that their arguments seem valid for explaining part of the size and value premium with arguably more clear proxies of monetary policy.

Figure 2 plots the realized versus predicted returns of the models examined. The closer a portfolio lies on the 45-degree line, the better the model can explain the returns of the portfolio. It can be seen from the graph that the implied pricing specification from De Graeve's model explains the value effect comparable to Fama-French three-factor model: In general, the fitted expected returns on value portfolios (larger second digit) are higher than the fitted expected returns on growth portfolios (smaller second digit).

To further investigate the issue, I run the Fama-Macbeth regressions including the two monetary factors, investment technology factor, and Fama-French three factors in the specification. Other than HML, only the premium on the permanent monetary policy shock is significant with the Shanken correction with -1.79 t-statistics, which suggests that the temporary monetary policy shock may embody similar pricing information as HML but less effectively. Finally, in order to demonstrate that the permanent monetary factor is not a useless factor, I report factor loadings of these portfolios on the permanent monetary policy shock are jointly significant in the Table IV and qualitatively explaining the pattern of the value premium in Figure 3.

C.2. The Momentum and the Financial Distress Premiums

Fama and French (1996) demonstrate that their three factor model with the market excess return (R_{mrf}) and two mimicking portfolios based on market capitalization (SMB) and book-to-market (HML) can explain the average return variations across portfolios formed on many different characteristics. However, the Fama and French (1996) model cannot explain several anomalies, such as the earning or price momentum, and financial distress premiums.

Here I investigate the performance of New-Keynesian factors on the portfolio returns sorted on the earning momentum, price momentum, and financial distress. First, earnings momentum reflects the subsequent out-performance of firms with high standardized-unexpected earnings (SUE) relative to those reporting unexpectedly low earnings (low-SUE). Second, price momentum refers to the strong abnormal returns of past winners relative to past losers. Finally, I include 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability. Campbell, Hilscher, and Szilagyi (2008) demonstrate a negative cross-sectional correlation between credit risk and future stock returns. This negative relation is anomalous because it suggests that investors pay a premium for bearing credit risk. Furthermore, Campbell, Hilscher, and Szilagyi (2008) report that more distressed firms have lower average returns despite their high loadings on HML than less distressed firms. They conclude that their results indicate a significant challenge to the Fama and French (1996) model.

Table III reports the posterior modes of coefficients, standard errors and the degrees of freedom-adjusted R^2 of Jagannathan and Wang (1996) and the RMSE for the cross-sectional regressions using the excess returns on 10 earning momentum portfolios sorted on standardized unexpected earning (SUE), 10 price momentum portfolios, and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability.

First, both the CAPM and Fama-French model perform poorly in pricing this cross-section. Importantly, the HML generates the significant but negative price of risk, completely missing the target. Including the New-Keynesian factors in the CAPM improves the performance of the models massively with the RMSE equal to 0.0052 and with 76% of the adjusted R^2 . Loadings on the permanent monetary factor have significant negative

prices of risk; this result is robust to the errors-in-variables (Shanken) correction with a corresponding t-statistics of -1.95. Loadings on the productivity factor are also significant with t-statistics of -2.34 after the Shanken correction. Other factors do not have significant prices of risk.

Figure 4 plots the realized versus predicted returns of the New-Keynesian ICAPM. The closer a portfolio lies on the 45-degree line, the better the model can explain the returns of the portfolio with or without constant term in the cross-sectional regression. It can be seen from the graph that the implied pricing specification from New Keynesian factor model explains 10 earning momentum portfolios sorted on standardized unexpected earning (SUE), 10 price momentum portfolios, and 10 financial distress portfolios quite well.

To examine how these New-Keynesian factors perform on each of three puzzles, I report the loadings of the factor and the pattern of the loadings in the Table V and Figure 5. First, impressively, the risk exposure to the productivity shock, i.e. factor loading on this shock from the time series regression, is monotonically decreasing in past stock performance. The winner portfolio have an average productivity shock beta of -0.0038 compared with 0.0539 (t-statistics of 2.33) for loser portfolio. Particularly, the productivity shock seems to capture the realized returns for loser portfolio. Recently, other papers also suggest a link between the productivity shock and momentum profits. Vassalou and Apedjinou (2003) argue that an aggregate measure of corporate innovation, which is similar in nature to total factor productivity (TFP) can explain a substantial proportion of the time-series variation in price momentum strategies. Liu and Zhang (2008) also show that the growth rate of industrial production is a priced risk factor, which explains more than half of momentum profits.

The permanent monetary policy shock, on the other hand, explains the pattern of financially distressed firms. Intriguingly, the risk exposure to the permanent monetary policy shock, i.e. factor loading on this shock from the time series regression, is monotonically decreasing in the degree of financial distress. The less financially distress portfolio have an average permanent monetary shock beta of -0.0151 compared with 0.9138 (t-statistics of 1.91) for more distressed portfolio. With a negative price of risk, this pattern explain a negative cross-sectional correlation between credit risk and stock returns.

Finally, both the productivity shock and permanent monetary policy shock do not seem to explain the pattern of the earning momentum fully while the factor loadings on both shocks are significant. Only the permanent monetary policy factor explain the difference between the winner minus the loser qualitatively with negative betas. While Chan, Jegadeesh, and Lakonishok (1996) find that the U.S. momentum effect is concentrated around subsequent earnings announcements, they argue that price momentum is not subsumed by earnings momentum. Empirical results in this paper also seem to suggest that we need an extra factor to fully understand the earning momentum premium.

C.3. Robustness Results

Given the conflicting point estimates of the factor premia on the HML from the two sets of data, I examine how the model performs when the 55 portfolio returns are combined as test assets. The results are reported in Table VI. First, the HML regains significant and positive risk premium. Second, all the signs of New-Keynesian models are preserved but only the permanent monetary policy and price mark-up shocks have significant prices of risk after the Shanken correction. To further investigate the issue, I run the Fama-Macbeth regression including all the factors. Again, the HML, permanent monetary policy shock, price mark-up shock have significant prices of risk with consistent sign patterns.

Finally, I also add 30 industry portfolios as test assets. Lewellen, Nagel, and Shanken (2006) argue that the proposed models for the value premium do not seem to explain premium of industry portfolios. Typically, they find that most of the models are even worse than the Fama-French three factor model in explaining industry premium. Therefore, Lewellen, Nagel, and Shanken (2006) recommend that we should augment 30 industry portfolios which don't correlate with SMB and HML as much for correct comparison of the models. Following this suggestion, I test the robustness of the proposed empirical models by examining the ability of the competing models to price industrial portfolios.

Table VII reports the cross-sectional regression results on the 85 portfolios returns. Here the risk price of the HML loses its statistical significance. The New-Keynesian factor model performs better than unconditional CAPM and the Fama-French three factor model, in explaining the test assets in terms of the intuitive measures (both R^2 and RMSE). Therefore, this model seems to satisfy the robustness criteria of Lewellen, Nagel, and Shanken (2006). Particularly, the permanent monetary policy shock to inflation target seems to price industry portfolios. The price of risk is significant with t-statistics 2.53. Table IV also confirms that this shock is a priced factor for the industry portfolios. I will not investigate further the determinants of the industry premium because other than the permanent monetary policy factor, the estimated betas for other factors do not have statistical significance in joint tests, indicating they are maybe useless factors, and the adjusted R^2 of the New-Keynesian model is also rather low (39%).

This result may indicate that interest rate channel is important to explain industry premium. Peersman and Smets (2005) show that there is considerable cross-industry heterogeneity in monetary policy effects and find that durability of the output produced by the sector is an important determinant of its sensitivity to monetary policy changes. They argue these facts as evidence for interest rate/cost-of-capital channel since the demand for durable products, such as investment goods, is known to be much more affected by a rise in the interest rate through the cost-of-capital channel than the demand for non-durable good such as food. Recently, Gomes, Kogan, and Yogo (2007) argue that durability of output is a risk factor since the demand for durable goods is more cyclical than that for nondurable goods and services. Consequently, the cash flow and stock returns of durable-good producers are exposed to higher systematic risk and investors request higher risk premium for that. This study might indicate that monetary policy shock is one of fundamental shocks behind this risk premium.

