The Effect of Confidence on Asset Pricing and the Macroeconomy

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Abstract

The introduction of consumer and producer confidence in the Consumption-based Capital Asset Pricing Model (CCAPM) can materially alter the equilibrium levels of real output, prices of goods/services, and security returns within a rational expectations equilibrium framework. Our main result is that the one-factor CCAPM becomes a more complex, multiple factor model when confidence is included. In addition to confidence, the key factors affecting security returns are monetary and fiscal policies, as well as the long run equilibrium growth rate of the economy. Numerical and empirical exercises exploring the dynamics of the model suggest that the effectiveness of monetary and fiscal policies, as well as the required return on risky securities, be predicated on the level of confidence. The model attempts to bridge the gap between traditional rational asset pricing models and more recent attempts to develop “behavioral” financial models. Several empirically testable hypotheses of the model are also proposed.
This paper reviews the role that consumer and producer confidence can play in the macroeconomy and financial markets. This topic is particularly salient given the recent discussion by economists, investors, and journalists about the Federal Reserve Chairman’s comments concerning the possible presence of “irrational exuberance” in the financial markets. Near-record levels of consumer confidence and the debate on whether a “New Economy” driven by technological innovation exists in the U.S. have also fueled discussion of the role of confidence in the economy and security markets.

To address the role of confidence in these areas, we develop a rational expectations equilibrium model that explicitly includes the effects of consumer and producer confidence. This macroeconomic model is then linked to a well-known model of financial asset pricing (the Consumption-based Capital Asset Pricing Model, or CCAPM, of Breeden, 1979) in an attempt to provide a more detailed, multiple factor, description of the relation between risk and return in the financial markets. Recent empirical results of the CCAPM in Lettau and Ludvigson (2000) suggest the explanatory power of this model can be improved greatly when it is cast in terms of conditional expectations of security returns. Our paper explores how the level of confidence among important economic agents such as producers and consumers can affect the rational expectations equilibria in both the goods and security markets. In the context of Lettau and Ludvigson (2000), our paper can provide a detailed theoretical rationale for the conditioning process Lettau and Ludvigson use to improve the CCAPM’s explanatory power. Namely, their conditioning variable can be viewed as a proxy for consumer and producer confidence in our framework.

The role of consumer/producer confidence (sometimes referred to as sentiment) has been studied in the economics literature on an intermittent basis. Pioneering work in the construction of consumer sentiment indexes at the University of Michigan by Katona during 1945-1955 spurred initial interest in the economic role of confidence. Early statistical work by Katona and his colleagues showed that the indexes were able to improve the explanatory power of models designed to predict changes in aggregate economic factors such as consumer durable goods purchases. However, empirical research in the late 1950s and early 1960s cast doubt on the earlier results of Katona. Several papers during this time period indicated consumer sentiment added little explanatory power beyond that which was available from “more objective” data such as past durable goods purchases and current stock price levels.

With the results of this later research, most economists shifted their research focus to other topics. It was not until the early 1990s that significant interest was renewed in the role of
consumer/producer confidence. Several recent empirical tests have shown that the inclusion of consumer sentiment factors can indeed improve the explanatory power of aggregate economic macroeconomic models. In addition, there have been recent efforts to develop theoretical models that directly incorporate the effects of consumer/producer confidence (such as those found in Burdekin and Langdana, 1995). As we show, the inclusion of confidence in a macroeconomic model can have a significant impact on the effectiveness of monetary and fiscal policy.

Our main result is that the one-factor CCAPM becomes a more complex, multiple factor model when confidence is included in the model. In addition to consumer/producer confidence, the key factors affecting security returns are monetary and fiscal policies, as well as the long run equilibrium growth rate of the economy. Further, the long run economic growth factor enters the asset pricing relation both linearly and nonlinearly. Numerical and empirical exercises exploring the dynamics of the model suggest that the effectiveness of monetary and fiscal policies, as well as the required return on risky securities, be predicated on consumer/producer confidence. In addition, confidence can fluctuate over time, thus causing confidence’s importance in the model to vary over the business cycle. Some empirically testable hypotheses are also presented for future research.

The intuition underlying these results is that confidence about present and future economic conditions affects current consumption and investing decisions by consumers and producers. In turn, these consumption and investment decisions affect the level of economic activity and the returns available to securities. Thus, fluctuations in the macroeconomy and security markets can be driven by changes in consumer/producer confidence. The end result is a simultaneous relation between confidence and economic activity that is sensitive to the current stage of the business cycle. The model therefore allows for a “behavioral” variable such as confidence to enter “rational” models of the macroeconomy and asset pricing. In this regard, one can view our model as an attempt to bridge the gap between traditional rational asset pricing models, such as Breeden’s (1979) CCAPM and Ross’s (1976) Arbitrage Pricing Theory (APT), and more recent attempts to develop “behavioral” financial models (e.g., Daniel, Hirshleifer, and Subrahmanyam, 1998, and Shefrin and Statman, 2000).

The paper is organized as follows. A brief review of the economics literature on the role of confidence is presented in the next section. In Section II, a rational expectations macroeconomic model that explicitly includes consumer/producer confidence is developed. Section III provides a theoretical linkage between rational expectations equilibria in the goods and securities markets. Section IV then examines some of the policy implications and empirical hypotheses of the models described in Sections II and III while Section V concludes the paper.

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1 See, for example, Throop (1991, 1992), Garner (1991), and Fuhrer (1993).
I. The Role of Confidence in Economic Activity

As indicated in the Introduction, the role of sentiment appeared to be a positive one when Katona first began constructing consumer sentiment/attitude indexes in the late 1940s / early 1950s. In Katona (1975), the author provides numerous examples from his research during 1950-1975 of how and why consumer sentiment can affect economic activity. The author borrows from the classic stimulus-response model of human psychology to explain his theoretical rationale for the inclusion of consumer sentiment in economic models. This stimulus-response (SR) model can be defined in its simplest form as follows:

\[ St \rightarrow I \rightarrow R \]

where, \( St \) = an external stimulus to the subject (e.g., a consumer), \( I \) = intervening variables which alter/modify the subject’s response, and \( R \) = the response to the initial stimulus.

Katona notes that consumer confidence is a powerful intervening variable which can substantially alter a consumer’s response to an initial stimulus. As Katona points out, the effect of such a stimulus cannot be analyzed properly unless the intervening variables are fully described and examined. The author argues that the intervening variables reflect the readiness and willingness of the consumer to respond to the initial stimulus. The expectations-oriented component of these intervening variables can be described by consumer confidence measures such as the ones developed by the University of Michigan and The Conference Board. Thus, one could argue that well-specified economic model should explicitly include confidence in some manner.

In contrast, Tobin (1959) appears to be one of the earliest and most prominent advocates of the belief that the role of confidence is adequately described by more traditional economic data and therefore the inclusion of confidence indexes does not improve our ability to explain fluctuations in aggregate economic activity. Tobin attempted to test the predictive value of consumer intentions and attitudes by using the survey data from Katona’s research. Tobin used data from follow-up “re-interviews” of consumers who had responded 12 months earlier to Katona’s survey. The author found that the consumer survey data conveyed little or no additional explanatory power in predicting the variables described above. Tobin showed that readily observable, “objective” variables such as previous levels of after-tax household income, debt, and liquid assets, as well as age, and marital status provided a fairly good description of future consumer activity. Therefore, Tobin concluded that the role of confidence is captured in

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2 Both of these organizations publish consumer confidence indexes which include survey responses to questions about current and future economic conditions such as a person’s willingness to buy a durable good in the next 12 months and his or her estimate of current and future income prospects.
these “objective” variables and macroeconomic models do not need to include a confidence factor.

Friend and Adams (1964) and Adams and Green (1965) extended the results of Tobin. These papers examined the effects of including consumer confidence indexes in models of aggregate consumption, GNP activity, and durable goods purchases. Similar to Tobin, these authors found relatively little value in adding consumer confidence to their models. With the publication of these papers, any further interest in exploring the usefulness of consumer confidence data dropped considerably.

It was not until the mid/late 1970s that a limited amount of interest was renewed in the role of confidence. Burch and Werneke (1975) and Mishkin (1978) are two notable papers that explicitly assess the impact of confidence on consumer decisions such as spending on durable goods and the level of personal savings. Burch and Werneke find that consumer sentiment is a statistically significant explanatory variable in models of consumer spending and saving. However, Mishkin argues that the statistical significance of consumer sentiment variables might be a proxy for consumers’ perceptions of economic uncertainty/financial distress. Mishkin proposes a liquidity hypothesis that states that durable goods purchases are affected by consumers’ expectations about future personal financial distress. Contrary to Katona’s position, Mishkin states that the illiquid nature of durable goods, and not their discretionary nature, is the main reason why consumer confidence affects durable goods spending. Similar to the early work by Tobin, the author concludes that any added value from including a confidence factor is already subsumed in other economic variables.

After Mishkin’s results, there once again was a dearth of interest in the role of confidence. However, research interest was rekindled in the 1990s due, in part, to the long delay in the recovery from the 1990-91 recession in the U.S. Papers by Throop (1991, 1992), Garner (1991), Fuhrer (1993), Carroll, Fuhrer, and Wilcox (1994), and Batchelor and Dua (1992) offered new insights into the long-standing debate over the relevance of confidence measures. For example, Throop’s papers highlighted the important role that confidence can play during political and economic crises. Throop found consumer confidence accurately predicted the rebound in economic activity after the conclusion of the Gulf War in 1991. The author noted that confidence measures reflected current information about consumer attitudes which was not contained in the “objective” macroeconomic data available when the Gulf War ended. The implication is that, in times of crisis or high uncertainty about the future direction of the economy, confidence indexes might be able to add a large degree of explanatory power.

