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Technology Shocks and Asset Pricing: The Role of Consumer Confidence*

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Abstract

We show that the introduction in a power utility function of a confidence index to signal the state of the world allows for an otherwise standard asset pricing model to match the observed consumption growth volatility and excess returns with a reasonable level of relative risk aversion. Our results stem from two quantitative exercises: a calibration and a non-linear estimation. In both cases, our findings are robust to different data frequencies and various indicators of confidence. Our estimations are also robust to a number of instrument specifications. We rationalise this finding by developing a model where monopolistically competitive firms are subject to idiosyncratic shocks, which affect both the quantity and the quality of the goods produced. When households foresee good times, they expect firms to generate higher profits and produce higher quality goods. While greater expected excess returns provide a larger incentive to save, better expected quality of consumption discourages saving, as it lowers the expected marginal utility of any given level of physical consumption. Compared to standard consumption-based frameworks, our model thus predicts a more stable consumption path. Building on the customary notion of confidence indicators as the household expectations on the future state of the economy, we argue that confidence provides a suitable proxy for the unobservable quality of consumption via the positive correlation between the latter and the overall performance of the economy.

JEL Classification: G12, E21

Keywords: Asset Pricing, Consumer Confidence, Technology Shocks

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1 Introduction

The financial markets, the media and the business community interpret the indices of consumer confidence as indicators of changes in household income or wealth. Higher confidence, the typical story goes, signalling better economic conditions, makes agents feel richer and, accordingly, consume more. A number of academic articles appear to endorse this view. Empirical evidence suggests that consumer confidence predicts consumption growth, over and above other commonly used economic indicators (for a discussion, see, *e.g.*, Ludvigson, 2004).

The link between confidence and consumption growth is particularly interesting in conjunction with the poor performance of the consumption-based asset pricing models. A long list of papers show that the existing asset pricing theories fail to match risk-free returns and equity premia with consumption growth volatility, when a power utility function represents household preferences. Economists have attempted to solve this issue by generalising the utility function, while retaining the attractive properties of its power specification. The leading contributions in this literature suggest to introduce time non-separability in consumption, or to posit that utility is a function of consumption and some other good. None of these attempts, however, appear to decisively improve the ability of the consumption-based model to fit the data: implausibly large values of either risk aversion or intertemporal elasticity of substitution are required for the model to match risk-free returns and equity premia with consumption growth volatility (for recent surveys of this literature, see, *e.g.*, Ludvigson, 2012; and Mehra, 2012).

In this paper, we investigate whether the predictive power of confidence indicators over consumption growth may improve the empirical performance of the consumption-based asset pricing model. In Section 2, we develop a model to formalise our hypothesis. Like in several other contributions in the literature, our model features an unobservable state variable that influences the magnitude of marginal utility of consumption, and thereby the value of the stochastic discount factor that prices assets. The state variable magnifies utility (and lowers *marginal* utility) of any given consumed quantity in good times, and has the opposite effect in bad times. If the state variable correlates positively with the performance of the economy, then risky assets payoffs tend to be large when marginal utility of consumption is lower than in the benchmark model, and vice versa. As a result, consumption is less responsive to financial incentives.

The novel feature of our approach is that consumer confidence is used as a proxy for the unobservable state variable. Our intuition, discussed in Section 3, builds on two arguments. On the one hand, the state variable influences household utility and, as such, may reflect aspects of the consumption experience that are not captured by a quantitative measure of consumption: in particular, some elements characterising the goods consumed (*e.g.*, consistency with pre-purchase expectancy, reliability, freshness, etc.). On the other hand, consumer confidence is designed to reveal the households' perception of the state of the economy, which is in turn the aggregate outcome of producers' performances: these performances may influence goods' attributes, and thereby have a significant impact in shaping consumption experience. Hence, consumer confidence may offer an indirect indication of the degree of satisfaction that households experience when consuming a given quantity of goods.

In our quantitative model, we accordingly substitute consumer confidence for the state variable. The stochastic discount factor is then determined by a function of the growth factors of confidence and consumption. We calibrate the Euler equation resulting from our model, and also test it empirically using method-of-moments estimators. Section 4 illustrates our quantitative and empirical results. Both exercises show that our model is able to match the observed asset returns and consumption growth volatility with plausible values of risk aversion, when consumer confidence is used as a proxy for the unobservable state variable. Our findings are robust to different data frequencies and various indicators of confidence. Our estimations are also robust to a number of instrument specifications.

Naturally, we are well aware of Fama's (1991) criticism to models that "search the data for variables that, *ex post*, describe [...] average returns." For this reason, Section 5 proposes a theoretical rationale for the introduction of the state variable. Our explanation refer to the *qualitative* dimension of consumption, which is generally unobservable in the data, and thereby neglected by several branches of the economic literature. In a nutshell, our intuition is that 'positive' states (high consumer confidence) may be signalling better quality of future consumption. A number of contributions suggest that the qualitative dimension of consumption may be an important driver of households' decisions, particularly in rich economies (see, *e.g.*, Fajgelbaum, Grossman and Helpman, 2011; and Jaimovich and Merella, 2012). Though obtaining an observed measure of the quality level of domestic aggregate consumption is virtually impossible, from these studies we learn that quality of consumption is tightly linked with the performance of the economy. Building on the arguments discussed in Section 3, the fact that confidence indicators are designed to reflect precisely the households' view about the performance of the economy suggests that consumer confidence may represent an indirect proxy for consumption quality.[1]

[1] Empirical studies of the effect of quality on household decisions are essentially confined to the literature of international trade, where the availability of data on import prices at the product level allows to construct consistent proxies for quality (see, e.g., Khandelwal, 2010; and Hallak and Schott, 2011). The lack of such figures for domestic trade prevents the development of analogous proxies for domestic consumption, at least at the aggregate level. (For an attempt to produce objective measures of quality at a sectoral level –more precisely, for the wine industry in France– see Crozet, Head and Mayer, 2012.) One may argue that a proxy for quality of aggregate consumption could be inferred from data on imports only, letting domestically produced goods unaccounted for. But since, among other reasons, imports generally amount to a modest fraction of a country's economic transactions (*e.g.*, about 16.5% of the U.S. GDP in the period 2008-2011), this strategy would hardly produce a reliable measure.