IV. Conclusion

Several neoclassical asset pricing models based on the q-theory have been proposed to explain the cross-section of stock returns. Xing (2008) shows that an investment growth factor can explain the value effect (HML), and Chen, Novy-Marx, and Zhang (2010) demonstrate that neoclassical factors can also explain part of the momentum and the financial distress premiums.

This paper proposes a new multi-factor asset pricing model with New-Keynesian monetary factors. Specifically, I select five structural shocks as New-Keynesian factors based on the previous researches and my research purpose; I choose two monetary policy shocks to investigate the main issue of this paper. And I also choose the shocks to investment technology, the total factor productivity shocks, the price mark-up shocks.

In summary, this new model provides rational explanations for the average returns of portfolios formed on the financial distress and momentum. The permanent monetary policy factor explains the negative relation between financial distress and average returns. The productivity factor captures the momentum premium. New-Keynesian factors also capture part of the value and industry premiums. While the proposed New-Keynesian factors model has a limited success in driving out the HML and explaining the earning momentum, these results with New-Keynesian factors are sufficiently encouraging to warrant further empirical investigation. At a minimum, my evidence shows that the New-Keynesian factor model is possible to shed new light on understanding the puzzling risk premium in stock markets.

The present study uses a reasonable approximation to the economy, but several refinements can be done in the future studies. First, the current study uses exogenous pricing kernel to investigate risk premium since it mainly focuses on obtaining reasonable structural shocks frequently used in monetary economics literature. It would be interesting to see how more consistent pricing kernels using either Campbell and Cochrane (1999) type conditional models or heteroskedasticity based models could explain both the stylized facts in monetary economics and in finance. Second, New-Keynesian models with more extensive form of firm heterogeneity can be developed to explain the industry risk premium. Third, Bekaert, Cho, and Moreno (2005) extend the

models of Cho and Moreno (2006) with term structure information. This extension could also be valuable for correct inferences since term structure information links the long-term and short-term interest rates and that link is regarded as a crucial channel for gauging the real effects of monetary policy on aggregate demand equation. Finally, Dedola and Lippi (2005) find sizable and significant cross-industry differences in the effects of monetary policy, using disaggregated data on twenty-one manufacturing sectors, from five industrialized countries. This fact indicates that the international New-Keynesian models could be worthwhile to develop to explain the risk premia in international stock markets.

References

- An, Sungbae, 2006, Bayesian estimation of dsge models: Lessons from second-order approximations, Working paper, Singapore Management University.
- , and Frank Schorfheide, 2005, Bayesian analysis of dsge models, C.E.P.R. Discussion Papers.
- Bekaert, Geert, Seonghoon Cho, and Antonio Moreno, 2005, New-keynesian macroeconomics and the term structure, *NBER Working Paper No. W11340*.
- Bekaert, Geert, and Eric Engstrom, 2010, Inflation and the stock market: Understanding the "fed model", *Journal of Monetary Economics* 57, 278–294.
- Bernanke, Ben, and Mark Gertler, 1989, Agency costs, net worth, and business fluctuations, *American Economic Review* 79, 14–31.
- , 1999, Monetary policy and asset price volatility, *Federal Reserve Bank of Kansas City Economic Review Quarter*, 17–51.
- , and Simon Gilchrist, 1999, The financial accelerator in a quantitative business cycle framework, *Handbook of macroeconomics, North-Holland : Elsevier*.
- Bernanke, Ben, and Kenneth N. Kuttner, 2005, What explains the stock market's reaction to federal reserve policy?, *Journal of Finance* 60, 1221–1257.
- Bernanke, Ben S, and Mark Gertler, 1995, Inside the black box: The credit channel of monetary policy transmission, *Journal of Economic Perspective* 9, 27–48.
- Brennan, M., A. Wang, and Y. Xia, 2004, Estimation and test of a simple model of intertemporal capital asset pricing, *Journal of Finance* 59, 1743–1775.
- Brooks, Stephen P., and Andrew Gelman, 1998, General methods for convergence of iterative simulations, *Journal of Computational Graphics and Statistics* 7, 434–455.
- Calvo, Guillermo, 1983, Staggered prices in a utility maximizing framework, *Journal of Monetary Economics* 12, 383–398.
- Campbell, John, 1996, Understanding risk and return, *Journal of Political Economy* 104, 298–345.
- Campbell, J., and J. Cochrane, 1999, By force of habit: A consumption-based explanation of aggregate stock market behavior, *Journal of Political Economy* 107, 205–251.

- Campbell, John Y., and John M. Ammer, 1993, What moves the stock and bond markets? a variance decomposition for long-term asset returns, *Journal of Finance* 48, 3–37.
- Campbell, John Y., Jens Hilscher, and Jan Szilagyi, 2008, In search of distress risk, *Journal of Finance* 63, 2899–2939.
- Chan, Louis K., Narasimhan Jegadeesh, and Josef Lakonishok, 1996, Momentum strategies, *Journal of Finance* 51, 1681–1713.
- Chen, Long, Robert Novy-Marx, and Lu Zhang, 2010, An alternative three-factor model, SSRN Working Paper Series.
- Cho, Seonghoon, and Antonio Moreno, 2006, A small-sample study of the new-keynesian macro model, *Journal of Money Credit and Banking* 38, 1461–1481.
- Christopher, Erceg, Dale Henderson, and Andrew Levin, 2000, Optimal monetary policy with staggered wage and price contracts, *Journal of Monetary Economics* 46, 281–313.
- Clarida, Richard H., Jordi Gali, and Mark Gertler, 1999, The science of monetary policy : A new keynesian perspective, *Journal of Economic Literature* 37, 1661–1707.
- Cochrane, John, 2001, Asset pricing, *Princeton University Press*.
- De Graeve, Ferre, 2006, The external finance premium and the macroeconomy : Us post-wwii evidence, Working paper, Ghent University.
- Dedola, Luca, and Francesco Lippi, 2005, The monetary transmission mechanism : evidence from the industries of five oecd countries, *European Economic Review* 49, 1543–1569.
- Fama, E., and K. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.
- , 1996, Multifactor explanations of asset pricing anomalies, *Journal of Finance* 51, 55–84.
- Fama, E., and J. MacBeth, 1973, Risk, return, and equilibrium:empirical tests, *Journal of Political Economy* 81, 607–636.
- Fama, Eugene F, 1991, Efficient capital markets: Ii, *Journal of Finance* 46, 1575–617.
- Foerster, Andrew T., 2010, Financial crises and occasional unconventional monetary policy, Working paper, Duke University.
- Fuhrer, Jeffrey C., 2000, Habit formation in consumption and its implications for monetary-policy models, *American Economic Review* 90, 367–389.

- Gertler, Mark, and Simon Gilchrist, 1994, Monetary policy, business cycles, and the behavior of small manufacturing firms, *Quarterly Journal of Economics* 109, 309–340.
- Gertler, Mark, and Peter Karadi, 2010, A model of unconventional monetary policy, Working paper, New York University.
- Gomes, Joao, Leonid Kogan, and Motohiro Yogo, 2007, Durability of output and expected stock returns, SSRN Working Paper Series.
- Hahn, Jaehoon, and Hangyong Lee, 2006, Yield spreads as alternative risk factors for size and book-to-market, *Journal of Financial and Quantitative Analysis* 41, 245–269.
- Harrison, M., and D. Kreps, 1979, Martingales and arbitrage in multiperiod security markets, *Journal of Economic Theory* 20, 281–408.
- Hordahl, Peter, Oreste Tristani, and David Vestin, 2006, A joint econometric model of macroeconomic and term-structure dynamics, *Journal of Econometrics* 127, 405–444.
- Jagannathan, R., and Z. Wang, 1996, The conditional capm and the cross-section of expected returns, *Journal of Finance* 51, 3–53.
- , 1998, An asymptotic theory for estimating beta-pricing models using cross-sectional regression, *Journal of Finance* 53, 1285–1309.
- Jegadeesh, Narasimhan, and Sheridan Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance* 48, 65–91.
- Jensen, Gerald R., Jeffrey M. Mercer, and Robert R. Johnson, 1996, Business conditions, monetary policy, and expected security returns, *Journal of Financial Economics* 40, 213–237.
- Kim, Changjin, and Charles Nelson, 1999, Has the u.s. economy become more stable? a bayesian approach based on a markov-switching model of the business cycle, *Review of Economics and Statistics* 81, 1–10.
- Lettau, Martin, and Sydney Ludvigson, 2001, Resurrecting the (c)capm: A cross-sectional test when risk premia are time-varying, *Journal of Political Economy* 109, 1238–1287.
- Lettau, Martin, and Harald Uhlig, 2000, Can habit formation be reconciled with business cycle facts?, *Review of Economic Dynamics* 3, 79–99.
- Lewellen, Jonathan, Stefan Nagel, and Jay Shanken, 2006, A skeptical appraisal of asset pricing tests, Working paper, Dartmouth College, Stanford University and Emory University.