Throop’s empirical tests suggest consumer sentiment data can improve the predictive capability of models of GDP, personal income, and consumer durable goods spending. Overall, Throop’s work, as well as the results found in Batchelor and Dua (1992), Carroll, et al. (1994),
Huth, Eppright, and Taube (1994), Gulley and Sultan (1998), Matsusaka and Sbordone (1995), and Acemoglu and Scott (1994) re-affirms some, if not always all, of Katona’s earlier research. This strand of the literature finds that including the sub-components which comprise the U. of Michigan ICS and/or The Conference Board’s Consumer Confidence Index can lead to an improved description of the movements in numerous economic and financial variables such as personal consumption, the unemployment rate, the Dow Jones Industrial Average, and some foreign exchange rates. In addition, Bram and Ludvigson (1998) perform empirical tests of various measures of consumer sentiment and find that The Conference Board’s index is superior to the ICS for forecasting consumer sentiment patterns.

Fuhrer (1993) provides a useful overview of the five possible roles that consumer confidence can play related to leading, coinciding, and lagging effects on the macroeconomy. Fuhrer then performs empirical tests in an attempt to identify which roles/theories are best supported by U.S. economic activity. The author finds evidence that consumer confidence indexes might reflect how consumers currently feel about future economic conditions. These indexes can therefore capture additional information about the future not already contained in other economic data.

Overall, it appears recent empirical work has confirmed that confidence can play a statistically significant role in describing fluctuations in economic activity. Although there has been considerable empirical research in the area of confidence during the last decade, there has not been as much theoretical work on the subject. One notable exception is Burdekin and Langdana (1995) which contains two chapters (co-authored with Giles Mellon) that describe how consumer and producer confidence can be introduced into a rational expectations model of the macroeconomy. Other recent attempts to incorporate confidence have focused on expectations formation (Weil, 1987), consumption volatility (Danthine, Donaldson, and Johnsen, 1998), and liquidity preference (Dequech, 2000). Although all of these papers identify the relevance of confidence in macroeconomic models, none of them incorporate confidence within a fully integrated model of the macroeconomy and asset prices. The next two sections describe our attempt to apply the concepts found in Burdekin and Langdana (1995) to simple models of the macroeconomy and asset prices.

II. Effects of Confidence in a Rational Expectations Model

Following in the spirit of Burdekin and Langdana (1995), a model of a rational expectations economy with flexible prices is developed which includes the effects of consumer and producer confidence. The confidence terms are determined endogenously and depend on the current and future levels of real output. In addition, the level of output (y) is determined endogenously while monetary and fiscal policy variables are assumed to be exogenous. The model presented below is simpler than the one presented in Burdekin and Langdana (1995) in
that it is built upon a Keynesian IS-LM approach which does not directly specify demand and supply equations for the labor market. In addition, the model assumes a closed economy. These assumptions are made for ease of exposition since the main goal of this paper is to derive a tractable relation that describes how confidence can affect not only the macroeconomy but also the market for risky securities. Clearly, more complicated asset pricing relations can be derived if one uses more complex assumptions about the underlying macroeconomic model. Thus, our objective here is not to develop the most complex, descriptive model. Instead, our more modest goal is to suggest a potentially fruitful avenue for future asset pricing research that directly considers the role of confidence in a simple, straightforward manner.

We can develop the model by first describing a classic Keynesian IS-LM framework which explicitly includes the role of confidence as follows:

**Aggregate Demand:**

\[ y^d = C + I + G \]  \hspace{1cm} (1)

where, \( C \) = current level of real consumption, \( I \) = current level of real Investment, and \( G \) = current level of real Government expenditures.

**Consumption function:**

\[ C = C_0 + b(y - T) \]  \hspace{1cm} (2)

and,

\[ C_0 = \text{CON} + \text{Cc} \]  \hspace{1cm} (3)

where, \( \text{CON} \) = constant/base level of consumption, \( b \) = marginal propensity to consume, and \( T \) = real tax collections.

**Investment Demand:**

\[ I = I_0 - hr \]  \hspace{1cm} (4)

and,

\[ I_0 = \text{INV} + \text{Ic} \]  \hspace{1cm} (5)

where, \( \text{INV} \) = constant/base level of investment, \( h \) = sensitivity of \( I \) to changes in the level of interest rates, \( r \).

**Money Demand:**

\[ \frac{M^d}{P} = m_0 + ky - lr \]  \hspace{1cm} (6)

where, \( m_0 \) = constant/base level of money demand, \( k \) and \( y \) = sensitivities of \( M^d \) to changes in the levels of real output \( (y) \) and interest rates, \( r \).

**Aggregate Confidence:**

\[ \text{CC} = \text{Cc} + \text{Ic} \]  \hspace{1cm} (7)

where, \( \text{Cc} \) = current level of consumer confidence, and \( \text{Ic} \) = current level of producer/investor confidence.
We can express CC as a function of current and expected future levels of real output/income:

\[ CC_t = \phi_1 y_t + \phi_2 y_{t+1}^e + \nu_t \]  

(8)

where, \( y_{t+1}^e \) = expected level of real output in the future (at time \( t + 1 \)), \( \phi_1 \) and \( \phi_2 \) are sensitivities of Aggregate Confidence to changes in current and expected future real output, and \( \nu_t \) = a normally distributed stochastic disturbance term with parameters \((0, \sigma^2)\).

The theoretical structure of (8) is consistent with Katona’s original concepts of consumer sentiment and confidence. In fact, the Consumer Confidence Index published by The Conference Board is based on a survey of consumers that contains questions directly related to personal estimates of current and future income at the household and national levels. Thus, The Conference Board’s index is a measure that closely follows the structure described by (8). In addition, the stochastic disturbance term, \( \nu_t \), is included in the above relationship because we assume consumers/producers possess imperfect information about current economic conditions (e.g., due to delays in the reporting of economic data). The reporting delays can therefore lead to random surprises as consumers'/producers’ perceptions about current economic conditions are revised to reflect new information about the economy (when the data are finally released). In turn, consumer/producer confidence will be directly affected by these surprises. Since these shocks are purely random (i.e., there is no systematic trend to them), it is assumed they can be adequately described in our model by including the stochastic disturbance term described above.

In addition to the above relations, we can specify an expectations-augmented aggregate supply curve (EAS) along the lines first proposed in Friedman (1968):

**Expectations-Augmented AS:**

\[ y^s = y^* + \gamma (P - P^e) \]  

(9)

where, \( y^* \) = long run equilibrium level of real output, \( \gamma > 0 \) = sensitivity of AS to unexpected changes in the economy’s price level, \( P \) = current level of prices in the economy, and \( P^e \) = the expected level of current prices in the economy (formed during the previous time period).

The EAS indicates the amount of goods and services that producers will supply is positively affected by unexpectedly high price levels. This increase in supply is created because it is assumed there must be excess demand in the economy when \( P > P^e \). Further, suppliers are assumed to have superior information about the economy’s true price level (compared to consumers). As \( P \) rises above what was originally expected, the real wage of employees (\( W / P \))
is actually decreasing (although consumers do not realize this) because \( W \) was set/fixed prior to the unexpected change in \( P \). Consequently, producers can afford to hire more workers or increase overtime work in order to increase the supply of goods and services. Since consumers maximize their utility of real consumption based on a different numeraire than producers (namely, the consumers’ numeraire is based on the price of a broad basket of goods and services while the producers simply use the sales prices of their goods/services), these workers are fooled into thinking that the higher levels of employment and income are due to an increase in the real wage. Thus, consumers are assumed to systematically misinterpret an increase in \( P \) as an increase in their real wages/income and are therefore willing to supply additional labor.

As can be seen in Appendix A, this behavior is not consistent with the concept of consumers who are rational and strive to minimize their errors in forecasting future levels of \( P \). Accordingly, we can derive a rational expectations equilibrium for the macroeconomy described above which does not rely on workers committing systematic errors. In addition, this model can explicitly consider the role of consumer and producer confidence. The term, “aggregate confidence” (CC) described earlier represents the combined level of confidence that producers and consumers possess during the current period. The above derivation of CC as a function of current and future income levels is based on the concept that consumers and producers have imperfect information about economic conditions.\(^4\)

As noted in Burdekin and Langdana, the weights, or elasticities, associated with current and future income in the CC equation, \( \phi_1 \) and \( \phi_2 \), are time-dependent. This means that producers/consumers are unable to differentiate between a temporary industry-specific decrease in output and an economy-wide decline in production. For example, as a recession worsens, producers and consumers will extract signals about future economic conditions along the lines first described in Lucas’s (1973) “islands economy”. Consequently, as consumers/producers begin to realize the true state of the economy (e.g., they are in an economy-wide recession), they will become more sensitive to current and future income levels. This behavior is represented in the model by allowing the weights, \( \phi_1 \) and \( \phi_2 \), to vary over time as economic conditions change. In the above situation, the growing realization of a recession is reflected in an increase in these weights.\(^5\) We will see below that changes in \( \phi_1 \) and \( \phi_2 \) can have significant effects on the level of real output, prices, and security returns.

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\(^4\) Although both producers and consumers have imperfect information, we can still assume that producers possess better information than consumers (i.e., producers have “less imperfect” information). This assumption allows the EAS derived earlier to remain applicable in our model.