Related literature

A number of contributions attempt to explain the observed correlation between current consumer confidence and future consumption growth. Two main ideas are investigated in this literature. The first is that, in line with the common wisdom, confidence may capture household expectations of future income or wealth, which might also be suggestive of a potential role for habit formation.[2] While we retain the view of consumer confidence as indicating household expectations of future events, we opt for a more literal reading, which posits that consumer confidence captures the household view on the performance of the economy. Building on our reasoning that links economic performance and the qualitative level of consumption, we argue that confidence indirectly signals a shift in the utility value achievable with any given level of expenditure, rather than a change in the spending capability *per se*. The second idea is that consumer confidence reflects uncertainty. As such, it might alter precautionary savings motives, owing to changes in the forecast variance of consumption.[3] Our approach differs in that confidence does not affect uncertainty in terms of consumption capability, but rather expresses variations in its utility value.

From a quantitative point of view, this paper refers to the vast literature attempting to resolve the equity premium and interest rate puzzles.[4] In particular, it relates to those contributions that have appealed to preference modifications. Most of these papers suggest either to disentangle relative risk aversion and intertemporal elasticity of substitution, or to introduce habit formation in consumption.[5] Our approach differs in that we retain the standard single-coefficient power

[2] This hypothesis finds little support in the data. Ludvigson (2004) shows that consumer confidence has some forecasting power for future labour income growth and non–stock market wealth growth, although this predictive power is not just confined to an indirect effect through household income or wealth. Carroll, Fuhrer and Wicox (1994) claim that the presence of habit formation, which implies that lagged consumption growth has predictive power for current consumption growth, might explain the correlation of lagged confidence with current consumption growth as arising from the correlation of lagged confidence with lagged consumption growth. Lagged consumption growth, however, is always included in their instrument sets. Thus, under their hypothesis, confidence should have had no incremental explanatory power.

[3] The relevant evidence is mixed. On the one hand, using UK data, Acemoglu and Scott (1994) find that high consumer confidence signals both higher consumption growth (savings accumulation) and a higher forecast variance (uncertainty), which suggests a positive link between saving and uncertainty. On the other hand, Carroll *et al.* (1994) and Ludvigson (2004) find a negative correlation between confidence and uncertainty in US data, and argue that precautionary saving motives would lead to a positive relationship between consumption growth and lagged uncertainty, which would contradict the observed positive correlation between confidence and consumption growth.

[4] The equity premium puzzle (EPP), first described by Mehra and Prescott(1985), arises empirically when asset prices are related to household saving decisions. The magnitude of the puzzle is measured by the difference between the value of the relative risk aversion required by asset pricing models (at least as large as twenty, see also Makiw and Zeldes, 1991) and that estimated by microeconometric works (just in excess of two, see *e.g.* Blume and Friend, 1975; Pratt and Zeckhauser, 1987). The interest rate puzzle, pointed out by Weil (1989), closely relates to the EPP, and refers to the large difference between the observed risk-free returns and those predicted by consumption-based asset pricing models.

[5] See, *e.g.*, Epstein and Zin (1989, 1991), and Melino and Yang (2003) on generalized expected utility; Constantinides (1990), Heaton (1995) and Boldrin, Christiano and Fisher (1997, 2001) on habit persistence; Abel (1990), Galí (1994) and Campbell and Cochrane (1999) on relative consumption effects.

specification, and postulate that utility is statically nonseparable in the quantity and the quality of the goods consumed rather than time-nonseparable in consumption. A smaller branch of the literature deviates from the view that financial risk is the sole force driving consumption decisions, and postulates that utility is a function of consumption and some other good.[6] We depart from this view by specifying preferences with exclusive regard to (the different aspects of) consumption.

From a theoretical point of view, the distinctive feature of the present model is that idiosyncratic technology shocks influence marginal utility of consumption by altering the quality level of the goods consumed. In this sense, our approach differs from the works of Lucas (1992) and Atkeson and Lucas (1992), who adopt aggregate taste shocks; and from that of Bencivenga (1992), who introduces shocks to aggregate consumption and leisure. It also complements the contributions by Horvath (1998, 2000), who introduces sectoral productivity shocks while abstracting from preference shocks.[7] Our model also relates to the setup in Busato (2004), who introduces the concept of relative demand shocks into a business cycle model while abstracting from productivity shocks.

2 The model

We begin our analysis by developing a simple consumption-based asset pricing model in which household preferences are state-dependent. For now, we just assume that household utility is a function of the product between aggregate consumption and the state variable. The rest of our framework is analogous to the typical model: household preferences are represented by a power utility function; two assets, one risk-free and the other state-contingent, are traded; free portfolio formation and the law of one price hold. In the next section, we discuss our choice for the proxy of the unobservable state variable introduced here. Later, Section 5 offers a rationale for the particular way we formalise the introduction of the state variable.

Let household intertemporal preferences be represented by an additively separable power utility, defined over the stream of present and future products between the state variable Θ_t and aggregate consumption X_t, and formally given by:

$$U = E_0 \left\{ \sum\nolimits_{t \in \mathbb{N}} \delta^t \frac{(\Theta_t X_t)^{1-\gamma}}{1-\gamma} \right\}, \tag{1}$$

[6] See, *e.g.*, Eichenbaum, Hansen and Singleton (1988), who suggest leisure; Aschauer (1985), who proposes government spending; Startz (1989), who advocates the stock of durable goods; and, more recently, Finkelstein, Luttmer and Notowidigdo (2013), who posit health indicators.

[7] Other interesting demand side uncertainty specifications can be found in Maliar and Maliar (2003, 2004), and Nakajima (2005), who show that introducing preference shocks is equivalent to considering some form of productivity or income heterogeneity; and Heatcote, Storesletten and Violante (2007), who consider preference heterogeneity.

where: t indicates time; E_0 denotes the expectation operator conditional on the information available at date 0; $\delta > 0$ is the household subjective discount factor; $\gamma > 1$ measures the curvature of one-period utility.[8]

Households can transfer resources over time by trading two types of assets: *equities*, whose holdings are denoted by A_t, which provide a state-contingent real rate of return $r_{A,t}$; *bonds*, whose holdings are denoted by B_t, which ensure a real rate of return $r_{B,t}$. Equities pay the holder (stochastic) dividends. Profits are distributed each period, hence dividends equal profits.