- Liu, Laura Xiaolei, and Lu Zhang, 2008, Momentum profits, factor pricing, and macroeconomic risk, *Review of Financial Studies* 21, 2417–2448.
- Lown, Cara, and Donald Morgan, 2006, The credit cycle and the business cycle: New findings using the loan officer opinion survey, *Journal of Money Credit and Banking* 38, 1575–1597.
- McConnell, Margaret M., and Gabriel Perez-Quiros, 2000, Output fluctuations in the united states: What has changed since the early 1980's?, *American Economic Review* 90, 1464–1476.
- Merton, R.C., 1973, An intertemporal capital asset pricing model, *Econometrica* 41, 867–887.
- Pagan, Adrian, 1984, Econometric issues in the analysis of regressions with generated regressors, *International Economic Review* 25, 221–247.
- Papanikolaou, Dimitris, 2010, Investment shocks and asset prices, SSRN Working Paper Series.
- Patelis, A.D., 1997, Stock return predictability and the role of the monetary sector, *Journal of Finance* 52, 1951–1972.
- Peersman, Gert, and Frank Smets, 2005, The industry effects of monetary policy in the euro area, *Economic Journal* 115, 319–342.
- Petkova, Ralitsa, 2006, Do the fama-french factors proxy for innovations in predictive variables?, *Journal of Finance* 61, 581–612.
- Rigobon, Roberto, and Brian Sack, 2003, Measuring the reaction of monetary policy to the stock market, *Quarterly Journal of Economics* 118, 639–669.
- Rudebusch, Glenn D., and Tao Wu, 2004, A macro-finance model of the term structure, monetary policy, and the economy, Working paper, Federal Reserve Bank of San Francisco.
- Shanken, J., 1992, On the estimation of beta pricing models, *Review of Financial Studies* 5, 1–34.
- Smets, Frank, and Rafael Wouters, 2003, An estimated dynamic stochastic general equilibrium model of the euro area, *Journal of the European Economic Association* 1, 1123–1175.
- , 2005, Comparing shocks and frictions in us and euro area business cycles: A bayesian dsge approach, *Journal of Applied Econometrics* 20, 161–183.
- , 2006, Shocks and frictions in us business cycles : A bayesian dsge approach, Working paper, ECB and NBB.
- Thorbecke, Willem, 1997, On stock market returns and monetary policy, *Journal of Finance* 52, 635–654.

Vassalou, Maria, and Kodjo Apedjinou, 2003, Investment shocks and asset prices, SSRN Working Paper Series.

Woodford, Michael, 2003, Interest and prices : Foundations of a theory of monetary policy, chapter 3, *Princeton University Press*.

Xing, Yuhang, 2008, Interpreting the value effect through the q-theory: An empirical investigation, *Review of Financial Studies* 21, 1767–1795.

Zhang, Lu, 2005, The value premium, *Journal of Finance* 60, 67–103.

Appendix A. New Keynesian DSGE models

A simple three-equation New-Keynesian model (e.g. Cho and Moreno (2006)) has been a working-horse model in monetary economics literature until recently. But this model assumes frictionless capital markets, and often cannot explain persistent macro data. The seminal paper by Bernanke and Gertler (1989) and a number of subsequent calibration studies document how relaxing this perfect capital market assumption can generate additional features observed in macroeconomic data.

A series of papers proposed by Smets and Wouters (e.g. Smets and Wouters (2003)) incorporate a number of additional frictions to capture this persistence in the macro-economic data and they also add an exogenous mechanism to impose capital market imperfection. Their New-Keynesian models have become a standard approach in monetary policy literature since they can explain many stylized facts in monetary economics. This model contains three agents; Households consume, work, set wages, and invest; firms hire labor and capital, produce goods and set the prices of those goods; and the central bank sets the short-term interest rate in response to the deviation of inflation from the inflation target and output gap. The model accommodates both real and nominal frictions such as monopolistic competition in goods and labor markets with sticky nominal prices and wages, partial indexation of prices and wages, costs of adjustment in capital accumulation, external habit formation and variable capital utilization and fixed costs.

First, households' maximization provides the aggregate consumption equation and wage equation.¹⁵ In addition to the external habit specification as in Cho and Moreno (2006), households have differentiated labor characteristics and some monopoly power over wages, which introduce sticky nominal wages in the sense of Calvo (1983). Households act as price-setters in the labor market and partial indexation of the wages is allowed. "Hat" means the steady state value.

The aggregate consumption (\hat{C}_t) in this model is determined by:

$$\hat{C}_t = \frac{h}{1+h}\hat{C}_{t-1} + \frac{h}{1+h}E_t\hat{C}_{t+1} + \frac{\sigma_c - 1}{(1+\lambda_w)(1+h)\sigma_c}(\hat{L}_t - E_t\hat{L}_{t+1}) - \frac{(1-h)}{(1+h)\sigma_c}\hat{R}_t + \frac{(1-h)}{(1+h)\sigma_c}(\hat{\xi}_t^B - E_t\hat{\xi}_{t+1}^B) \quad (\text{A1})$$

¹⁵Most of the equations are directly adapted from Smets and Wouters (2005) except for capital market imperfection mechanisms. For detailed review of microfoundation of these models, see De Graeve (2006)

where $\hat{\varepsilon}_t^\beta$ is interpreted as preference shock and follows a first-order autoregressive process with an i.i.d normal error term; \hat{L}_t stands for the labor supply included as the non-separability of the utility function of labor and consumption; $\hat{R}_t(\hat{R}_t^n - E_t \hat{\pi}_{t+1})$ is the ex-ante real interest rate, where \hat{R}_t^n is the nominal interest rate and $\hat{\pi}_{t+1}$ is the inflation rate; Finally, E_t indicates conditional expectation given information up to time t.

Households set their wages with the following Calvo (1983) type staggered wage-setting scheme proposed by Christopher, Henderson, and Levin (2000). In this model, the real wage \hat{w}_t is a function of expected and past real wages and the expected, current and past inflation rates($\hat{\pi}_t$).

$$\hat{w}_t = \frac{\beta}{1+\beta} E_t \hat{w}_{t+1} + \frac{1}{1+\beta} \hat{w}_{t-1} + \frac{\beta}{1+\beta} (E_t \hat{\pi}_{t+1} - \bar{\pi}_t) - \frac{1+\beta\gamma_w}{1+\beta} (\hat{\pi}_t - \bar{\pi}_t) - \frac{\gamma_w}{1+\beta} (\hat{\pi}_{t-1} - \bar{\pi}_t) - \frac{1}{1+\beta} \frac{(1-\beta\xi_w)(1-\xi_w)}{(1+\frac{\lambda_w}{\lambda_w})\xi_w} \left[\hat{w}_t - \sigma_l \hat{L}_t - \frac{\sigma_c}{1-h} (\hat{C}_t - h\hat{C}_{t-1}) - \hat{\varepsilon}_t^L \right] + \eta_t^W \quad (A2)$$

where η_t^W is interpreted as a wage-markup disturbance. And $\hat{\varepsilon}_t^L$ represents the shock to the labor supply and is assumed to follow a first-order autoregressive process with an i.i.d. normal error term.