\(^5\) Note that the increase in weights could also occur when the economy is emerging from the late stages of a recession or economic agents perceive a “New Economy” of high growth and low inflation has arrived. That is, consumers and producers become more sensitive to current and future income levels whenever current economic conditions are radically different than what was previously expected. In this sense, the above model follows in the spirit of Katona’s (1975) concept that a consumer’s response to new information
As derived in Appendix A, the rational expectations equilibrium (REE) levels of real output (y) and aggregate prices (p) at time t are:

\[ y_t = y_t^* + \theta (\alpha_t - \alpha_t^e) + \beta \theta (m_t - m_t^e) + \delta \theta (v_t) \]  

\[ p_t = \left\{ m_t^e + \frac{1}{\beta} (\delta (\phi_1 + \phi_2 (1 + g)) - 1) y_t^* + \frac{1}{\beta} \alpha_t^e \right\} + \left\{ \frac{\theta}{\gamma} ((\alpha_t - \alpha_t^e) + \beta (m_t - m_t^e) + \delta (v_t)) \right\} \]  

where,

\[ y_t^* = \alpha_t^e + \delta \epsilon c_t^e + \beta (m_t^e - p_t^e) \]  

and,

\[ \theta = \left\{ \frac{1}{(1 - \delta \phi_1 + \frac{\beta}{\gamma})} \right\} \]  

The above equations show that real output is a function of the long run equilibrium level of output (i.e., \( y^* \) can be viewed as the full-employment level of real GDP). In addition, real output is affected by unexpected changes in monetary policy (\( m - m^e \)), aggregate confidence (via the error term, \( v_t \), and the parameters, \( \phi_1 \), \( \phi_2 \), and \( \theta \)). Further, unexpected changes in factors such as government spending, tax collections, and base levels of consumption and investment (as summarized in the term, \( \alpha - \alpha^e \)). We can see that prices (p) in an REE framework are influenced not only by expected factors (i.e., those variables in the first bracketed term of Equation 11) but also by unexpected changes in money supply, confidence, and \( \alpha \) (i.e., those variables in the second bracketed term of Equation 11). Specifically, the first term in curly brackets in (11) represents the effect on prices from expected changes in money supply, \( y^* \), and \( \alpha \). The second term in brackets in (11) signifies the effect on prices of unexpected changes in money supply, confidence, and \( \alpha \).

Both Equations (10) and (11) are indirectly affected by consumer and producer confidence through the presence of time-dependent elasticities (\( \phi_1 \) and \( \phi_2 \)). Note that these elasticities affect the parameter, \( \theta \), as well as the coefficient of \( y^* \) in the price equation. The role depends on how “new” the information is. Katona argues that the news of, say, a fifth consecutive quarterly increase in real GDP (or decrease, for that matter) is no longer “news”. In this situation, only a GDP report that departs significantly from what has occurred in the recent past will be considered new information by consumers and producers. In our context, real “news” as defined above will cause the weights, \( \phi_1 \) and \( \phi_2 \), to increase substantially.

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6 Although we could substitute the equation for \( y^* \) into Equation (10) and thus remove \( y^* \) from (10), this has not been done because we want to simplify the derivation of the coefficients as well as clearly delineate the impact of changes in the full-employment level of income on \( y \). Also, note that the lower case letters used in (10) indicate that these are natural logarithms of the respective variables.

7 The superscript, e, denotes an expectation of the relevant variable formed during the previous period.
of θ is the same in both Equations (10) and (11). As consumers/producers become more
centered about current income, φ₁ will rise. As φ₁ increases, θ will initially rise, then abruptly
reverse sign before eventually gravitating to zero. More details on these dynamics will be
discussed later in Section IV. The movements in the confidence parameter indicate that the
second bracketed term in (11) will become zero as φ₁ grows large. In this situation, unexpected
changes will have virtually no effect on current prices. As we will discuss later in Section IV,
changes in φ₁ and φ₂ can have a material impact not only on y, p, and security returns but also on
the effectiveness of monetary and fiscal policy. The presence of these elasticities is the main
difference between our model and a traditional REE model. Before proceeding to an analysis of
monetary and fiscal policy, however, we must derive a formal relation between the REE model
described above and an equilibrium asset pricing model.

III. Linking the Real Goods Sector to the Financial Markets

A well known asset pricing model which has formally related security returns to
fluctuations in the macroeconomy is the Consumption-based Capital Asset Pricing Model
(CCAPM). The CCAPM was developed by Breeden (1979) using the seminal works of Lucas
(1978) and Rubinstein (1976) as a theoretical foundation. The derivation of the CCAPM
provided in Appendix B is based on a combination of Lucas’s and Breeden’s contributions as
described in Huang and Litzenberger (1988). The final result of Appendix B is the traditional
CCAPM and is presented below:

\[
E \left[ r_{jt} \mid \mathcal{F}_{t-1} \mathcal{S}_{t-1} \right] = r_{ft} + \beta_{jc} \left( E \left[ r_{ct} \mid \mathcal{F}_{t-1} \mathcal{S}_{t-1} \right] - r_{ft} \right)
\]  

(14)

where,

- \( r_{jt} \) = the return on the j-th firm’s security at time t conditional on the information set, \( \mathcal{S} \), available at time t - 1,
- \( r_{ft} \) = the return on the riskless asset,
- \( r_{ct} \) = the return on the portfolio most highly correlated with changes in aggregate consumption
  (a.k.a. the consumption portfolio),
- \( \beta_{jc} \) = the consumption beta of the j-th firm (this measures the relative riskiness of the return on
  the j-th firm’s security vis-à-vis the return on the consumption portfolio).

Equation (14) reveals that the return on a risky asset can be described as a linear function
of the return on the portfolio that is most highly correlated with fluctuations in aggregate
consumption (C). In addition, interest rates enter into the asset pricing relation of (14) through
the term, \( r_{ft} \). The main intuition underlying the CCAPM is that risky assets should be priced
relative to fluctuations in C because risk-averse investors are assumed to maximize the utility
derived from consumption over a lifetime. Thus, securities should be priced based on how
volatile their returns are relative to the volatility of aggregate consumption. Equation (14) shows
that securities which are more volatile than the return on the consumption portfolio will have consumption betas greater than 1.0 whereas securities which are less volatile than C will have consumption betas lower than 1.0. Accordingly, a security’s consumption beta can be viewed as the sole relevant measure of the security’s riskiness when investors hold well-diversified portfolios. Investors with different levels of risk-aversion can therefore construct more or less risky portfolios of securities (depending on their preferences) using each security’s consumption beta as the appropriate measure of risk.

We can now examine how the REE macroeconomic model developed in the previous section modifies the asset pricing relationship described in (14). To do this, we first note that the return on the consumption portfolio is clearly a function of the growth in real output \((\dot{y}^*)\) since \(C\) is a component of \(y^*\). Further, we can see that the return on the riskless asset is a function of the real interest rate \((i)\) and the expected inflation rate \((\dot{p}^*)\). Thus, we can substitute equations similar to (10) and (11) into (14) in order to derive an asset pricing model which explicitly incorporates confidence factors in a rational expectations economy. The result of these substitutions is presented below (see Appendix C for the derivation):

\[
E[r_{jt} | \mathcal{F}_{t-1}] = \lambda_0 + \lambda_1 \dot{m}_t^* + \lambda_2 \dot{\alpha}_t^* + \lambda_3 \dot{y}_t^* + \lambda_4 \left(\dot{y}_t^*\right)^2
\]  

Equation (15) illustrates the effects of incorporating confidence into the CCAPM. As can be seen, the return on a risky asset is no longer a simple linear function of aggregate consumption. Equation (15) describes the CCAPM pricing relationship in terms of expected growth rates for money supply \((m^*)\), government spending/taxation and base investment/consumption \((\alpha^*)\), and the long run equilibrium level real output \((y^*)\). Of particular interest is the nonlinear term present in (15), \((\dot{y}^*)^2\). This term indicates that the expected return on a security is both linearly and nonlinearly related to the long run, or “natural”, growth rate of the economy. The above result is in sharp contrast to the conventional CCAPM outlined in Equation (14) because the CCPM states that the expected return on a risky security is, in effect, a linear function of one macroeconomic variable, real consumption. As can be seen in (15), there is more than one macroeconomic variable in the above relationship and the function possesses a nonlinear term rather than strictly linear variables. Thus, linking the CCAPM with the REE macroeconomic model holds the potential of providing a richer description of the relation between risk and return in the securities markets.

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8 In fact, in a Lucas-type economy (1978), consumption is assumed to equal total output.
9 In Appendix C, we assume, as in Lucas (1978), that all output is perishable and therefore \(C = y\). In addition, for simplicity, we have assumed the real interest rate, \(i\), is constant.
10 The dots above the variables on the right hand side of (15) indicate they are one-period growth rates rather than dollar levels.
11 Clearly, extensive empirical research would be necessary to determine whether the relationship in (15) is a superior description of real-world asset pricing. Such tests are beyond the scope of this paper.
Another interesting component of our attempt to link the CCAPM and REE models is that we can derive an explicit pricing relationship for not only expected security returns but also observed security returns. This can be accomplished by incorporating the unexpected changes in money supply, prices, and \( \alpha \) from equations similar to (10) and (11) into Equation (15). The results, derived in Appendix C, are presented below:

\[
r_t = \lambda_0 + \lambda_1 \hat{m}_t^e + \lambda_2 \hat{\alpha}_t^e + \lambda_3 \hat{y}_t^e + \lambda_4 \left( \hat{y}_t^e \right)^2 + \lambda_5 \left( \hat{m}_t - \hat{m}_t^e \right) + \lambda_6 \left( \hat{\alpha}_t - \hat{\alpha}_t^e \right) + \epsilon_t
\]  

(16)

Equation (16) explicitly describes how and why actual security returns can deviate from expected returns. For example, unexpected changes in money supply, government expenditures, and confidence can all cause actual returns to be different than expected returns. More importantly, investor/consumer sensitivity to current and future income will have an impact on both actual and expected returns since \( \phi_1 \) and \( \phi_2 \) affect nearly all of the parameters in (15) and (16).\(^\text{12}\) Thus, changes in confidence can play a significant role in determining not only real output and prices but also the observed returns on risky securities.