The representative household chooses the value for the stream of consumption indices $\{X_t\}_{t\in\mathbb{N}}$ in order to maximize utility (1), subject to the intertemporal budget constraint:

$$X_t = w_t - A_{t+1} + (1 + r_{A,t}) A_t - B_{t+1} + (1 + r_{B,t}) B_t. \tag{2}$$

The household problem can thus be formally stated as follows:

$$\begin{aligned} \max_{\{A_{t+1},B_{t+1},X_t\}_{t\in\mathbb{N}}} \quad & U = E_0 \left\{ \sum\nolimits_{t\in\mathbb{N}} \delta^t \frac{(\Theta_t X_t)^{1-\gamma}}{1-\gamma} \right\}, \\ \text{subject to:} \quad & X_t = w_t - A_{t+1} + (1 + r_{A,t}) A_t - B_{t+1} + (1 + r_{B,t}) B_t. \end{aligned} \tag{3}$$

The dynamics of our model economy are driven by a pair of shocks. A technology shock ε_t^a affects equity returns, which evolve according to the function $r_{A,t} = \mu_r e^{\varepsilon_t^a}$, where $\mu_r \equiv E_0 (r_{A,t})$. A preference shock ε_t^θ affects the state variable through the equation $\Theta_t = e^{\varepsilon_t^\theta}$, hence $\mu_\theta \equiv E_0 (\Theta_t) = 1$. We assume that the two shocks are i.i.d. over time, but display a positive (simultaneous) correlation: $\rho_{\varepsilon^a,\varepsilon^\theta} > 0$.[9] The positive link between the overall performance of the economy and the state variable implies that utility of any given level of consumption, measured by $(\Theta_t X_t)^{1-\gamma} / (1-\gamma)$, tends to be magnified by Θ_t in good times, and reduced in bad times, whereas marginal utility of consumption, measured by $(\Theta_t)^{1-\gamma} (X_t)^{-\gamma}$, has the opposite response, decreasing in good times and increasing in bad times.

The influence of the state variable on the optimal intertemporal consumption path formally works through the Euler equation, which solves problem (3), and from which we obtain the

[8] By assuming that the household has power utility, the relative risk aversion (RRA) coefficient is automatically tied to the consumption intertemporal elasticity of substitution. More precisely, the relative risk aversion coefficient is given by the reciprocal of the elasticity of the marginal utility of consumption with respect to consumption, *i.e.*:

$$RRA \equiv \left(\varepsilon_{U'(X_t),X_t}\right)^{-1} = -\frac{U''(X_t) X_t}{U'(X_t)} = \gamma.$$

The assumption $\gamma > 1$ follows from the fact that the value of the RRA coefficient is estimated to be in excess of two. See, *e.g.*, Blume and Friend (1975); and Pratt and Zeckhauser (1987).

[9] At this time, no further assumption about the distributions of the shocks is required. These will be made explicit in Section 4, when assessing the model quantitatively.

optimal distribution of resources over time:[10]

$$E_0\left[\frac{1+r_{A,t+1}}{1+r_{B,t+1}}\left(\frac{\Theta_{t+1}}{\Theta_t}\right)^{1-\gamma}\left(\frac{X_{t+1}}{X_t}\right)^{-\gamma}\right]=E_0\left[\left(\frac{\Theta_{t+1}}{\Theta_t}\right)^{1-\gamma}\left(\frac{X_{t+1}}{X_t}\right)^{-\gamma}\right]. \quad (4)$$

We can draw two conclusions from the inspection of the equilibrium condition expressed by (4). On the one hand, for a given value of the state variable, household choice is pretty standard. Expected future high returns $1 + r_{A,t+1}$ induce households to increase the demand for equities, giving up some units of either current consumption X_t or bonds B_t (or both). As a result, larger expected future returns imply *higher* expected consumption growth. On the other hand, given equity returns, variations in the state variable entails the following mechanism. Higher expected values of the state variable lower the expected marginal utility of consumption. The household is induced to adjust its consumption pattern by raising current relative to future consumption. As a result, higher expected values of the state variable imply *lower* expected consumption growth.

As we show below, the correlation between equity returns and each confidence indicator, our proxy for the state variable, is positive (and in line with what assumed above). Taken together, the two conclusions just sketched then imply that the effect of the expected value of the state variable on household choice tend to balance out the influence of expected returns, and consumption is predicted to fluctuate less than in models where the state variable is absent. Section 4 assesses this prediction quantitatively. In the next section, we explain the reasons for choosing consumer confidence to 'quantify' the unobservable state variable when bringing the model to the data.

3 The role of consumer confidence

As far as the model described in the previous section is concerned, there is no obvious way to find a direct measure the state variable Θ in the data. We therefore need to identify some indirect proxy for it: we choose the indicators of consumer confidence. As we mentioned in the introduction, the intuition behind this choice builds on a number of considerations. First, we postulate that the state variable reflects the level of satisfaction in the consumption experience due to other aspects than the quantity consumed. Second, given that firm performances govern at least some elements influencing the consumption experience, on aggregate this level of satisfaction correlates positively with the state of the economy. Third, consumer confidence is designed to reveal the households' perception of the state of the economy. Jointly taken, these considerations suggest that consumer confidence may offer an indirect indication of the degree of satisfaction of consuming a given amount of goods.

A formal theoretical rationale for our reading of the state variable will be discussed in Section

[10] For the complete derivation of (4), see Appendix B.

5. Here, we focus on the more practical matter of understanding whether, and if so which, indicator of consumer confidence depicts a households' view of the performance of the economy that suits our interpretation of proxy for the state variable. In particular, we seek an indicator that portrays the state of the economy 'in absolute terms', asking respondents to evaluate the economic situation at a given point in time rather than to compare it at two different dates. The reason for this is that we ultimately aim to capture a signal, brought forth by consumer confidence via the correlated variation in the consumption experience, that is contemporaneous to the household decision on the quantity consumed.