New-Keynesian economists emphasize the role of nominal rigidities(price stickiness) based on microfoundations of imperfect competition. However, for these rigidities to have important implications, it is necessary that wages do not respond much to fluctuations in demand. The fall in output also results in a fall in labor demand which, in turn, would drive down the equilibrium wage in the labor market and the firm's marginal cost curves. This may increase the gain from price adjustment significantly. Thus, for the lack of price adjustment to be a macroeconomic equilibrium, we need real rigidity in the labor market. Staggered wage-setting equation is one of the mechanisms to generate this real rigidity in labor market. In fact, Smets and Wouters (2003) use partial or full indexation of this kind for both wages and prices, and find that this extension of the Calvo pricing model improves the empirical fit of their models.

Intermediate goods firms' optimizations in monopolistic competition markets yield the following equations. First, Cobb-Douglas production function augmented with fixed costs and variable capital utilization is given by:

$$\hat{Y}_t = \phi \hat{\varepsilon}_t^A + \phi \alpha \hat{K}_{t-1} + \frac{\phi \alpha}{\psi} \hat{r}_t^k + \phi(1-\alpha) \hat{L}_t \quad (A3)$$

where output(\hat{Y}_t) is produced using capital (\hat{K}_{t-1}) and labor services (\hat{L}_t). Total factor productivity ($\hat{\xi}_t^A$) is assumed to follow a first-order autoregressive process.

The firm's labor demand(\hat{L}_t) depends negatively on the real wage(\hat{w}_t) and positively on the rental rate of capital(\hat{r}_t^k) by equalizing marginal cost:

$$\hat{L}_t = -\hat{w}_t + \left(1 + \frac{1}{\psi}\right) \hat{r}_t^k + \hat{K}_{t-1} \quad (\text{A4})$$

Finally, price is determined following Calvo (1983) scheme.

$$\begin{aligned} \hat{\pi}_t - \bar{\pi}_t &= \frac{\beta}{1 + \beta} (E_t \hat{\pi}_{t+1} - \bar{\pi}_t) + \frac{\gamma_p}{1 + \beta \gamma_p} (\hat{\pi}_{t-1} - \bar{\pi}_t) \\ &+ \frac{1}{1 + \beta \gamma_p} \frac{(1 - \beta \xi_p)(1 - \xi_p)}{\xi_p} \left[\alpha \hat{r}_t^k + (1 - \alpha) \hat{w}_t - \hat{\xi}_t^A \right] + \eta_t^P \end{aligned} \quad (\text{A5})$$

where the deviation of inflation($\hat{\pi}_t$) from the target inflation rate ($\bar{\pi}_t$) depends on past and expected future inflation deviations and on the current marginal cost($\alpha \hat{r}_t^k + (1 - \alpha) \hat{w}_t - \hat{\xi}_t^A$). The stochastic component $\hat{\xi}_t^A$ is assumed to follow a first-order autoregressive process and η_t^P is an i.i.d. normal price mark-up shock.

Capital goods producers work in a perfectly competitive environment and their investment decision can be summarized as:

$$\hat{I}_t = \frac{1}{1 + \beta} \hat{I}_{t-1} + \frac{\beta}{1 + \beta} E_t \hat{I}_{t-1} + \frac{1/\varphi}{1 + \beta} (\hat{Q}_t + \hat{\xi}_t^I) \quad (\text{A6})$$

where \hat{Q}_t is the real value of installed capital and φ is the investment adjustment cost parameter. A positive shock to the investment-specific technology, $\hat{\xi}_t^I$ increases investment in the same way as an increase in the value of the existing capital stock \hat{Q}_t . This investment shock is also assumed to follow a first-order autoregressive process with an i.i.d normal error term.

And the capital stock evolves as:

$$\hat{K}_{t+1} = (1 - \tau)\hat{K}_t + \tau\hat{I}_t + \tau\hat{\varepsilon}_t^I \quad (\text{A7})$$

where τ is the depreciation rate, \hat{I}_t stands for investment and $\hat{\varepsilon}_t^I$ represents a shock to the investment technology.

Unlike the forward-looking monetary policy used in Cho and Moreno (2006), the monetary policy rule follows a generalized Taylor rule by gradually responding to deviations of lagged inflation from an inflation objective and the lagged output gap. This reaction mechanism contains two monetary policy shocks: a temporary i.i.d. normal interest rate shock(η_t^R) and a persistent shock for changes in inflation target($\hat{\pi}_t - \bar{\pi}_t$).

$$\begin{aligned} \hat{R}_t^n = & \rho\hat{R}_{t-1}^n + (1 - \rho) \left\{ \bar{\pi}_t + r_\pi(\hat{\pi}_t - \bar{\pi}_t) + r_Y(\hat{Y}_t - \hat{Y}_t^P) \right\} + r_{\Delta\pi}(\hat{\pi}_t - \bar{\pi}_{t-1}) \\ & + r_{\Delta Y}(\hat{Y}_t - \hat{Y}_t^P - (\hat{Y}_{t-1} - \hat{Y}_{t-1}^P)) + \eta_t^R \end{aligned} \quad (\text{A8})$$

where \hat{R}_t^n is the federal funds rate, $\bar{\pi}_t$ is the inflation target set by the central bank and potential output(\hat{Y}_t^P) is defined as the level of output that would prevail under flexible price and wages in the absence of cost-push shocks and in frictionless credit market equilibrium. Finally \hat{Y}_t is the actual real GDP and $\hat{\pi}_t$ is the actual inflation rate.

The goods market equilibrium condition can be written as:

$$\hat{Y}_t = c_y\hat{C}_t + \tau k_y\hat{I}_t + \varepsilon_t^G + \frac{(\bar{R}^K - 1 + \tau)}{\psi k_y} \hat{r}_t^k + k_y(\bar{R}^K - \bar{R})(1 - \frac{\bar{N}}{\bar{K}})(\hat{R}_t^K + \hat{Q}_{t-1} + \hat{K}_t) \quad (\text{A9})$$

where c_y and k_y denotes the steady-state ratio of consumption and capital to output respectively. And ε_t^G is interpreted as government spending shock, which follows a first-order autoregressive process with an i.i.d. normal error term.

Finally, in order to endogenize capital market imperfection mechanism into standard New-Keynesian models, De Graeve (2006) extends the role of entrepreneurs in Smets and Wouters's economy by explicitly accounting for the external finance premium equation in the sense of Bernanke, Gertler, and Gilchrist (1999). Entrepreneurs buy the capital stock K_{t+1} from

capital goods producers at a given price Q_t with internal funds (net worth, N_{t+1}) and bank loans. And they choose capital utilization and rent out capitals to intermediate goods firms at a rate \hat{r}_t^k .¹⁶

The aggregate expected real return to capital is given by:

$$E_t \hat{R}_{t+1}^K = \frac{1-\tau}{\bar{R}^K} E_t \hat{Q}_{t+1}^K + \frac{\bar{r}^k}{\bar{R}^K} E_t \hat{r}_{t+1}^K - \hat{Q}_t \quad (\text{A10})$$

where \bar{R}^K denotes the steady state return to capital and \bar{r}^k stands for the steady state rental rate. The first term in the equation states the value of remaining capital ($\frac{1-\tau}{\bar{R}^K} E_t \hat{Q}_{t+1}^K$), the second term indicates the return from renting out the capital ($\frac{\bar{r}^k}{\bar{R}^K} E_t \hat{r}_{t+1}^K$) and the last term indicates the paid price for the purchase of capital stock (\hat{Q}_t).

While De Graeve (2006) uses set of equations adopted directly from Smets and Wouters (2005) for the equations described up to now, De Graeve (2006) extends the Smets-Wouters model by assuming that entrepreneurs cannot borrow at the risk-less rate because of capital market imperfection. In that case, because of the asymmetric information between the financial intermediary and entrepreneurs, the bank should pay a state verification cost for monitoring entrepreneurs. In equilibrium, entrepreneurs borrow up to the point where the expected return to capital equals the cost of external finance.