IV. Implications for Fiscal and Monetary Policy and Asset Pricing

The relations developed in Sections III and IV are clearly different than the conventional REE and CCAPM models presented in the economics and finance literatures. The principal difference in our model stems from the inclusion of consumer and producer confidence terms. The effect of these variables is somewhat subtle in that the levels of consumer/producer confidence do not directly enter into any of our equations. However, the sensitivities of consumers and producers to current and expected future income (\( \phi_1 \) and \( \phi_2 \)) appear in numerous components of Equations (10), (11), (15), and (16). Thus, we can explore the impact of changes in these elasticities on the above equations in order to identify how confidence affects real output, prices, and security returns.

A. The Impact of Confidence on Real Output and Price Levels

We can begin this analysis by examining the effect of changes in \( \phi_1 \) and \( \phi_2 \) on real output. Equation (10) appears to illustrate the typical REE result that monetary and fiscal policy changes which are fully anticipated have no effect on real output. However, on closer inspection, we can see that the parameter, \( \theta \), will play a role in determining the overall effects of unexpected changes in \( \alpha \), \( m \), and confidence (via \( \psi \)). The term, \( \theta \), is directly affected by consumer and producer confidence because the parameter, \( \phi_1 \), represents consumers’ and producers’ sensitivity to changes in the current level of real income/output (\( y_t \)). As consumers and producers become more concerned about \( y_t \), the value of \( \phi_1 \) will increase. In turn, this increase in \( \phi_1 \) will initially

\(^{12}\) Only \( \lambda_0 \), \( \lambda_1 \), and \( \lambda_2 \) do not contain one or both of the confidence parameters.
make $\theta$ rise, then turn negative before ultimately causing $\theta$ to trend toward zero (e.g., $\theta = 0$ when $\phi_1$ goes to $\infty$). Figure 1 illustrates this result.\footnote{In order to calculate the values of $\theta$, we have assumed numerical values of $\beta = \gamma = \delta = 0.9$. Extensive econometric testing would be required to estimate properly these parameters. However, our intent in Figure 1 is to illustrate the theoretical impact of changes in $\phi_1$ on $\theta$. As can be seen in Figure 1, $\theta$ is negative whenever $\left(1 + \left(\frac{\beta}{\gamma}\right)\right) / \delta < \phi_1$ (in our numerical example, the threshold point is at $\phi_1 = 2.222$). Also, note that Figure 1 is truncated at $\theta = +60$ and -20 since the values of $\theta$ would be close to $+/\sim \infty$ when $\phi_1$ approaches 2.222.}

In addition to real output, confidence also affects prices in a direct manner. Namely, the sensitivities of confidence to both current and future income levels ($\phi_1$ and $\phi_2$) are present in the first bracketed term of (11). Thus, as people become more concerned about future (as well as current) income levels, the level of prices will increase commensurately. So, if $\phi_1$ and $\phi_2$ grow to infinity, prices will rise in tandem with this increase. According to the relation described by Equation 10, large values of $\phi_1$ and $\phi_2$ will result in high inflation while real output will be constrained to the level of $y^*$. Fiscal and monetary policy will be ineffective in this environment.

The above analysis shows that when consumer/producer confidence is radically altered, the impact of any type of change (even unexpected ones) will be seriously diminished. Thus, fiscal and monetary policies are virtually ineffective when $\phi_1$ rises to high levels. This does not mean, however, that there is no role for monetary/fiscal policy in the above framework. Governmental interventions might be effective in controlling prices and real output if fiscal and/or monetary policy tools are used before $\phi_1$ and $\phi_2$ grow too large. That is, monetary and fiscal policy might be useful when the government uses them to keep people’s concerns about current and future income within reasonable bounds. In fact, if government policies can keep $\phi_1$ within certain prescribed levels, then the effects of monetary and fiscal policy may be made more effective (by making $\theta$ larger). This result can be seen in the left hand portion of Figure 1 where $\phi_1 < 2.222$.

Clearly, it is imperative that policymakers act quickly and decisively when income growth begins to falter in order to stave off a large increase in $\phi_1$ and $\phi_2$. Otherwise, it may take a long period of time before consumers and producers regain sufficient confidence in the economy in order to allow $\phi_1$ and $\phi_2$ to decline back to more “normal” levels. In fact, if Katona’s concept is correct, then consumers/ producers will not respond to any government intervention until the bad news of a recession is no longer “news”. Once a recession has taken hold and producers’/consumers’ sensitivity to current income is very high, then monetary and/or fiscal policy will be relatively ineffective until a sufficient number of consecutive reports of poor economic conditions have been received. When bad news is no longer considered “news”, then $\phi_1$ will begin to decline. As this occurs, the impact of fiscal/monetary policy will eventually grow (via an increase in $\theta$).
Interestingly, the initial effect of such a decrease in $\phi_1$ will be to make $\theta$ more negative if $\phi_1$ had moved above the threshold point of \((1+\beta/\gamma)/\delta\) (thus causing stimulative policies to actually exacerbate the decline in real output while also exerting downward pressure on prices). Eventually, as $\phi_1$ continues to drop, $\theta$ will begin to increase and ultimately become positive (thus allowing policy to be more effective in stimulating the economy and controlling inflation).

To test some of the above dynamics of the system, we perform a simple econometric test of Equation (8) based on monthly data for the Consumer Confidence Index (CCI) and Total U.S. Industrial Production (used here as a proxy for income). Data for June, 1977-March, 2000 are used to estimate (8) via OLS. The dependent variable is the CCI and the current (time-t) monthly level of industrial production is used as a proxy for $y_t$ while the next-period (time-t+1) level of industrial production is used as a proxy for $y^c_{t+1}$. This model therefore assumes perfect foresight of future industrial production levels. Ideally, a model of income expectations can be used to form expectations about $y^c_{t+1}$ rather than relying on the unrealistic assumption of perfect foresight. However, to conserve space and provide a simple empirical illustration of Equation (8), we retain the more expedient assumption of perfect foresight.

In order to test (8) via OLS, we orthogonalize the $y_t$ and $y^c_{t+1}$ variables by first regressing $y^c_{t+1}$ on $y_t$ and using the residuals of this regression as the orthogonalized estimate of $y^c_{t+1}$. This effectively removes any collinearity between the two independent variables. We then perform regressions on a rolling 60-month basis starting with the period of June, 1977-May, 1982. The parameter estimates for $\phi_1$ are then plotted over the June, 1977-April, 1995 period in Figure 2. Each point on the graph represents the parameter estimate of $\phi_1$ for the 60-month period starting on the corresponding date in Figure 2. In general, both parameter estimates ($\phi_1$ and $\phi_2$) are statistically significant across the rolling 60-month periods with the $\phi_2$ parameter typically being 0.005 lower than $\phi_1$. Also, the explanatory power of the model is good when one inspects a plot of predicted versus actual CCI levels (although it is difficult to measure this precisely since the $R^2$ cannot be interpreted in the usual sense because (8) does not included a constant term).

Figure 2 shows that the confidence parameter, $\phi_1$, exhibits a wide degree of variation over the sample period. As predicted by Katona’s theory, the confidence parameter increases in value whenever a recession occurs. This result can be seen by the points highlighted in Figure 2. These points represent either economic peaks (with diamond shapes and dates in bold face) or troughs (square shapes and dates in normal type) as defined by the National Bureau of Economic Research (NBER). The three recessions that occurred during the sample period coincide with shifts in the confidence parameter from a downward to an upward direction. This is consistent with the notion that consumers become more concerned about income levels when economic problems appear to be looming.
Further, the confidence parameter estimates have been rising after the 1990-1991 recession. This can be interpreted as a sign that consumers have become increasingly concerned (in a positive sense) with income levels as U.S. economic growth rose at a surprisingly strong rate while inflation remained subdued. The unexpectedly good economic activity of the 1990s was also “news” to consumers and thus caused the confidence parameter to rise throughout the 1992-1999 period. Interestingly, the rate of acceleration in $\phi_1$ appears to have slowed during the 1994-1999 period. This could be viewed as an indication that the unusually good economic activity of the 1990s is no longer important “news” when compared to consumers’ sensitivity to income during the 1991-1993 period. Clearly, these are tentative conclusions at best given the relatively limited nature of the empirical tests presented here. Much more extensive testing is required before a definitive conclusion can be made.

Based on the above analysis, it appears that it will be quite difficult for the government to influence the economy in a meaningful way via monetary and fiscal policies. This difficulty can be seen by that the fact that the policymaker not only needs to know the effects of $\phi_1$ on $\theta$ but also must understand the lead time required for a policy change to affect $\phi_1$ (and, for that matter, $\phi_2$). The net effects of our analysis illustrate that discretionary policymaking must be done with a considerable degree of precision. Otherwise, government actions might either have no impact at all or exacerbate weak economic conditions (and, conversely, over-stimulate vigorous economic expansions).

In theory, however, one can see from (10) and (11) that confidence can play a role in an REE framework and that there is room for fiscal/monetary policy to be effective (even when consumers/producers form their expectations rationally). As was seen in Figure 1, the area where Keynesian-type positive effects of governmental discretionary policy changes is fairly limited while the area for either no impact (or even worse, perverse negative effects) is relatively large. Although the specific shapes of the graph in Figure 1 are affected by the numerical assumptions we have made, it appears that from a conceptual standpoint it is plausible to think that the range of $\phi_1$ where discretionary policy can be beneficial is relatively bounded. Taken together, Equations (10) and (11) represent how real output, prices, expectations, and confidence jointly influence each other in an REE model of the macroeconomy.