Several indicators measure U.S. consumer confidence or similar concepts. Among them, two in particular have attracted the attention of academics: the Conference Board's Consumer Confidence Index (CC), and the University of Michigan's Consumer Sentiment Index (CS). They display similarities (both are based on five questions; and have two sub-components: a two-question present situation and a three-question expectations component) as well as distinctive features (sample size of about 3500 and 500 individuals, respectively; different survey and aggregation procedures, etc.).[11] Since the first indicator asks respondents to evaluate the economic situation at a given point in time while the second asks for a comparison at two different dates, we focus on the Conference Board's index to construct our argument linking confidence to the household perception of the state of the economy.[12]

The Conference Board defines the Consumer Confidence Index as "a barometer of the health of the U.S. economy from the perspective of the consumer."[13] The five questions asked to the respondents are:

1. how would you rate present general business conditions in your area [good/normal/bad];
2. what would you say about available jobs in your area right now [plentiful/not so many/hard to get];
3. six months from now, do you think business conditions in your area will be [better/same/worse];
4. six months from now, do you think there will be [more/same/fewer] jobs available in your area;
5. how would you guess your total family income to be six months from now [higher/same/lower].

[11] For a thorough analysis of the two indicators, we refer to Bram and Ludvigson (1998).

[12] In particular, the Consumer Sentiment Index features an heterogeneous "timing" in formulating the relevant questions, which include comparison to one year lag in the past and to one to five years in the future.

[13] The Consumer Confidence Index is released on a monthly basis since June 1977. The indicator first appeared in February 1967, and was initially released every two months.

The first two questions constitute the present situation component (CCP), and portray the households' view on the *level* of the current economic conditions. The remaining three questions comprise the expectations component (CCE), and depict the household's projection of the *variation* of the state of the economy relative to the current condition.[14]

The present situation component can be interpreted as the households' assessment on the current performance of the economy. As such, current CCP represents a natural candidate to reflect the households' perception on the realised state of the economy, and thus a possible proxy for Θ_t. The expectations component can be thought of as reflecting the information that households at present possess about the change in the future, relative to the current, realisation of CCP. As such, current CCE may represent a possible proxy for Θ_{t+1}/Θ_t, once the benchmark for this change (*i.e.*, the value of Θ_t or, in quantitative terms, the current realisation of CCP) is properly accounted for. Since households appear to be observationally capable to produce good forecasts of the variations in the future realisation of CCP, we opt for using CCP variation as our leading variable to choose the proxy for Θ_{t+1}/Θ_t, rather than constructing a composite index based on information from the lagged realisations of CCP and CCE, whose functional form would be arbitrary by construction.

The fact that household forecasts about their future view of the economic performance are fitting is illustrated in tables 1-3, where we report the results obtained by regressing the current value of CCP against its lagged value and the past realisation of CCE using monthly, quarterly and yearly data, respectively. Under all specifications, the coefficients of both regressors are positive as expected and significantly different from zero.[15] The tables also report large R^2, which suggests a very high goodness of fit. Adding other lags, or the past values of the overall indicator, does not substantially increase the fraction of variance explained. Hence, we expect CCP to produce analogous results as those produced by a potential composite index, in both our quantitative and empirical exercises. In addition, the correlation between the present situation component and the overall indicator, (which equals 0.94 in monthly and quarterly data, and 0.95 yearly,) suggests that current CC may also be used as a proxy for Θ_t.

Note that, substituting CCP for the state variable in the interpretation of the Euler equation (4) discussed in the last subsection, it follows that consumption growth is stimulated when confidence is currently high, and weakened otherwise. This prediction is in line with empirical evidence. Acemoglu and Scott (1994), Bram and Ludvigson (1998) and Ludvigson (2004) find that lagged consumer confidence (positively) predicts current consumption growth, which remain significant after controlling for variables such as income or labour income. It should be stressed,

[14] The overall index is a weighted average of the two components, where 40% is the weight associated to the value of CCP.

[15] Consistently with the "timing" of the questions asked, the importance of past realisations of CCE in determining current CCP raises as data frequency decreases, becoming in fact crucial once the aggregation period is over six months (which is the assessment requested to respondents in questions 3-5).

however, that our interpretation of confidence as an indicator of the state of the economy does not rely on its observed predictive power over consumption growth. In fact, we argue that it is the link between the current value of the expectations component and the future value of the present situation component to influence consumption decisions, by portraying the household view about the prospective conditions of the economy.

In this perspective, the link between confidence and consumption growth would merely reflect a by-product of the household choice resulting from the twofold influence exerted by the expected performance of the economy (through the equity premia on the one hand, and satisfaction of the consumption experience on the other). In particular: (i) the positive correlation between consumption growth and the excess return (from table 5: between 0.17 and 0.19) suggests that financial incentives are a fundamental driver of the household decision; while (ii) the positive correlation between the excess return and the variation in the value of the Consumer Confidence Index (from table 5: from 0.3 to 0.38) points towards a positive link between financial incentives and changes in the household perception of the state of the economy.

Finally, notice that the index developed by the University of Michigan, though unfitting given our interpretation of the state variable, may still be used as an alternative proxy for the performance of the economy by virtue of its strong correlation with the Consumer Confidence Index (0.83 in monthly data, 0.81 both quarterly and yearly). For robustness, we thus include the Consumer Sentiment Index among the proxies used to capture the state of the economy. To summarise, in our quantitative exercises illustrated in the next section, we use in turn the Consumer Confidence Index (CC), its present situation component (CCP), and the Consumer Sentiment Index (CS) as proxies for the state variable (and hence as an indirect measure for the households' satisfaction of their consumption experience).

4 Quantitative results

In our consumption-based asset pricing model, a new element, measured by the ratio of the values taken by the state variable at two successive dates, appears in the stochastic discount factor in (4). Section 2 has shown that expected future high values of the state variable induce individuals to raise current (relative to future) consumption in order to smooth the value of utility at different dates, thereby influencing their intertemporal choice. The effects of this influence are assessed quantitatively by exploring whether they help in resolving one of the most famous drawbacks of the asset pricing theory, namely the *equity premium puzzle*.

The equity premium puzzle is an issue that arises empirically when the representative agent paradigm is used to relate asset prices to investors' saving decisions. This problem, first described by Mehra and Prescott (1985), originates from observing that the real return on equities have been on average about six percent higher than that on Treasury bills, over the last one hundred years. The puzzle arises because consumption growth is stable, its correlation with the equity returns is moderate, so the resulting covariance is too low to explain the equity premium, unless the relative risk aversion (RRA) coefficient is implausibly high. Household preferences, specified by a standard constant RRA utility function, are made consistent with such a large equity premium only if the coefficient of relative risk aversion is at least as large as twenty.[16] In contrast, empirical works that have undertaken systematic investigations of cross-sectional data on individual's asset holdings to assess the nature of its utility function, pioneered by Blume and Friend (1975), find that the RRA coefficient is estimated to be just in excess of two.[17] The difference between the estimated and the required value of the relative risk aversion gives a measure of the puzzle magnitude.