At equilibrium, De Graeve (2006) argues that the external finance premium is given by:

$$E_t \hat{R}_{t+1}^K = -\varepsilon E_t [\hat{N}_{t+1} - \hat{Q}_t - \hat{K}_{t+1}] + \bar{R}_t \quad (\text{A11})$$

where ε measures the elasticity of the external finance premium to variations in entrepreneurial financial health ($E_t [\hat{N}_{t+1} - \hat{Q}_t - \hat{K}_{t+1}]$), measured by net worth relative to capital expenditures. Following Bernanke, Gertler, and Gilchrist (1999), he assumes that the premium over the risk-free rate required by the financial intermediary is a negative function of the amount of collateralized net worth. When entrepreneurs have sufficient net worth to finance the entire capital stock, De Graeve (2006) explains that his model reduces to the Smets and Wouters model.

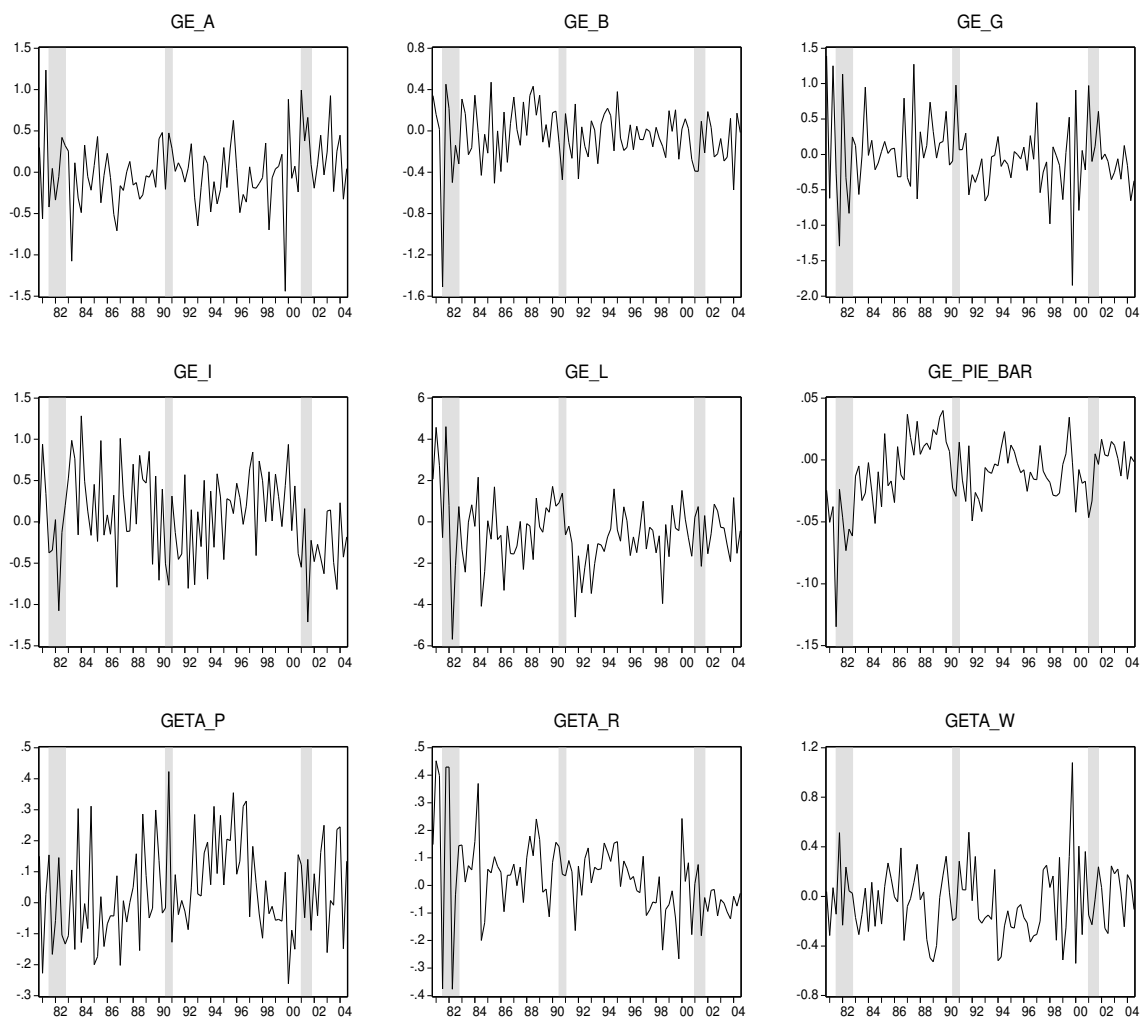
And De Graeve (2006) sets the net worth equation of entrepreneurs by:

$$\hat{N}_{t+1} = \gamma \bar{R}^K \left[\frac{\bar{K}}{\bar{N}} \left(\hat{R}_t^K - E_{t-1} \hat{R}_t^K \right) + E_{t-1} \hat{R}_t^K + \hat{N}_t \right] \quad (\text{A12})$$

¹⁶This is modified equation (3) of Smets and Wouters (2005) without exogenous risk premium shock. From now on, I closely follows page 8 and 9 of De Graeve (2006)

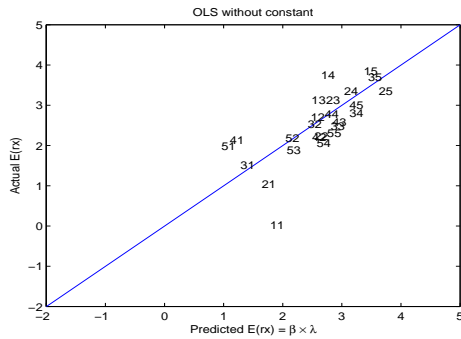
where γ is the entrepreneurial survival rate and $\frac{\bar{K}}{\bar{N}}$ is the steady state ratio of capital to net worth.

De Graeve (2006) concludes that his model with the financial accelerator (endogenous external finance premium) performs substantially better in matching the macro-dynamics relative to the Smets-Wouters model without that mechanism from examining the Bayes factor.

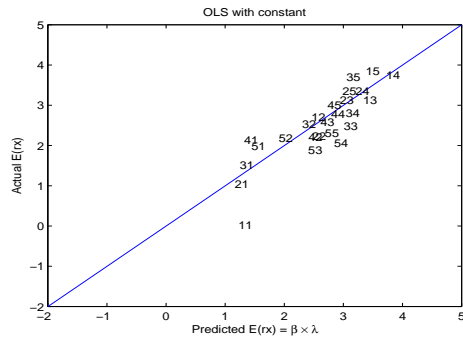


This figure plots the quarterly time series of smoothed structural shocks implied by the extended New-Keynesian DSGE of De Graeve (2006) Note: GE_A is the estimated technology shocks;GE_B is the estimated preference shocks;GE_G is the estimated government spending shocks;GE_I is the estimated shocks to investment technology; GE_L is the estimated labor demand shocks;GE_PIE_BAR is the estimated shocks to inflation target set by the Federal reserve(permanent monetary policy shocks);GETA_P is the estimated price mark-up shocks;GETA_R is the estimated temporary monetary policy shocks;GETA_W is the estimated wage mark-up shocks. Shared areas indicate NBER business recessions.