B. The Effect of Confidence on Security Returns

The returns on risky assets ($r_{jt}$) are affected in a manner similar to that described above for real output and prices. The confidence elasticities, $\phi_1$ and $\phi_2$, explicitly enter the asset pricing model of Equations (15) and (16) and thus will have a direct impact on security returns. For example, nearly all of the parameters of (16) contain either $\phi_1$ or both $\phi_1$ and $\phi_2$. When concerns about current and future income increase, the unexpected changes in the growth rates of money
supply and α diminish in importance (as φ₁ causes θ to go to zero). Thus, λ₅ and λ₆ tend toward zero as φ₁ rises. In addition, λ₃ and λ₄ (which contain both φ₁ and φ₂) increase linearly as the confidence elasticities grow large. At the extreme, λ₃ and λ₄ go to infinity as φ₁ and φ₂ do the same.¹⁴ This result indicates that security returns typically increase to very high levels (and that \( \dot{y}^* \) becomes, in effect, the only relevant variable in Equations 15 and 16) when φ₁ and φ₂ increase dramatically.

The effects of confidence on \( r_{jt} \) are consistent with our earlier analysis which found that an increase in φ₁ and φ₂ causes prices to rise greatly while discretionary policies become ineffective in altering real output growth. Thus, as the confidence elasticities rise, a chain reaction occurs between prices and security returns. Specifically, higher levels of φ₁ and φ₂ exert upward pressure on inflation which, in turn, causes the riskless return to increase when \( r_{ft} \) is a Fisher-type (1930) function of inflation (e.g., \( r_{ft} = i + \dot{p}_t^* \)). Consequently, higher levels of \( r_{ft} \) causes the security’s return (\( r_{jt} \)) to rise since \( r_{jt} \) is also a function of the riskless return (\( r_{ft} \)). Therefore, the model’s prediction that a very large increase in the confidence elasticities will lead to an increase in security returns simply indicates that investors will demand higher nominal rates of return in order to maintain the purchasing power of the returns on their investments. A real world example of this behavior was observed when Brazil was experiencing annual inflation rates of over 1,000% during the early 1990s. At that time it was not uncommon for average stock returns to range from 5 to 10% per day simply to keep up with inflation.

In addition to the effect of prices on security returns, Equations (15) and (16) show that \( \dot{y}^* \), the long run full employment growth rate of real output, can have a positive and nonlinear impact on \( r_{jt} \). Research work in the area of applying nonlinear dynamics to finance and macroeconomics (notably, Scheinkman and LeBaron, 1989, Brock, 1986, and LeBaron, 1992) suggests that the relationship between risk and return might be a great deal more complex than traditional linear asset pricing models. As these authors note, nonlinear models can be more effective in describing time series and cross-sectional data that exhibit sudden changes in volatility (as has been found in many real-world financial data series). Due to space constraints, the analysis of the effects of the nonlinear term in Equations (15) and (16) is left for future research.

One additional insight we can derive from our model and the empirical results discussed in the previous section is the potential impact of changes in confidence and other macroeconomic factors on required security returns. As noted earlier, economists and practitioners have debated whether investors have been exhibiting “irrational exuberance” in the U.S. stock market during

¹⁴ Note that the signs of \( \lambda_{i} \) will depend on not only φ₁ and φ₂ but also the firm’s consumption beta (\( \beta_{jc} \)). For example, the betas of securities riskier than the consumption portfolio will be greater than 1.0 and therefore will influence the range of φ₁ and φ₂ which results in positive or negative signs on these \( \lambda_{i} \)’s.
the second half of the 1990s. In terms of our model, we can see from Figure 2 that there has been a substantial increase in the confidence parameter, $\phi_1$, during the 1990s. From its low of 0.562 in August, 1990, the parameter’s most current reading is 0.736. This represents nearly a 31% increase in this parameter during the decade.

The main point of the following numerical exercise is to illustrate how changes in recent U.S. economic data related to confidence and macroeconomic factors can potentially describe sudden large increases (or decreases) in security returns. Differentiating (16) with respect to $\phi_1$ results in a fairly complicated derivative that is a function of nearly all of the parameters and variables found in (16). If we assume the same parameter values as those used to create Figure 1, as well as an estimate of 0.74 for $\phi_1$, we can compute the effect of the rising confidence parameter on security returns during 1994-1999. To do this, we must also make some assumptions about unexpected growth rates in the monetary and fiscal variables. We can assume that, due to the Federal Reserve’s unexpectedly expansionary monetary policy during most of the second half of the 1990s, the average annual “surprise” in broad monetary growth was 3% and that fiscal policy was, on average, as expected (and therefore did not contain an unexpected component). We can also assume the error term ($\nu$) is equal to its mean of zero. Based on these assumptions, the effect of an increase in confidence like the one reported in Figure 2 for the 1990s was to raise investors’ expected returns by 1.8 percentage points. Given that the Standard & Poor’s 500 Stock Index has had an annual total return of 12.7% during 1926-1997, an increase of 1.8 percentage points is quite significant in economic terms since it represents over a 14% increase when compared to the average historical return.

We can also use our model to examine the impact of an increase in the long run equilibrium growth on security returns. Numerous economists, investors, and journalists have argued recently in the popular press that a “New Economy” has dawned in the U.S. during the second half of the 1990s due to technological and telecommunications advances. Let us assume, as many New Economy supporters suggest, that these advances have led to a higher long run equilibrium growth rate of 4%. Prior to this New Economy debate, many analysts had used a benchmark of 2.5% as an estimate of the long run U.S. economic growth rate. Thus, if we assume that $\gamma$ has increased by 1.5 percentage points (in addition to our earlier assumptions),

15 It should be noted that during 1994-1999, the U.S. M-3 money supply grew 8.25% per year while nominal GDP expanded at a 5.55% annual rate. Thus, the 2.7% difference between these growth rates suggests, from a monetarist perspective, that the U.S. money was growing at an unexpectedly rapid rate when compared to nominal GDP. We therefore round this difference in growth rates to its nearest integer (3% per year) and use this figure as our guess of the unexpected component of money supply growth during the period. Clearly, this analysis warrants more rigorous econometric treatment in order to form a more definitive conclusion. However, as noted before, we are only attempting to illustrate the application of our model rather than establish a precise empirical estimate.
then a security with a consumption beta of 0.9 would have experienced a sizable increase in required return of 4.1 percentage points.

Furthermore, combining the effects of increased confidence and higher expected long run economic growth creates a very large jump in required security returns of 5.9 percentage points (a 46% increase over the S&P 500 average of 12.7%). Thus, an investor that employed our model and the above assumptions would expect to earn 18.6% annually (12.7% + 5.9%) on her investments in large, blue chip U.S. common stocks when compared with the average of 12.7%. Interestingly, the actual average annual return on the S&P 500 during 1994-1999 was 24.1%. Thus, our model describes a large portion of the unusually high stock returns observed during the second half of the 1990s. Admittedly, these results are based on assumptions that need to be examined more rigorously via in-depth econometric testing. More extensive empirical tests are left for future research.

C. Effects of Confidence on Fiscal and Monetary Policy

Although we have discussed the roles of fiscal and monetary policy in the previous two sections, it is helpful to summarize some of the key aspects of the REE and modified CCAPM models described above. As noted earlier, the confidence elasticities (φ₁ and φ₂) enable changes in consumer and producer confidence to influence the equilibrium levels of real output (y), prices of goods and services (p), and security returns (rjt). These effects can be transmitted via the parameter, θ. In fact, we can show that the effects of discretionary monetary and fiscal policy are directly related to θ. This can be done by taking the partial derivatives of y, p, and rjt with respect to the discretionary policy variables, mt and α t. The results of this differentiation process are presented below:

\[
\frac{\partial y_t}{\partial m_t} = \beta \theta \quad \frac{\partial y_t}{\partial \alpha_t} = \theta \quad \frac{\partial p_t}{\partial m_t} = \frac{\beta \theta}{\gamma} \quad \frac{\partial p_t}{\partial \alpha_t} = \frac{\theta}{\gamma} \\
\frac{\partial r_{jt}}{\partial m_t} = \lambda_e = \beta \theta \left( \frac{1 - \beta_{jc}}{\gamma} + \beta_{jc} \right) \quad \frac{\partial r_{jt}}{\partial \alpha_t} = \lambda_e = \theta \left( \frac{1 - \beta_{jc}}{\gamma} + \beta_{jc} \right)
\]

(17)

where, once again,

\[
\theta = \left[ \frac{1}{(1 - \delta \phi_1 + \frac{\beta}{\gamma})} \right]
\]

Note that all of the above partial derivatives with respect to the policy variables (m_t and \(m_t\) for monetary as well as \(\alpha_t\) and \(\dot{\alpha}_t\) for fiscal policy) contain the parameter, θ. Consequently, the effectiveness of monetary and fiscal policy will be affected by the value of θ which, in turn, is influenced by changes in the confidence elasticity, \(\phi_1\) (as noted earlier in Figure 1). Both
forms of discretionary policy decisions can be made more significant by keeping $\phi_1$ within certain bounds. Earlier sections demonstrated how uncontrolled increases in $\phi_1$ can cause $\theta$ to trend toward zero and thus render changes in $m_t$ and $\alpha_t$ virtually ineffective. Thus, our results are different than the typical REE finding that only unexpected changes in monetary/fiscal policy can affect real output.

In addition, the confidence parameters appear in the $\lambda_3$ and $\lambda_4$ terms of Equation (16). The $\lambda_3$ and $\lambda_4$ terms represent the sensitivity of security returns to changes in the long run equilibrium economic growth rate ($y^*$). This demonstrates that confidence can also affect security returns via its relation to long run economic growth as well as fiscal and monetary variables. Thus, our model demonstrates that three fundamental factors affect asset prices: long run economic growth, monetary policy, and fiscal policy. As noted earlier, a fourth factor (confidence) indirectly affects asset prices via confidence’s impact on the relative sensitivity of asset prices to the economic growth rate and monetary and fiscal policies.