Predictions are tested by adopting two different approaches. First, following Mehra and Prescott (1985), we propose a calibration of the model. By log-linearising the Euler equation (4), we derive the relative risk aversion coefficient implied by the U.S. data (described below) in the last four and a half decades, and compare its value to that obtained by microeconometric estimations. Second, in order to check the robustness of our findings, following Favero (2001) we also implement a GMM estimation. Below, we present the results obtained by applying this method, which allows to assume away the log-normal joint distribution of consumption, confidence and equity returns, after those resulting from the calibration of the model.

Dataset

The Consumer Confidence Index series, provided by the Conference Board, is available only for four and a half decades. Hence, working only with the Mehra-Prescott dataset is not ideal to test our predictions, as a yearly dataset may leave too few observations to obtain robust results. The dataset is then reconstructed, exploiting the fact that confidence indicators are provided on a monthly basis. In particular, we use three different frequencies to perform our quantitative exercises: monthly, quarterly and yearly.

We begin our description of the dataset with the entries for the proxies for the state variable. Exploiting the fact that the Consumer Confidence Index is released every two months since February 1967, the quarterly and yearly dataset contain 183 and 45 observations, respectively. The monthly dataset entries are instead restricted to the period when the indicator was released on a monthly basis: since June 1977, yielding 427 observations. The same figures apply to the present situation component of the Index. Regarding the University of Michigan's Consumer

[16] The constant RRA utility function is typically employed in most macroeconomic frameworks to represent the representative agent's preferences. In more recent contributions that make use of such a paradigm, the magnitude of the RRA coefficient is even higher, in some cases up to 70.

[17] These authors also show that the assumption of a constant relative risk aversion utility function is a fairly accurate description of household preferences. Regarding the magnitude of the proportional risk aversion, later contributions show that the RRA coefficient may take higher values, up to 7. See, *e.g.*, Pratt and Zeckhauser (1987).

Sentiment Index, the monthly dataset contains 420 observations, since the index is released at such a frequency since January 1978. Previously, this indicator was released every quarter since November 1959, thus the quarterly dataset features 213 observations. Furthermore, the Consumer Sentiment Index was released three times a year since 1953, leading to 60 entries in the yearly dataset.

The rest of the variables have longer time series. Financial data are since November 1952, featuring 722 (240, 61) observations in the monthly (quarterly, yearly) dataset. The equity returns are derived from the price and dividend time series of the Standard & Poor's 500 composite index. As a series for the bond returns, we use the monthly data of annual based nominal yield on three-month U.S. government treasury bills. Since the rates are reported using the bank discount convention, we get the non annualised monthly return by using the appropriate conversion formula. Then, the nominal returns are converted in real terms by using the price index provided by the Bureau of Economic Analysis of the U.S. Department of Commerce. This index is provided by the same institution as the consumption data (the latter is available since January 1959, covering 648, 215, and 53 entries in the monthly, quarterly, and yearly datasets, respectively). These in turn correspond to the sum of two series on real personal consumption: expenditures on services and expenditures on nondurables.

To summarise, the datasets used for the quantitative exercises that exclude the proxies for the state variables contain a common sample of 648 monthly, 215 quarterly, and 53 yearly observations. The datasets using the Consumer Confidence Index, or its present situation component, as a proxy for the state variables feature a common sample of 427 monthly, 183 quarterly, and 45 yearly observations. Finally, the datasets using the Consumer Sentiment Index as a proxy for the state variables feature a common sample of 420 monthly, 213 quarterly, and 60 yearly observations.

Calibration

We are now all set to evaluate quantitatively the predictions of the Euler equation (4) by calibrating the model on the observable U.S. data. Under certain conditions, we find the following exact log-linear expression for the terms in brackets of that equation:[18]

$$E_t r_{t+1}^a - r_{t+1}^b = \sigma_r \left[\gamma \rho_{rx} \sigma_x - (1-\gamma)\, \rho_{r\vartheta} \sigma_\vartheta \right]. \tag{5}$$

where $r_{t+1}^a \equiv \ln(1 + r_{A,t+1})$ and $r_{t+1}^b \equiv \ln(1 + r_{B,t+1})$ represent the rates of return on equities and bonds, respectively; subscripts x and ϑ refer to $x_{t+1} = \ln(X_{t+1}/X_t)$ and $\vartheta_{t+1} = \ln(\Theta_{t+1}/\Theta_t)$, which denote the growth rates of consumption and average quality of consumption, respectively; γ gives a measure of the RRA coefficient; σ_i stands for the standard deviation

[18] For the complete derivation of (5), see the Appendix A.

of the variable $i = \{r, x, \vartheta\}$; $\rho_{ii'}$ is the correlation coefficient between the variables $i, i' = \{r, x, \vartheta\}$, with $i \neq i'$.

It is easy to make a comparison between this expression and the equation calibrated by Mehra and Prescott (1985), given by:

$$E_t r^a_{t+1} - r^b_{t+1} = \gamma \rho_{rx} \sigma_r \sigma_x. \tag{6}$$

Equation (6) does not include the second term in brackets on the right-hand side of (5). Note that, by definition, $\sigma_\vartheta > 0$ and $\gamma > 0$. The effect of this additional term thus depends on the sign of the correlation between equity premium and the variation in the proxy for the state variable. The required magnitude of the RRA coefficient is expected to raise if $\rho_{r\vartheta} < 0$, and to decrease otherwise. From Table 5, it is straightforward to notice that all the proxies for the state variable variation factor deliver a positive correlation with the excess return factor. Hence, we expect the calibration of (5) to produce a lower value for the RRA coefficient than that resulting from calibration of (6).

Table 6 reports the calibrations of the RRA coefficient obtained with reference to (6) on monthly, quarterly and yearly data. Under all specifications, the "standard" model implies a value of RRA coefficient well above 80. Tables 7-9 report the calibration obtained with reference to (5) on the same frequencies as above, using data on the overall Consumer Confidence Index (CC), on its present situation component (CCP), and on the Consumer Sentiment Index (CS), respectively, as proxies for the state variable Θ. According to our model, the calibrated value for the RRA coefficient ranges from 4.2 to 10.5. Our calibration strongly suggests that the Euler equation, augmented using confidence indicators as proxies for the effect of the consumption experience satisfaction on household decisions, reduces the required magnitude of the RRA coefficient at least by a factor of 8 (and up to a factor of 23). As a result, our calibrated values for the RRA coefficient are clearly much closer to the interval $\gamma \in [2, 4]$, where the economic literature estimates the true value of that coefficient actually lies, than those required by the benchmark model.