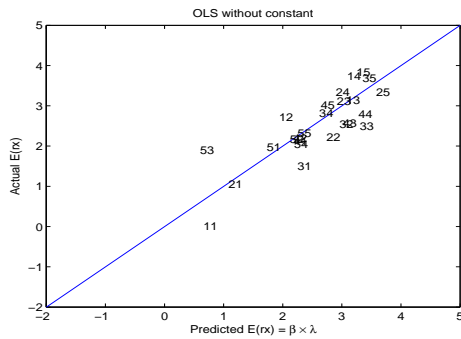
Figure 1. Estimated modes of Smoothed Structural Shocks from De Graeve (2006) (1980:4-2004:4)



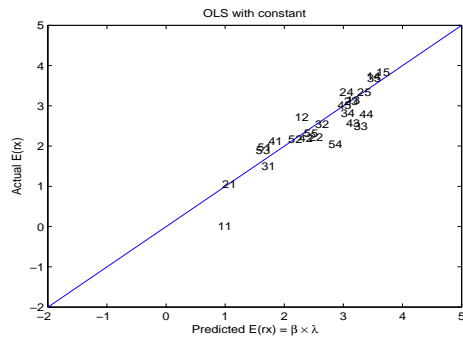
(a) Fama-French without constant



(b) Fama-French with constant



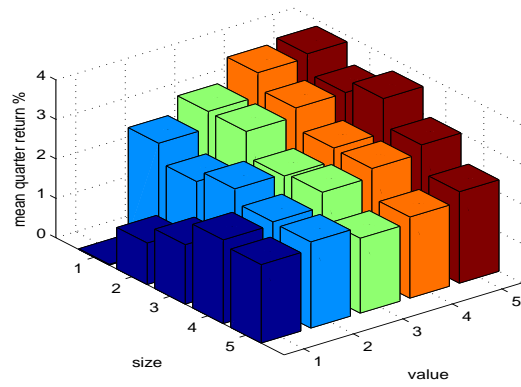
(c) New Keynesian Factor model without constant



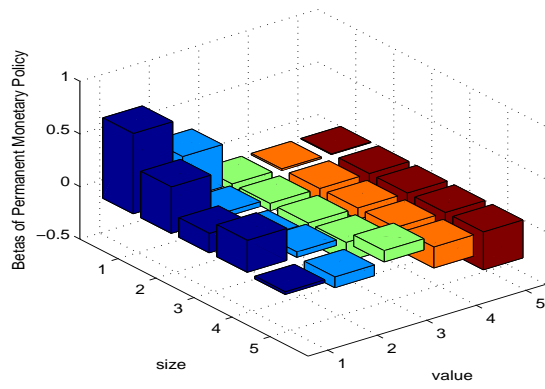
(d) New Keynesian Factor model with constant

The plot shows realized average returns (in percent) on the vertical axis and fitted expected returns (in percent) on the horizontal axis for 25 size and book-to-market sorted portfolios. The first digit refers to the size quintile (1 being the smallest and 5 the largest), while the second digit refers to the book-to-market quintile (1 being the lowest and 5 the highest). For each portfolio, the realized average return is the time-series average of the portfolio return and the fitted expected return is the fitted value for the expected return from the corresponding model. The straight line is the 45-degree line from the origin. All models are defined in section B

Figure 2. Fitted Expected Returns Versus Average Realized Returns for the Fama French 25 portfolios(1980:4-2004:4)



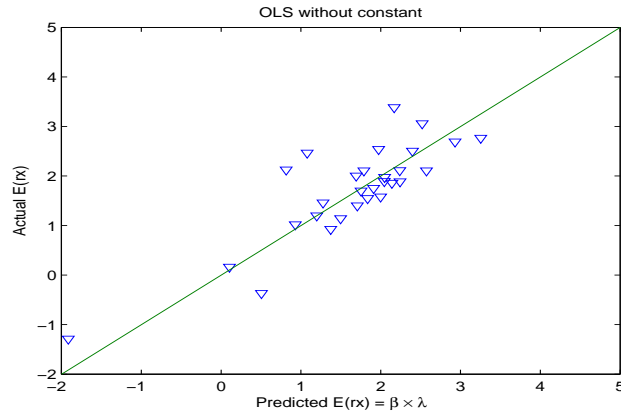
(a) Mean returns of Fama-French 25 portfolios



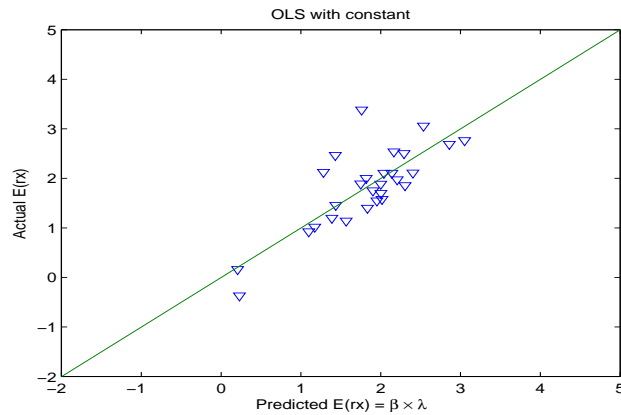
(b) Betas of Permanent Monetary Policy

The first plot shows realized average returns (in percent) for 25 size and book-to-market sorted portfolios. For each portfolio, the realized average return is the time-series average of the portfolio return. The second plot shows the estimated betas of permanent monetary policy from the New Keynesian factor model.

Figure 3. Value Premium Versus Betas of Permanent Monetary Factor(1980:4-2004:4)



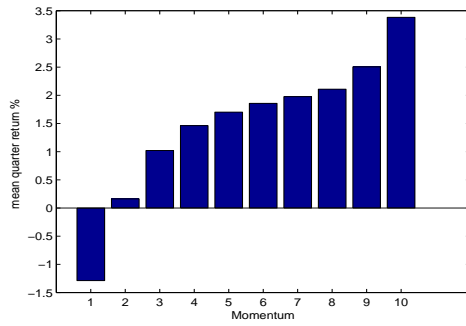
(a) New Keynesian Factor model without constant



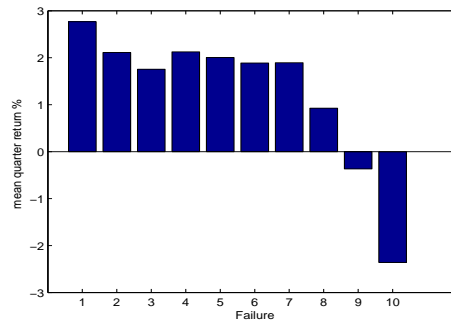
(b) New Keynesian Factor model with constant

The plot shows realized average returns (in percent) on the vertical axis and fitted expected returns (in percent) on the horizontal axis for 10 earning momentum portfolios sorted on standardized unexpected earning (SUE), 10 momentum portfolios and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability. For each portfolio, the realized average return is the time-series average of the portfolio return and the fitted expected return is the fitted value for the expected return from the corresponding model. The straight line is the 45-degree line from the origin. All models are defined in section B

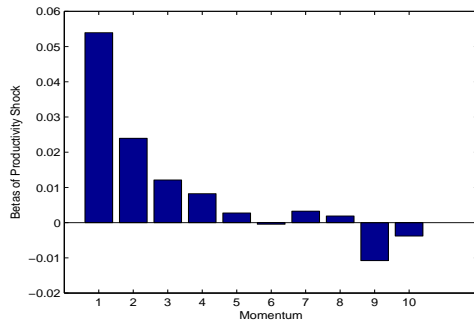
Figure 4. Fitted Expected Returns Versus Average Realized Returns for the Momentum and Failure Portfolios(1980:4-2004:4)



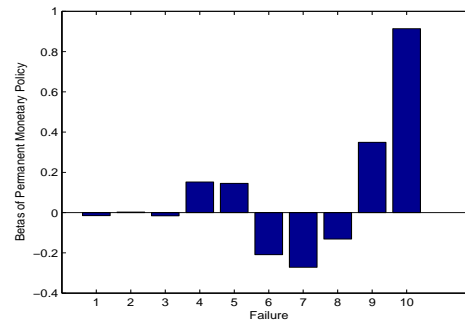
(a) Mean Return of Momentum Portfolios



(b) Mean Return of Failure Portfolios



(c) Momentum Betas of Productivity Shock



(d) Failure Betas of Permanent Monetary Policy

The plot first shows realized average returns (in percent) for 10 momentum portfolios and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability. For each portfolio, the realized average return is the time-series average of the portfolio return. The second and third plot show the estimated betas of permanent monetary policy and temporary monetary policy from New Keynesian factor model. The New Keynesian model is defined in section B

Figure 5. Momentum and Distress Premiums Versus Betas of the New-Keynesian Factors(1980:4-2004:4)

Table I
Summary Statistics for De Graeve(2006)

Summary statistics for structural shocks from De Graeve(2006) from 1980:4 to 2004:4. The Auto(1) give the first autocorrelation. Note: GE_A is the estimated productivity shocks;GE_B is the estimated preference shocks;GE_G is the estimated government spending shocks;GE_I is the estimated shocks to investment technology; GE_L is the estimated labor demand shocks;GE_PIE_BAR is the estimated shocks to inflation target set by the Federal reserve(permanent monetary policy shocks);GETA_P is the estimated price mark-up shocks;GETA_R is the estimated temporary monetary policy shocks;GETA_W is the estimated wage mark-up shocks.