In our model, discretionary government policy can still be ineffective even if it is unexpected because consumers and producers might have become greatly concerned about current income levels (i.e., $\phi_1$ rises sharply). Consumers and producers can become myopic and concentrate solely on current economic conditions and their impact on current income levels. In this state of mind, consumers and producers place little weight on any actions by the government. Thus, if $\phi_1$ is very high because consumers/producers are concerned about deteriorating (booming) economic conditions, then stimulative (restrictive) discretionary actions such as increasing (decreasing) the money supply and raising (lowering) the level of government spending will be ignored. In effect, producers and consumers in this mental state have a “show-me” attitude where governmental action and rhetoric is not believed. At this point, consumers and producers only trust news/information that provides solid, tangible evidence of a meaningful change in the direction of income/economic activity.

D. Some Empirically Testable Hypotheses

Based on Equations (8), (13), and (16), there several hypotheses of our model that can be tested empirically. Presented here are some thoughts in this vein. Undoubtedly, careful readers of this paper can develop additional hypotheses beyond those discussed below:

1. Estimate Equation (16) using fiscal and monetary variables such as Total Government Expenditures and the M2 Money Supply. Expectations for these variables can be formed using vector autoregression or error correction models in conjunction with monthly security returns for a market-wide stock index from a data source such as the Center for Research in Securities Prices. One can then estimate a random coefficients model of (16) using consumer and business confidence indexes and the theoretical relation of (8) to allow for time variation in the model’s
parameters. We expect that a random coefficients technique would describe the variation of security returns better than a conventional fixed coefficients model.

2. Compare the explanatory model of (16) to single-factor models such as the Sharpe (1964) CAPM, Breeden (1979) CCAPM, as well as a multiple-factor model such as the Chen, Roll, and Ross (1986) APT. We expect (16) to explain a greater amount of the variation in security returns than these other models.

3. Identify whether or not the confidence parameters of (8), $\phi_1$ and $\phi_2$, are related to monthly security returns. As shown in Figure 2, consumer confidence data and industrial production data can be used to estimate the parameters of (8) which, in turn, can be compared to security returns. We expect higher levels of these parameters to be positively related to the absolute magnitude of security returns.

V. Conclusion

This paper has outlined a theoretical model that links a rational expectations equilibrium (REE) economy to the Consumption-based Capital Asset Pricing Model (CCAPM). One important difference between this model and conventional models based on the rational expectations paradigm is that the role of consumer and producer confidence is explicitly incorporated in the equilibrium solutions. Recent empirical work and some empirical tests presented here suggest that confidence factors can have a statistically significant influence on aggregate economic activity and security returns.

The introduction of confidence can materially alter the equilibrium levels of real output, prices of goods/services, and security returns within our REE/CCAPM framework. For example, the asset pricing relation developed in Section III is a more complex, nonlinear function compared to the conventional linear CCAPM. In addition, the effectiveness of monetary and fiscal policy can change dramatically depending on fluctuations in consumer/producer confidence. In sum, the introduction of confidence in an REE economy and subsequent linkage of this model to the CCAPM provides interesting insights to the problems of pricing risky securities and analyzing macroeconomic fluctuations. A potentially fruitful avenue for future research is to perform more extensive empirical tests in order to identify the explanatory power of the model relative to existing asset pricing models. For example, monthly data for monetary and fiscal policy variables are readily available (e.g., broad money supply figures and federal government expenditure data) while models to form expectations of these variables, along with the long run economic growth rate, exist in the literature. Ultimately, empirical validation of the model will determine the usefulness of our approach over existing linear asset pricing models.
Appendix A

Derivation of the Rational Expectations Equilibrium levels of real output (y) and prices (p)

Based on the relationships described in the body of the paper, we can first derive IS and LM, as follows:

**IS:** \( y = C_0 + b(y - T) + I_0 - hr + G \), or via algebraic re-arrangement:

\[
y_{IS} = \left( \frac{1}{1-b} \right) \left[ C_0 + I_0 + G - bT - hr \right]
\]

(A1)

**LM:** \( \frac{M^d}{P} = m_0 + ky - lr \), or via re-arrangement:

\[
y_{LM} = \left( \frac{1}{k} \right) \left[ \frac{M}{P} - m_0 + lr \right]
\]

(A2)

where, \( M = \) nominal money supply.

In the above equations, it is assumed that the values of \( h, k, l, \) and \( m_0 \) are greater than zero and the marginal propensity to consume, \( b \), is bounded between 0 and 1.

We can set \( y_{IS} = y_{LM} \) to solve for the equilibrium level of the interest rate, \( r \), and then substitute this value of \( r \) into \( y_{LM} \) in order to obtain the Keynesian equilibrium level of real output:

\[
y = \frac{1}{1-b + \frac{kh}{l}} \left[ C_0 + I_0 + G - bT - hr \right] + \frac{h}{l} \left( \frac{M}{P} - m_0 \right)
\]

(A3)

Now, if we assume that in equilibrium, \( y = \) aggregate demand (AD) = expectations-augmented aggregate supply (EAS), then \( y = y^d = y^e \). By setting \( y = y^d \), and removing the Aggregate Confidence (CC) term from \( C_0 \) and \( I_0 \) (as found in Equations 3 and 5 of the text), we can represent the aggregate demand curve as:

\[
y^d = \left[ CON + INV + G - bT - hr - \frac{h}{l} \left( m_0 \right) \right] \left[ 1-b + \frac{kh}{l} \right] + \left[ 1 - \frac{h}{l} \right] \left[ CC + \frac{h}{l} \left( m_0 \right) \right] \left( \frac{M}{P} \right)
\]

(A4)

The above equation can be simplified by defining the defining the first, second, and third terms in parentheses as \( \alpha, \delta, \) and \( \beta \), respectively. The simplified equation for AD at time \( t \) is therefore:

\[
y^d_t = \alpha_t + \delta_t cc_t + \beta_t (m_t - p_t)
\]

(A5)

where, the lower case letters denote logarithms of the respective variables.

The expected long run equilibrium level of real output can be denoted as \( y^* \) and is derived by simply taking the expectation of the above AD function:

\[
y^*_t = \alpha^*_t + \delta^*_t cc^*_t + \beta^*(m^*_t - p^*_t)
\]

(A6)

where, the superscript, \( e \), represents expectations of the respective variables.
We can also assume that the long run equilibrium level of real output grows at a constant (or ‘natural’) rate over time (i.e., we can say that $y_{t+1}^* = (1 + g)y_t^*$, where $g$ is the constant growth rate).

We can derive the rational expectations equilibrium level of real output by establishing one more relation by re-arranging (A6) to isolate the natural logarithm of the expected price variable:

$$p_t^* = (m_t^*) - \frac{1}{\beta} (y_t^* - \alpha_i^*) + \frac{\delta}{\beta} (cc_t^*) \tag{A7}$$

Now, we can take the difference between the actual level of AD and the long run equilibrium level of output $(y - y^*)$ as follows:

$$y_t - y_t^* = \alpha_i - \alpha_i^* + \beta (m_t - p_t) - \beta (m_t^* - p_t^*)+ \delta (cc_t - cc_t^*) \tag{A8}$$

we can then substitute for the last term using Equation (8) of the text,

$$y_t - y_t^* = \alpha_i - \alpha_i^* + \beta (m_t - p_t) - \beta (m_t^* - p_t^*)$$

$$+ \delta \left( \phi_1 y_t^* + \phi_2 y_{t+1}^* + \nu_t - (\phi_1 y_t^* + \phi_2 y_{t+1}^* + \nu_t^*) \right)$$

$$= \alpha_i - \alpha_i^* + \beta (m_t - m_t^*) - \beta (p_t - p_t^*) + \delta \left( \phi_1 (y_t - y_t^*) + \nu_t \right) \tag{A9}$$

since $\nu_t^* = 0$ (by assumption) and $y_t^* = y_t^*$. This, in turn, can be re-arranged as:

$$(1 - \delta \phi_i) (y_t - y_t^*) = \alpha_i - \alpha_i^* + \beta (m_t - m_t^*) - \beta (p_t - p_t^*) + \delta (\nu_t) \tag{A10}$$

and substituting for $p_t - p_t^* = \frac{1}{\gamma} (y_t - y_t^*)$ via the EAS curve equation yields,

$$(1 - \delta \phi_i) (y_t - y_t^*) = \alpha_i - \alpha_i^* + \beta (m_t - m_t^*) - \left( \frac{\beta}{\gamma} (y_t - y_t^*) \right) + \delta (\nu_t) =$$

$$(1 - \delta \phi_i + \frac{\beta}{\gamma}) (y_t - y_t^*) = \alpha_i - \alpha_i^* + \beta (m_t - m_t^*) + \delta (\nu_t) \tag{A11}$$

dividing by the first term on the left hand side of Equation (A11) and re-arranging yields:

$$y_t = y_t^* + \frac{1}{(1 - \delta \phi_i + \frac{\beta}{\gamma})} \left( \alpha_i - \alpha_i^* + \beta (m_t - m_t^*) + \delta (\nu_t) \right) \tag{A12}$$

The above rational expectations equilibrium (REE) level of real output can be represented in a simpler manner by defining the term in brackets as:

$$\theta = \frac{1}{(1 - \delta \phi_i + \frac{\beta}{\gamma})} \tag{A13}$$
and, therefore, the REE level of \( y \) can be defined as:

\[
y_t = y_t^* + \theta (\alpha_t - \alpha_t^*) + \beta \theta (m_t - m_t^*) + \delta \theta (\nu_t)
\]  

(A14)

As can be from Equation (A14), \( y \) is affected by the long run REE level of \( y \) (\( y^* \)) and unexpected changes in \( \alpha \), \( m \), and confidence (via the term, \( \nu \)). That is, \( y \) will only deviate from \( y^* \) when there are unexpected changes in the nominal money supply (\( m \)), consumer and producer confidence (\( \nu \)), and other factors which comprise \( \alpha \) (such as the level of government expenditures (\( G \)), tax collections (\( T \)), and base levels of consumption/investment (\( \text{CON} \) and \( \text{INV} \)).