Finally, it is worth noting that the value of the RRA coefficient obtained by calibrating (5) using data on the Consumer Confidence Index is smaller than those obtained by using data on its present situation component or the Consumer Sentiment Index – and therefore closer to that considered in the literature as the benchmark value for γ. This is due to the fact that variations in CC correlate much more with equity returns than those in CCP, and are much more volatile than the changes in CS.

GMM estimation

For robustness, a number of estimations are implemented, based on a non-linear instrumental variables (GMM) estimator. Under the joint hypothesis of representative agent intertemporal optimization and rational expectations (IOREH), the only significant variables in predicting consumption at date $t+1$ given the information at date t are consumption and state variable at date t. Denoting the Euler equation (4) generically as $f(\mathbf{y}_{t+1}, \boldsymbol{\theta})$, we have

$$E_t\left[f\left(\mathbf{y}_{t+1}, \boldsymbol{\theta}\right)\right] = 0, \quad E_t\left[f\left(\mathbf{y}_{t+1}, \boldsymbol{\theta}\right)\mathbf{z}_t\right] = 0,$$

where $\mathbf{y}_{t+1}$ is the vector of observed variables of interest at date $t+1$, $\boldsymbol{\theta}$ is the vector of parameters to be estimated, and $\mathbf{z}_t$ is a vector containing any economic variable observable at date t. These two expressions essentially imply that the conditional expectation for date $t+1$ taken at date t of the term in brackets is in fact zero. Moreover, $f(\mathbf{y}_{t+1}, \boldsymbol{\theta})$ is orthogonal to any variable other than consumption and state variable included in the agent's information set at date t. Notice that the Euler equation does not have any implication for the contemporaneous relation between consumption and other economic variables.

Euler equations from intertemporal optimization and rational expectations usually delivers a potentially infinite number of valid instruments. In this application, any lagged variable is a valid instrument under the null that the IOREH model is a data generating process. The parameters can be therefore estimated by using orthogonality conditions based on the following set of instruments:

$$\text{constant}, \ \frac{\Theta_{t+1-\tau}}{\Theta_{t-\tau}}, \ \frac{X_{t+1-\tau}}{X_{t-\tau}}, \ \frac{1+r_{A,t+1-\tau}}{1+r_{B,t+1-\tau}},$$

where we have chosen various combination of lags such that $\tau = [1, 6]$ when dealing with monthly data, $\tau = [1, 4]$ quarterly, and $\tau = [1, 2]$ yearly.[19]

The quantitative results of the GMM estimations are once again based on the dataset described above. The estimates obviously differ in the choice of the proxy used for the state variable, that is the overall consumer confidence index (CC), its present situation component (CCP), and the consumer sentiment index (CS). Estimation of the Euler equation (4) is implemented by using the appropriate routine in the E-Views software, using the HAC (Newey-West) weighting matrix, with the Hannan-Quinn criterion for Whitening lag specification and Andrews' bandwidth method and Tuckey-Hanning routine to implement the kernel, in order to choose the appropriate lag truncation parameter.

The results are reported in tables 10-15. Firstly, tables 10-12 report the results obtained by estimating equation (4) when considering $\Theta_{t+1}/\Theta_t = 1, \ \forall t \in \mathbb{N}$ on monthly, quarterly, and

[19] For each frequency, we first used the full range of lags, then for we reduced them in steps to check whether the goodness of fit of the instrument would increase. In order to maximise the latter, we also chose the two better performing lags for each frequency, and run regressions considering all the resulting combinations.

yearly data respectively. Tables 13-15 report those obtained by calibrating the same equation using data on the CC index, again on the three frequencies respectively. Regarding the standard model, although the estimates are qualitatively analogous to the results obtained by calibration, the magnitudes of γ obtained here generally drop: the range is between 50 and 73 (calibrated: 95) on a monthly frequency, and between 28 and 67 (113) quarterly.[20] In the literature, this result has often been regarded as suggestive of a greater significance of the higher moments of the joint distribution between consumption growth and excess returns than typically believed. As such, together with the evidence linking confidence and consumption growth, it could appear to advocate for a role for confidence in explaining habit formation in consumption, or precautionary saving. However, the outlined 'trend' does not clearly appear in the estimations reported in tables 13-15: there, the range is between 3 and 5 (4.2) on a monthly frequency, between 1 and 8 (4.8) quarterly, and between 2 and 5 (6) quarterly. In fact, all these estimations still lie in the range of values indicated by the literature as appropriate for the RRA coefficient, suggesting that confidence may (though indirectly) reflect a more straightforward influence on household decision.

5 Quality of consumption and the state of the economy

In Section 2, we have introduced a state variable into our consumption-based asset pricing model, interpreting it as an indicator of the satisfaction in the household's consumption experience. This leaves us with the task of rationalising such an interpretation, particularly since it represents the building block for the use of consumer confidence as a proxy for the state variable. We perform this task in three steps. First, we formalise a static framework with differentiated consumption goods, whose quality levels are subject to idiosyncratic shocks. Second, we show that this framework can be easily embedded in the dynamic model, and relate the state variable Θ to the aggregate outcome of the deviations of the quality levels from their means. Third, we explore the formal link between the state variable so obtained and the present situation component of the Consumer Confidence Index.

Static model

Exploiting the fact that utility (1) is time-additive, we can think of the household choice as a two-stage problem. The second stage is the dynamic problem discussed in Section 2, whose solution deliver the resource allocation over time, given the composition of the consumption bundle. Here we discuss the first stage, which deals with the static choice of the optimal consumption bundle composition, taking as given the resource allocation at the generic date considered.

[20] We do not report the results obtained using yearly data, as the validity of instruments is rejected in all estimations.