	GE_A	GE_B	GE_G	GE_I	GE_L	GE_PIE_BAR	GETA_P	GETA_R	GETA_W
Panel A: Correlation Matrix									
GE_A	1.000								
GE_B	-0.019	1.000							
GE_G	0.389	0.000	1.000						
GE_I	-0.209	0.100	-0.055	1.000					
GE_L	0.242	0.006	0.301	0.196	1.000				
GE_PIE_BAR	-0.041	0.644	-0.062	0.082	-0.031	1.000			
GETA_P	-0.067	-0.230	0.148	-0.317	-0.013	0.077	1.000		
GETA_R	0.185	0.409	0.327	0.307	0.658	-0.017	-0.200	1.000	
GETA_W	0.002	-0.109	-0.316	-0.269	0.030	0.063	-0.081	-0.273	1.000
Panel B: Univariate Summary Statistics									
Mean	-0.008	-0.045	-0.022	0.073	-0.529	-0.011	0.041	0.029	-0.038
Std. Dev.	0.405	0.282	0.524	0.522	1.666	0.026	0.152	0.148	0.276
Skewness	-0.033	-1.402	0.168	-0.084	0.025	-1.138	0.364	0.302	0.684
Kurtosis	4.826	8.976	4.653	2.461	4.594	6.768	2.405	4.528	4.444
Auto(1)	-0.127	-0.183	-0.305	-0.020	0.202	0.454	-0.023	0.084	0.018

Table II: Cross-Sectional Tests of Asset Pricing Models on Fama French 25 portfolios(1980:4-2004:4)

The table presents the estimated results of Fama and MacBeth (1973) cross-sectional regression using the excess returns on 25 portfolios sorted by size and book-to-market ratio. The full-sample factor loadings, which are the independent variables in the regressions, are computed in one multiple time-series regression following Lettau and Ludvigson (2001). The Adjusted R^2 follows the specification of Jagannathan and Wang (1996) and is calculated from Fama-Macbeth regression. The first set of standard errors, indicated by FM, stands for the Fama-MacBeth estimates. The second set, indicated by Shanken, adjusts for errors-in-variables and follows Shanken (1992). The last column reports the root mean squared pricing errors of the model from Fama-Macbeth regression. Note: Rmrf, SMB, and HML are the Fama and French (1993)'s market and size and B/M factors; The New-Keynesian model is defined in section B, which uses the investment shocks, productivity shocks, price mark-up shocks, permanent monetary policy shocks or shocks to the inflation target(monetary1), and temporary monetary policy shocks(monetary2).

	constant	Rmrf	SMB	HML	Investment	Monetary1	Monetary2	Price-Markup	Productivity	Adj. R2	RMSE
CAPM	0.0471	-0.0212								0.3169	0.0069
	0.012	0.0142									
	0.0124	0.0144									
Fama-French	0.0706	-0.0505	0.0024	0.0156						0.6812	0.0045
	0.013	0.0155	0.0053	0.0067							
	0.0158	0.0179	0.0054	0.0068							
New Keynesian	0.0448	-0.0237			-0.3708	-0.02	-0.1814	-0.0631	0.0959	0.7617	0.0036
	0.0142	0.0162			0.2351	0.0083	0.0594	0.052	0.1165		
	0.0239	0.0247			0.3872	0.0134	0.097	0.0848	0.1881		
FF+NK	0.0582	-0.0369	0.0029	0.0147	-0.3169	-0.019	-0.0686			0.7521	0.0037
	0.0143	0.0167	0.0053	0.0067	0.1888	0.0079	0.0539				
	0.02	0.0217	0.0054	0.0069	0.2575	0.0106	0.0734				

Table III: Cross-Sectional Tests of Asset Pricing Models on 10 earning momentum (SUE), 10 price momentum, and 10 financial distress portfolios(1980:4-2004:4)

The table presents the estimated results of Fama and MacBeth (1973) cross-sectional regression using the excess returns on 10 earning momentum portfolios sorted on standardized unexpected earning (SUE), 10 price momentum portfolios, and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability. The full-sample factor loadings, which are the independent variables in the regressions, are computed in one multiple time-series regression following Lettau and Ludvigsson (2001). The Adjusted R^2 follows the specification of Jagannathan and Wang (1996) and is calculated from Fama-Macbeth regression. The first set of standard errors, indicated by FM, stands for the Fama-MacBeth estimates. The second set, indicated by Shanken, adjusts for errors-in-variables and follows Shanken (1992). The last column reports the root mean squared pricing errors of the model from Fama-Macbeth regression. Note: Rmrf, SMB, and HML are the Fama and French (1993)'s market and size and B/M factors; The New-Keynesian model is defined in section B, which uses the investment shocks, productivity shocks, price mark-up shocks, permanent monetary policy shocks or shocks to the inflation target(monetary1), and temporary monetary policy shocks(monetary2).

	constant	Rmrf	SMB	HML	Investment	Monetary1	Monetary2	Price-Markup	Productivity	Adj. R2	RMSE
CAPM	0.0563	-0.0375								0.5404	0.008
	FM	0.0121	0.015								
	Shanken	0.0132	0.016								
Fama-French	0.012	0.0097	-0.0333	-0.0193						0.7093	0.0061
	FM	0.0132	0.0158	0.009	0.0112						
	Shanken	0.0172	0.0193	0.0109	0.0136						
New Keynesian	0.0209	-0.0013			0.0007	-0.0232	-0.0356	-0.1135	-0.3623	0.766	0.0052
	FM	0.0094	0.0128		0.1293	0.0074	0.0417	0.0439	0.0969		
	Shanken	0.016	0.0183		0.2039	0.0119	0.0666	0.0713	0.1548		

Table IV: Estimated Betas of Monetary Policy Factors

The table presents the full-sample factor loadings, computed in one multiple time-series regression following Lettau and Ludvigson (2001) on 30 industry portfolios and 25 portfolios sorted by size and book-to-market ratio for the permanent monetary factor. The last column reports F-statistics and their corresponding p-values from an SUR system, testing the joint significance of the corresponding loadings.

	Betas for Fama-French 25 portfolios				t-statistics of Betas for Fama-French 25 portfolios				F-test		
	Low	2	3	4	High	Low	2	3		4	High
small	0.7696	0.4072	-0.0671	-0.0132	-0.004	2.3726	1.4294	-0.3131	-0.067	-0.0174	75.79
2	0.4464	0.0471	-0.0667	-0.2227	-0.3731	2	1.8853	0.2648	-0.4931	-1.4949	-2.0978
3	0.192	-0.1067	-0.2437	-0.1084	-0.2295	3	1.1662	-1.0578	-1.9766	-0.7525	-1.4544
4	0.3081	0.0511	-0.1842	-0.2365	-0.1434	4	1.522	0.3629	-1.2119	-1.8649	-1.2437
Big	-0.0238	-0.1044	0.1028	-0.2038	-0.3595	Big	-0.233	-0.8722	0.6024	-1.2153	-1.6856
	Betas for 30 Industry portfolios				t-statistics of Betas for 30 Industry portfolios				F-test		
	Low	2	3	4	High	Low	2	3		4	High
	-0.4722	-0.4688	-0.5567	0.1997	-0.4729	-2.255	-2.0039	-0.9708	1.0001	-3.5681	48.63
	-0.3691	-0.305	-0.4089	0.1165	0.0633	-2.2494	-1.4161	-1.4616	0.9793	0.2338	0.017
	0.0689	0.6067	0.5831	0.19	-0.0162	0.3576	2.3152	3.0214	1.2408	-0.0787	
	0.0863	0.4587	1.0586	0.3021	-0.2617	0.4044	1.3813	3.8051	1.4973	-1.2028	
	-0.2509	-0.0615	0.3717	-0.1625	-0.0422	-1.33	-0.3129	1.2251	-1.5578	-0.232	
	-0.3195	-0.341	-0.4111	-0.4583	-0.1889	-2.4469	-2.3993	-1.541	-2.616	-0.736	

Table V: Estimated Betas of New-Keynesian Factors

The table presents the full-sample factor loadings, computed in one multiple time-series regression following Lettau and Ludvigson (2001) on 10 earning momentum portfolios sorted on standardized unexpected earning (SUE), 10 price momentum portfolios, and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability. Panel A presents the betas for the permanent monetary factor, and panel B presents the betas for the productivity factor respectively. The last column reports F-statistics and their corresponding p-values from an SUR system, testing the joint significance of the corresponding loadings.