From the EAS curve specified in the body of the text, a formal relation for the economy’s price level can be developed using the above rational expectations framework based on the EAS curve: \( p_t - p_t^* = \left( \frac{1}{y} \right) (y_t - y_t^*) \)

so, via re-arrangement and substitution for \( (y_t - y_t^*) \) via (A12):

\[
p_t = p_t^* + \frac{1}{\gamma} \left( \theta \left( (\alpha_t - \alpha_t^*) + \beta (m_t - m_t^*) + \delta (\nu_t) \right) \right)
\]  

(A15)

and substituting for \( p_t^* \) via (A7):

\[
p_t = \left\{ m_t^* - \frac{1}{\beta} (y_t^* - \alpha_t^*) + \frac{\delta}{\beta} c_{c_t}^* \right\} + \left\{ \frac{\theta}{\gamma} \left( (\alpha_t - \alpha_t^*) + \beta (m_t - m_t^*) + \delta (\nu_t) \right) \right\}
\]  

(A16)

next, we can substitute for \( c_{c_t}^* = \phi_1 y_t^* + \phi_2 y_{t+1}^* = (\phi_1 + \phi_2 (1 + g)) y_t^* \) and factor \( y_t^* \):

\[
p_t = \left\{ m_t^* + \frac{1}{\beta} (\delta (\phi_1 + \phi_2 (1 + g)) y_t^*) + \frac{1}{\beta} \alpha_t^* \right\} + \left\{ \frac{\theta}{\gamma} \left( (\alpha_t - \alpha_t^*) + \beta (m_t - m_t^*) + \delta (\nu_t) \right) \right\}
\]  

(A17)

Equation (A17) shows how the aggregate price level (\( p \)) is affected by both expected and unexpected changes in key macroeconomic factors. The first bracketed term in (A17) represents the expected price level (\( p^* \)) while the second bracketed term denotes the effect of unexpected changes in macroeconomic factors on the aggregate level of prices.
Appendix B

Derivation of the Fundamental Relations of the Consumption-based Capital Asset Pricing Model (CCAPM)

To begin, we can assume an Arrow-Debreu state-space economy where markets are complete (i.e., all states of nature are insurable via the construction of appropriately weighted portfolios of complex, or ‘primitive’, securities). A securities market exists which permits claims on future real consumption (i.e., securities) to be traded costlessly. As in Lucas (1978), one can assume that there are multiple firms in the economy which produce different numbers of units of a single perishable good.\(^{16}\) Each firm’s share of the economy’s real aggregate production (X) can be denoted as \(x_j\) (and, therefore, \(\sum x_j = X\)). Prices for each firm’s securities are then determined by the expected units of production each firm produces. These expectations are based on investors’ estimates of the likelihood of each state of nature and the payoffs to a set of ‘pure’ Arrow-Debreu securities (i.e., a security which pays off 1 dollar if one state occurs and zero if any other state occurs). In a complete market, the market value of a firm’s ‘primitive’ security must be equal to the cost of a portfolio of Arrow-Debreu securities which provides an identical set of payoffs. If we denote the price of a pure security which pays $1 in state \(s\) as \(p_s\), then the price of the \(j\)-th firm’s security \((S_j)\) with a payoff of \(x_s\) when state \(s\) occurs must be equal to the following:

\[
S_j = \sum_s p_s \cdot x_s \quad (B1)
\]

For simplicity, we can assume investors possess homogeneous expectations about future states of nature and expected payoffs for all firms. In addition, we can assume that all investors are risk averse and maximize the utility of their lifetime consumption \((C_i)\) subject to the budget constraint that one’s consumption must not exceed one’s income \((Y)\) plus wealth, \(W\), (i.e., \(C \leq Y + W\)). Specifically, it is assumed that investors possess the same utility function [i.e., all investors possess a quadratic utility function of the form, \(u(C_i) = \rho'(aC_i - (b/2)C_i^2)\), where \(\rho'\) is a present value discount factor and \(a, b\) are parameters which are greater than zero]. Thus, a representative agent can be employed by aggregating the \(i\)-individual investor utility functions (since \(\sum C_i = C\)) in order to obtain an aggregate utility function:

\[
u(C) = \rho'(aC - (b/2)C^2) \quad (B2)
\]

As will be seen below, these assumptions simplify the analysis and make it feasible to derive an exact, market-based asset pricing relationship.

---

\(^{16}\) Assuming a single perishable good ensures that each period’s production will be consumed (i.e., no inventories are allowed to be held from the current period to future periods). Thus, consumption equals production, or \(C = X\) in our model.
As demonstrated in Huang and Litzenberger (1988)\textsuperscript{17}, the price of a pure security which pays off $1 if state \(s\) occurs at time \(t+1\) can be defined as:

\[
P_{s,t+1} = \pi_{s,t+1} \frac{u'(C_{s,t+1})}{u_t(C_{s,t})}
\]

where, \(u'(C_{s,t})\) and \(u'(C_{s,t+1})\) are the marginal utilities of consumption at times \(t\) and \(t+1\), respectively, when state \(s\) occurs. Also, the term, \(\pi_{s,t+1}\), is the conditional probability that state \(s\) will occur at time \(t+1\). This probability is conditioned on the information set available at time \(t\) (denoted as \(\mathcal{I}_t\)).

The above relationship indicates that a pure security’s price should be equal to the expected value of investors’ marginal rate of substitution (the term in parentheses) between future and current consumption when state \(s\) occurs. Substituting the above equation into our earlier pricing relationship for the \(j\)-th firm’s security price, we can find:

\[
S_{s,t+1} = \sum_{s',t+1 \in \mathcal{I}_{t+1}} \pi_{s',t+1} \left( \frac{u'(C_{s',t+1})}{u_t(C_{s,t})} \right) (x_{s',t+1} + S_{s',t+1})
\]

where, \(x_{s',t+1}\) is the firm’s share of production in state \(s\) at time \(t+1\) and \(S_{s',t+1}\) is the firm’s security price at time \(t+1\) if state \(s\) occurs.

The equation presented above states that a long-lived security’s price is simply equal to the expected value of the firm’s payoffs at time \(t+1\). Specifically, the security can generate payoffs in two ways: a) via the payment of cash/units of production which can be consumed at \(t+1\) (i.e., \(x_{s,t+1}\)) and b) via changes in the value of the security’s price at \(t+1\) (e.g., a capital gain could be realized at \(t+1\) if \(S_{j,t+1}\) is greater than \(S_{j,t}\), which, in turn, can be used to increase consumption at \(t+1\)). These payoffs to a long-lived, complex security are then adjusted to reflect their inherent uncertainty by multiplying each possible payoff by the respective expected payoff of a pure security in each state of nature. The above pricing equation can be written in a simplified form as follows:

\[
S_t = E\left[ \left( \frac{u'(C_{s,t})}{u_t(C_{s,t})} \right) (x_{s,t+1} + S_{s,t+1}) \bigg| \mathcal{I}_t \right]
\]

where, \(E\) is an expectation operator formed at time \(t\) conditioned on the information set, \(\mathcal{I}_t\).

We can use the above relationship, along with the definition of a security’s one period return presented below, to establish the CCAPM. First, the one period return on the \(j\)-th security during the period of time from \(t-1\) to \(t\) is:

\[
r_{jt} = \left( \frac{(x_{j,t+1} + S_{j,t+1})}{S_{j,t}} \right) - 1
\]

\textsuperscript{17} For purposes of brevity and space constraints, a detailed derivation of the following result is not provided here. A description of this derivation can be found in Huang and Litzenberger (1988), pp. 180-187.
Also, the corresponding value of the j-th firm’s security at time t - 1 is:

\[ S_{j,t-1} = E\left[ \left( \frac{u'_j(C_t)}{u'_{t-1}(C_{t-1})} \right) \left( x_{jt} + S_{jt} \right) | \mathcal{F}_{t-1} \right] \]  \hspace{1cm} (B7)

Equations (B6) and (B7) imply that:

\[ 1 + r_{jt} \equiv \left( \frac{x_{jt} + S_{jt}}{S_{t-1}} \right) \]  \hspace{1cm} (B8)

and, therefore, via substitution of \((1 + r_{jt})\) into (B7) and then re-arrangement of (B7):

\[ 1 = E\left[ \left( \frac{u'_j(C_t)}{u'_{t-1}(C_{t-1})} \right) (1 + r_{jt}) | \mathcal{F}_{t-1} \right] \]  \hspace{1cm} (B9)

We can further manipulate the above equation by noting that the covariance of two random variables (say, X and Y) is defined as: \( \text{cov}(X, Y) = E(XY) - E(X)E(Y) \). The above equation is similar to that of \( E(XY) \) and can therefore be re-defined as: \( E(XY) = \text{cov}(X, Y) + E(X)E(Y) \).