Consider a unit continuum of *horizontally* differentiated goods available for purchase, represented by the set $\mathbb{Z} \subset \mathbb{R} : z \in [0,1]$. Each good in the set $\mathbb{Z}$ is produced by a different firm. Firms maximise profits, and their productions consist of transforming labour services into different final goods, according to sector-specific technologies.[21] The production technology of each firm $z \in \mathbb{Z}$ at a generic date $t \in \mathbb{N}$ is assumed to be concave in the amount of labour $l_{z,t}$ employed, that is:

$$y_{z,t} = \phi_{z,t} (l_{z,t})^{\zeta}, \tag{7}$$

where $y_{z,t}$ is firm z output, and $\zeta \in (0,1)$ is a technological parameter. The terms $\{\phi_{z,t}\}_{z\in\mathbb{Z}}$ represent firm-specific productivities. These are subject to idiosyncratic shocks (henceforth referred to as technology shocks), which induce productivities to fluctuate around their (known) mean values $\{\bar{\phi}_z\}_{z\in\mathbb{Z}}$.

The novel feature of this framework is that technology shocks, denoted by $\{\varepsilon_{z,t}\}_{z\in\mathbb{Z}}$, also influence the quality dimension of production. We denote by $\{q_{z,t}\}_{z\in\mathbb{Z}}$ the realised quality levels of the consumption goods, which also take values around their (known) means $\{\bar{q}_z\}_{z\in\mathbb{Z}}$. Henceforth, we normalise the quality ladders to have a unit mean value, *i.e.*, $\bar{q}_z = 1$, for all $z \in \mathbb{Z}$.[22]

The demand side of the economy is populated by a unit continuum of identical individuals, each provided with one unit of labour services. Labour is homogeneous across individuals, so the total labour force sums up to one (hence, the labour market clearing condition can be written as $\int_{\mathbb{Z}} l_{z,t} dz = 1$). Individuals derive utility by consuming a bundle of the goods available for purchase. The consumption index C_t measures one-period utility of consuming that bundle, and is defined by the constant elasticity of substitution (*CES*) function of Dixit and Stiglitz (1977) type:

$$C_t = \left[\int_{\mathbb{Z}} q_{z,t} (x_{z,t})^{\alpha} dz \right]^{\frac{1}{\alpha}}, \tag{8}$$

where $\alpha \in (0,1)$ is a parameter governing the (limited) consumption elasticity of substitution among the different commodities, $\{x_{z,t}\}_{z\in\mathbb{Z}}$ are the quantities consumed, and $\{q_{z,t}\}_{z\in\mathbb{Z}}$ represent the quality levels of the goods consumed.[23] Denoting by $p_{z,t} > 0$ the price for a consumption

[21] To simplify matters, the goods set is invariant over time (hence innovation is ruled out), and all stock variables (physical capital, human capital, etc.) are normalised to one.

[22] Formally, each technology shock affects firm z productivity according to the process $\phi_{z,t} \equiv \bar{\phi}_z e^{\varepsilon_{z,t}}$, and good z quality via $q_{z,t} \equiv e^{\eta_z \varepsilon_{z,t}}$, where the parameters $\{\eta_z\}_{z\in\mathbb{Z}}$ reflect the heterogenous impact of technology shock across the differentiated goods. The shocks have zero mean, *i.e.*, $E(\varepsilon_{z,t}) = 0$ for all $z \in \mathbb{Z}$, and variance-covariance matrix Σ such that static (across-goods) correlation is allowed, *i.e.*, $cov(\varepsilon_{z',t}, \varepsilon_{z'',t}) \neq 0$ for all $z', z'' \in \mathbb{Z}$, but serial correlation is prevented, *i.e.*, $cov(\varepsilon_{z',t'}, \varepsilon_{z'',t''}) = 0$ for all $z', z'' \in \mathbb{Z}$ and $t' \neq t''$.

[23] Shocks to the quality levels therefore influence the budget shares spent on the different consumption goods. In this respect, the model relates to preferences representations with a bidimensional commodity space, where individuals optimally make the choice of which good to consume among those with an infinite degree of substitutability (vertically differentiated), along with the choice of how much to consume of the horizontally differentiated goods (see Merella, 2006; and Jaimovich and Merella, 2012). For tractability, here we simplify the framework by assuming away that households may choose among different qualities of the same good, and letting the relevant quality

unit of good z, and by S_t the resources allocated to consumption at date t, the static budget constraint reads:

$$\int_{\mathbb{Z}} p_{z,t} x_{z,t} dz \leq S_t \tag{9}$$

Both the representative household and all firms solve the static problem after the current state of nature is realised. That is, all agents are aware of the realisations of all types of shocks. The representative household solves:

$$\begin{aligned} \max_{\{x_{z,t}\}_{z\in\mathbb{Z}}} \quad & C_t = \left[\int_{\mathbb{Z}} q_{z,t} \left(x_{z,t}\right)^{\alpha} dz \right]^{\frac{1}{\alpha}}, \\ \text{subject to:} \quad & \int_{\mathbb{Z}} p_{z,t} x_{z,t} dz = S_t. \end{aligned} \tag{10}$$

From the solution of problem (10), the following expression for the inverse demand for each good z obtains:[24]

$$p_{z,t} = q_{z,t} P_t \left(C_t\right)^{1-\alpha} \left(x_{z,t}\right)^{\alpha-1}. \tag{11}$$

The solution also implies that the maximised value of the consumption index (8) must equal nominal spending, deflated by a suitable price deflator:

$$C_t = \frac{S_t}{P_t}, \tag{12}$$

where $P_t = \left(\int_{\mathbb{Z}} \left(q_{z,t}\right)^{\frac{1}{1-\alpha}} \left(p_{z,t}\right)^{-\frac{\alpha}{1-\alpha}} dz \right)^{-\frac{1-\alpha}{\alpha}}$ represents the price index that must be used to convert nominal variables in terms of the *numeraire* C_t.

Each firm $z \in \mathbb{Z}$ maximises profits by appropriately setting the optimal amount of labour to hire, taking household demand (11) as given. The production technology is given by (7). The z-th firm problem can be formally stated as follows:

$$\pi_{z,t} = \max_{l_{z,t}} q_{z,t} P_t \left(C_t\right)^{1-\alpha} \left(\phi_{z,t}\right)^{\alpha} \left(l_{z,t}\right)^{\alpha\zeta} - w_t^n l_{z,t}, \tag{13}$$

where w_t^n is the (nominal) wage spent to hire one unit of labour services. From the solution of problem (13), considering the goods market clearing condition $x_{z,t} = y_{z,t}$, the following equilibrium allocation obtains:[25]

$$x_{z,t} = \left(\Psi_t\right)^{-\zeta} \left(q_{z,t}\right)^{\frac{\zeta}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{1}{1-\alpha\zeta}}, \tag{14}$$

where $\Psi_t \equiv \int_{\mathbb{Z}} \left(q_{z,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz$. It is easy to notice that the response of the equilibrium

levels be determined exclusively by exogenous supply-side factors.