Panel A. Permanent Monetary Policy Factor

	Low	2	3	4	5	6	7	8	9	High	F-test
SUE	0.1374	0.0755	0.0486	0.2102	-0.0512	-0.2679	0.0841	-0.0584	-0.1052	-0.1924	22.8
Betas	1.4875	0.7323	0.4823	3.0249	-0.6053	-1.4851	1.6798	-0.7295	-1.2158	-2.359	0.012
tstats											
Momentum	Losers	2	3	4	5	6	7	8	9	Winners	F-test
Betas	0.4486	0.0682	0.014	-0.0599	-0.1239	-0.1696	-0.113	-0.0263	0.0486	0.383	14.67
tstats	1.0968	0.255	0.074	-0.3933	-1.2485	-2.6928	-1.9857	-0.4605	0.5592	1.6602	0.1443
Failure	Low	2	3	4	5	6	7	8	9	High	F-test
Betas	-0.0151	0.0028	-0.0159	0.1519	0.1452	-0.2092	-0.2715	-0.1315	0.3491	0.9138	30.14
tstats	-0.1308	0.0341	-0.2132	2.0334	1.3617	-1.733	-1.4114	-0.6021	0.891	1.9095	< 0.01

Panel B. Productivity Factor

	Low	2	3	4	5	6	7	8	9	High	F-test
SUE	0.004	0.012	-0.0075	0.0004	0.0141	0.0012	-0.0096	0.0134	-0.0265	-0.004	35.22
Betas	0.7859	2.0966	-0.593	0.0463	1.4579	0.1693	-1.9078	1.302	-4.8149	-0.7082	< 0.01
tstats											
Momentum	Losers	2	3	4	5	6	7	8	9	Winners	F-test
Betas	0.0539	0.024	0.0121	0.0082	0.0028	-0.0004	0.0033	0.0019	-0.0108	-0.0038	17.44
tstats	2.3347	1.8098	1.532	1.5415	0.5205	-0.1284	0.8437	0.5386	-1.3473	-0.366	0.065
Failure	Low	2	3	4	5	6	7	8	9	High	F-test
Betas	-0.0241	-0.0032	0.0022	0.0012	-0.0054	-0.0053	0.009	0.0255	0.0251	0.0214	12.35
tstats	-3.8247	-0.6371	0.3925	0.1422	-1.1738	-0.7949	0.8919	3.187	1.4938	0.7416	0.262

Table VI: Cross-Sectional Tests of Asset Pricing Models on 55 portfolios(1980:4-2004:4)

The table presents the estimated results of Fama and MacBeth (1973) cross-sectional regression using the excess returns on 25 portfolios sorted by size and book-to-market ratio, 10 earning momentum portfolios sorted on standardized unexpected earning (SUE), 10 price momentum portfolios, and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability. The full-sample factor loadings, which are the independent variables in the regressions, are computed in one multiple time-series regression following Lettau and Ludvigson (2001). The Adjusted R^2 follows the specification of Jagannathan and Wang (1996) and is calculated from Fama-Macbeth regression. The first set of standard errors, indicated by FM, stands for the Fama-MacBeth estimates. The second set, indicated by Shanken, adjusts for errors-in-variables and follows Shanken (1992). The last column reports the root mean squared pricing errors of the model from Fama-Macbeth regression. Note: Rmrf, SMB, and HML are the Fama and French (1993)'s market and size and B/M factors; The New-Keynesian model is defined in section B, which uses the investment shocks, productivity shocks, price mark-up shocks, permanent monetary policy shocks or shocks to the inflation target(monetary1), and temporary monetary policy shocks(monetary2).

	constant	Rmrf	SMB	HML	Investment	Monetary1	Monetary2	Price-Markup	Productivity	Adj. R2	RMSE
CAPM	0.0536	-0.0316								0.4153	0.0087
	FM	0.0101	0.0133								
	Shanken	0.0108	0.0138								
Fama-French	0.0829	-0.0631	0.0009	0.0157						0.5791	0.0073
	FM	0.0155	0.0175	0.0053	0.0068						
	Shanken	0.0203	0.0218	0.0055	0.0071						
New Keynesian	0.03	-0.0093			-0.333	-0.0303	-0.148	-0.17	-0.0911	0.6171	0.0067
	FM	0.0091	0.0123		0.2229	0.0063	0.0436	0.049	0.0722		
	Shanken	0.0174	0.0188		0.4155	0.0111	0.0784	0.0902	0.1209		
FF+NK	0.0545	-0.0346	0.0032	0.0145	-0.0863	-0.0288	-0.0206	-0.1305	-0.1493	0.7752	0.005
	FM	0.0125	0.0151	0.0053	0.1268	0.0056	0.0331	0.0346	0.0691		
	Shanken	0.0221	0.0235	0.0055	0.2068	0.009	0.0524	0.0567	0.1067		

Table VII: Cross-Sectional Tests of Asset Pricing Models on 85 portfolios(1980:4-2004:4)

The table presents the estimated results of Fama and MacBeth (1973) cross-sectional regression using the excess returns on 30 industry portfolios, 25 portfolios sorted by size and book-to-market ratio, 10 earning momentum portfolios sorted on standardized unexpected earning (SUE), 10 price momentum portfolios, and 10 financial distress portfolios sorted by Campbell, Hilscher, and Szilagyi (2008)'s failure probability. The full-sample factor loadings, which are the independent variables in the regressions, are computed in one multiple time-series regression following Lettau and Ludvigson (2001). The Adjusted R^2 follows the specification of Jagannathan and Wang (1996) and is calculated from Fama-Macbeth regression. The first set of standard errors, indicated by FM, stands for the Fama-MacBeth estimates. The second set, indicated by Shanken, adjusts for errors-in-variables and follows Shanken (1992). The last column reports the root mean squared pricing errors of the model from Fama-Macbeth regression. Note: Rmrf, SMB, and HML are the Fama and French (1993)'s market and size and B/M factors; The New-Keynesian model is defined in section B, which uses the investment shocks, productivity shocks, price mark-up shocks, permanent monetary policy shocks or shocks to the inflation target(monetary 1), and temporary monetary policy shocks(monetary2).

	constant	Rmrf	SMB	HML	Investment	Monetary1	Monetary2	Price-Markup	Productivity	Adj. R2	RMSE
CAPM	0.041	-0.0201								0.2217	0.009
	FM	0.0099	0.0129								
	Shanken	0.0102	0.0131								
Fama-French	0.0469	-0.0272	-0.0014	0.0109						0.2337	0.0088
	FM	0.0101	0.0131	0.0055	0.0071						
	Shanken	0.0107	0.0135	0.0055	0.0072						
New Keynesian	0.0256	-0.0051			-0.0906	-0.018	-0.0436	-0.0633	-0.1075	0.394	0.0077
	FM	0.01	0.0128		0.1359	0.0059	0.0399	0.032	0.0785		
	Shanken	0.0126	0.0146		0.1647	0.0071	0.0484	0.0383	0.0936		
FF+NK	0.0426	-0.0228	0.0014	0.0109	0.0861	-0.0178	-0.0151	-0.0811	-0.1414	0.5007	0.0069
	FM	0.0101	0.0131	0.0053	0.007	0.0056	0.0379	0.0326	0.0778		
	Shanken	0.014	0.0161	0.0055	0.0075	0.0072	0.0495	0.0424	0.1		