This result is presented below:

\[ 1 = \text{cov}_{t-1} \left( \left( \frac{u'_j(C_t)}{u'_{t-1}(C_{t-1})} \right), (1 + r_{jt}) \right) + \left[ E\left[ \left( \frac{u'_j(C_t)}{u'_{t-1}(C_{t-1})} \right) | \mathcal{F}_{t-1} \right] \right] \cdot E\left[ (1 + r_{jt}) | \mathcal{F}_{t-1} \right] \]  \hspace{1cm} (B10)

If we assume that a riskless asset exists which generates a return of \( r_{ft} \) in every possible state of nature, then we can derive a useful relation:

\[ 1 = E \left[ MRS_{t-1,t} (1 + r_{jt}) | \mathcal{F}_{t-1} \right] \]  \hspace{1cm} (B11)

where, \[ MRS_{t-1,t} = \left( \frac{u'_j(C_t)}{u'_{t-1}(C_{t-1})} \right) \]

and, thus:

\[ E \left[ MRS_{t-1,t} \right] = \frac{1}{1 + r_{ft}} \]  \hspace{1cm} (B12)

The above equation follows from the assumption/definition that \( r_{ft} \) is the same regardless of which state occurs and therefore \( r_{ft} \) can be treated as a constant during the period of time \( t-1 \) to \( t \).

Equation (B12) states that the expected marginal rate of substitution between current and future consumption is equal to the reciprocal of \((1 + r_{ft})\). That is, the difference in utility between consuming now or postponing consumption for one period is simply related to the opportunity cost of having to wait one period. Since the ability to consume today or one period from now is the same (i.e., there is no risk involved in consuming $1 now or later), the appropriate discount factor for discounting future consumption is the return on the riskless asset. In effect, Equation (B12) indicates that the expected marginal rate of substitution between a dollar’s worth of current and future consumption is equal to $1 discounted to the present using \((1 + r_{ft})\) as the discount factor.

Equation (B12) can then be substituted into (B10) and re-arranged as follows:
Equation (B16) demonstrates that the risk premium for a firm’s security (the left hand side of B16) is negatively related to the covariance between the security’s expected return and the marginal rate of substitution between current and future consumption (MRS).

We can now employ the representative agent’s quadratic utility function to show that the covariance specified in (B16) depends only on the covariance between $r_{jt}$ and consumption $(C)$.

Using the quadratic utility function, we can see that the MRS term is equal to:

$$\text{MRS}_{t-1,j} = \left( \frac{u'(C_t)}{u'(C_{t-1})} \right) = \rho^i (a_{r} - b_{r} C_t) / \rho^i (a_{r} - b_{r} C_{t-1})$$

As can be seen from the above equation, the only component of MRS which represents a random variable is consumption $(C_{t-1}$ and $C_t)$. Thus, the covariance of MRS and $r_{jt}$ is effectively described by the covariance of $C$ and $r_{jt}$:

$$\text{cov}_{t-1} (\text{MRS}_{t-1,j}, r_{jt}) = \text{cov}_{t-1} (r_{jt}, C_t)$$

(B18)

In addition to the above relationships, we need to develop another pricing equation to account for the fact that in a multi-period securities market there may be no portfolio which perfectly replicates the pattern of aggregate consumption (since some of the portfolio’s returns are in the form of unrealized capital gains rather than simple dividends). Accordingly, we can construct a portfolio which is most highly correlated with aggregate consumption. Note that equation (B19) can be re-arranged as follows:

$$\frac{E[r_{ct} | \mathcal{Z}_{t-1}]}{\text{cov}_{t-1} (r_{ct}, C_t)} = -(1 + r_{jt})$$

(B20)
Equation (B20) can then be substituted into (B16) and re-arranged:

\[
E[r_{jt} | S_{t-1}] - r_f = \frac{\text{cov}_{t-1}(r_{jt}, C_t)}{\text{var}_{t-1}(C_t)} (E[r_{ct} | S_{t-1}] - r_f)
\]  \hspace{1cm} (B21)

and consumption betas \( \beta_{jc,t-1} \) can be defined as follows:

\[
\beta_{jc,t-1} = \frac{\text{cov}_{t-1}(r_{jt}, C_t)}{\text{var}_{t-1}(C_t)} \quad \text{and} \quad \beta_{cc,t-1} = \frac{\text{cov}_{t-1}(r_{ct}, C_t)}{\text{var}_{t-1}(C_t)}
\]  \hspace{1cm} (B22)

which can be substituted into the above pricing equation:

\[
E[r_{jt} | S_{t-1}] - r_f = \frac{\beta_{jc,t-1}}{\beta_{cc,t-1}} (E[r_{ct} | S_{t-1}] - r_f)
\]  \hspace{1cm} (B23)

The above relationship can then be re-defined as:

\[
E[r_{jt} | S_{t-1}] - r_f = \beta_{jc} (E[r_{ct} | S_{t-1}] - r_f)
\]  \hspace{1cm} (B24)

where the firm’s CCAPM consumption beta is:

\[
\beta_{jc} = \frac{\beta_{jc,t-1}}{\beta_{cc,t-1}}
\]

Equation (B24) is the Consumption-based Capital Asset Pricing Model. As can be seen in (B24), the risk premium associated with the j-th firm’s security is positively and linearly related to the risk premium of the portfolio which is most highly correlated with consumption (i.e., the consumption portfolio). The CCAPM consumption beta, \( \beta_{jc} \), is a measure of the riskiness of the firm’s security relative to the riskiness of the consumption portfolio. The next step is to link the CCAPM derived above to the REE macroeconomic model specified in Appendix A. This linkage is developed in Appendix C.
Appendix C

Derivation of the Relation between the Consumption-based Capital Asset Pricing Model (CCAPM) and the Rational Expectations Equilibrium Macroeconomic Model

The CCAPM and REE model can be linked through a relation noted in Lucas (1978). Specifically, a firm’s return is related to its proportionate share of the total output produced during a particular time period (i.e., the term, \( x_j \), defined in Appendix B). Thus, a firm’s return is directly related to the economy’s aggregate output (\( X \)). Since all output is assumed to be perishable, \( X \) is also equal to aggregate real consumption (\( C \)). In turn, the above relations reveal that a firm’s return is therefore directly linked to both \( C \) and \( X \). We can therefore use Equation (A14) from Appendix A as our model of real output since \( y \equiv X \) in the above context. In addition, the CCAPM pricing relation derived in Equation (B24) of Appendix B can be used since we are assuming \( C = X \). Another interesting aspect of our analysis is that the riskless asset’s return can be described as a function of expected inflation and the real rate of interest (\( i \)) as in Fisher (1930). Since we have a model of aggregate prices in the form of Equation (A17), we can specify the following Fisher approximation:

\[
r_{ft} = i + \hat{p}_i^f
\]  

(C1)

where, for simplicity, we can assume that the real rate, \( i \), is constant, and

\[
\hat{p}_i^f = \ln(P_t^f / P_{t-1}) = \text{inflation variable}
\]

We can then substitute for the return on the consumption portfolio (\( r_{ct} \)) in the CCAPM by using the real output equation of (A14) and the aggregate price equation of (A17). This substitution links the REE macroeconomic model with the CCAPM. Before doing so, however, we must transform (A14) and (A17) into equations comprised of rates of change rather than dollar or price levels. Equations (A14) and (A17) can be readily modified using the transformation described above for inflation. That is, each variable in (A14) and (A17) can be transformed into rates of change via the following equation:

\[
\dot{z}_j = (Z_j / Z_{j-1}) = z - \text{variable transformed into a rate of change, for example,}
\]

\[
\dot{y}_t = (y_t / y_{t-1}) = \text{rate of change in real output from t - 1 to t.}
\]

Formally, we can state the return on the consumption portfolio (\( r_{ct} \)) is a function of \( y \) and \( p \) that can be written as follows:
Equation (C5) demonstrates how the CCAPM’s pricing relation depends on fluctuations in $y^*$ and $p^*$. This relation can be made more explicit by substituting Equations (A14) and (A17) for $y^*$ and $p^*$ as follows:

\[
E[r_{it} | S_{it}] = \left(1 - \beta_{jc}\right) y^* + \left(1 - \beta_{jc}\right) \frac{1}{\beta} \left(\delta(\phi_1 + \phi_2 (1 + g)) - 1\right) y^* + \frac{1}{\beta} \alpha^* + \frac{1}{\beta} \lambda^*
\]

Another interesting component of our attempt to link the CCAPM and REE models is that we can derive an explicit pricing relation for not only expected security returns but also actual security returns. This can be accomplished by incorporating the unexpected changes in money supply, prices, confidence, and $\alpha$ into Equation (C8) via (C5).
The above actual return equation can be re-written in simpler notation with each of the above parameters defined by their respective \( \lambda_i's \) (e.g., \( \lambda_5 = \beta((1-\beta)_{jc}/\gamma + \beta_{jc}) \), \( \varepsilon = \theta\delta((1-\beta)_{jc}/\gamma + \beta_{jc}) \), etc.):

\[
\begin{align*}
    r_{jt} &= \lambda_0 + \lambda_1 \hat{m}_t^e + \lambda_2 \hat{\alpha}_t^e + \lambda_3 \hat{y}_t^e + \lambda_4 (y_t^e)^{\gamma} + \lambda_5 (\hat{m}_t - \hat{m}_t^e) + \lambda_6 (\hat{\alpha}_t - \hat{\alpha}_t^e) + \varepsilon_{jt} \\
    &= \text{(C10)}
\end{align*}
\]

Equation (C10) explicitly describes how and why observed security returns can deviate from expected returns. Since \( \phi_1 \) and \( \phi_2 \) affect many of the parameters of (C10), changes in confidence can play a significant role in determining not only real output and prices but also the actual returns on risky securities.
References:


Lettau, M., and S. Ludvigson, 2000 (forthcoming), Resurrecting the (C) CAPM: A cross-sectional test when risk premium are time-varying, *Journal of Political Economy*.


Fig. 1 The Effect of Changes in the Confidence Parameter ($\phi_1$) on $\theta$
Fig. 2 Rolling Regression Parameter Estimates of $\phi_1$ based on Consumer Confidence Index (6/1977 - 3/2000)