[24] For the complete derivation of (11) and (12), see Appendix B.

[25] For the complete derivation of (14) and (15) below, see Appendix B.

allocation to technology shocks is positive: that is, a rise in the quality of the good reinforces the effect of an increase in productivity, implying a greater quantity exchanged.

Consumption and the state variable

Using (14) into (8), the consumption bundle can be rewritten as:

$$C_t = \left[\int_{\mathbb{Z}} \left(q_{z,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz \right]^{\frac{1-\alpha\zeta}{\alpha}} \tag{15}$$

In this form, the value of the consumption bundle captures all effects arising from technology shocks hitting firm-specific productivities $\left\{\phi_{z,t}\right\}_{z\in\mathbb{Z}}$ in (7) and good-specific quality levels $\{q_{z,t}\}_{z\in\mathbb{Z}}$ in (8). Once again, the relationship between the consumption bundle and each type of shock is positive. The value of the bundle is therefore the higher the greater the shocks to quality (and productivity).

To compare the value of the consumption bundle in our model, where technology shocks affect the quality levels of the consumed goods, with the one in the benchmark model, where shocks only influence firm productivities, we construct a baseline consumption index, denoted by X_t, by replacing the realised quality levels in (8) with their mean values, *i.e.*, $q_{z,t} = 1$, for all $z \in \mathbb{Z}$:

$$X_t = \left[\int_{\mathbb{Z}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz \right]^{\frac{1-\alpha\zeta}{\alpha}} . \tag{16}$$

The original consumption bundle C_t can be then written as:

$$C_t = \Theta_t X_t, \tag{17}$$

where, using (8) and (16), and rearranging, Θ_t is formally given by:

$$\Theta_t = \left[\frac{\int_{\mathbb{Z}} \left(q_{z,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz}{\int_{\mathbb{Z}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz} \right]^{\frac{1-\alpha\zeta}{\alpha}} . \tag{18}$$

In the light of its structure, (18) can be defined as the weighted *average quality* of the consumption bundle, with realised productivities as weights. Hence, average quality Θ_t accounts for the deviations from the mean values of the quality levels in conjunction with those to technology, net of the aggregate effect of sole productivity shocks, which is captured by the consumption bundle (16).

The interaction between quality levels and productivities affects the average quality by magnifying (if $\phi_{z,t} > 1$) or reducing (if $\phi_{z,t} < 1$), for each good z, the role of each realised quality level $q_{z,t}$. In particular, since the deviations of quality levels and productivities always "match", then the larger the fraction of firms hit by a positive shock, the higher the value of the average quality of the consumption bundle. In fact, *ceteris paribus*, a positive technology shock increases the value of $\phi_{z,t}$, (infinitesimally) raising both the numerator and the denominator of (18). The relative magnitude of these increments depends on the deviation of the quality level from its mean: since the sign of this deviation is the same as for productivity, then the numerator rises more than the denominator, and the resulting value of average quality is higher; the opposite naturally occurs when the shock is negative. As a result, the larger the fraction of sectors where shocks are positive, the greater the corresponding value of Θ_t, and the higher the value of the consumption index C_t relative to the consumption index X_t.

In order to get an immediate grasp on the relationship between the technology shocks and the average quality of consumption, consider for a moment the case of full symmetry, in which firms have identical production functions, are hit by a common shock, and produce goods whose quality has identical responses to the common shock. Formally, this amount to assume that $\bar{\phi}_z = \bar{\phi}$, $\varepsilon_{z,t} = \varepsilon_t$, and $\eta_z = \eta$, for all $z \in \mathbb{Z}$. Under this conditions, using the definitions of $\phi_{z,t}$ and $q_{z,t}$, and recalling that by definition $\bar{q}_z = 1$ for all z, the function capturing the average quality of consumption simplifies to $\Theta_t = e^{(\eta/\alpha)\varepsilon_t}$, from which it straightforwardly follows that $\Theta_t \lesseqgtr 1$ whenever $\varepsilon_t \lesseqgtr 0$. Interpreting ε_t as the prevailing technology shock in the economy, this result implies a positive link between the overall state of the economy and the average quality of consumption. In other words: (i) the utility of any given level of consumption, measured by $(\Theta_t X_t)^{1-\gamma}$, tends to be magnified by Θ_t in good times, and reduced in bad times; (ii) the marginal utility of consumption, measured by $(1-\gamma)(\Theta_t X_t)^{-\gamma}$, has the opposite response, decreasing in good times and increasing in bad times.

State variable and consumer confidence

From a theoretical perspective, questions 1 and 2 may be translated into algebra, using the equilibrium conditions just found, to obtain a formal representation of the CCP component. As we discussed above, shocks to technology influence the performance of the economy by enhancing or reducing the ability of firms to generate profits and labour demand. In this mechanism, the relative quality of the differentiated goods also play a role, assigning more or less weight to the realised productivity shocks in the different sectors.

The aggregate performance of the economy can be then assessed as follows. First, we compute aggregate profits Π_t/P_t and wages w_t in real terms, as predicted by the model presented in the previous section. Then, we compare these figures with those that would obtain by adopting a model abstracting from technology shocks, *i.e.*, $\bar{\Pi}/\bar{P}$ and $\bar{w}$ respectively. Notice that both asset and labour supplies are assumed to be fixed, and labour is inelastically supplied. As a result, prices rather than allocations in these markets must be used to assess the economic performance.

Formally, the CCP indicator at date t is thus computed as follows:[26]

$$
\begin{aligned}
CCP_t &= \psi \frac{w_t}{\bar{w}} + (1-\psi) \frac{\Pi_t}{P_t} / \frac{\bar{\Pi}}{\bar{P}} \\
&= \left[\frac{\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha\gamma}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\gamma}} dz}{\int_{\mathbb{Z}} \left(\bar{\phi}_z\right)^{\frac{\alpha}{1-\alpha\gamma}} dz} \right]^{\frac{1-\alpha\gamma}{\alpha}}
\end{aligned}
\tag{19}
$$

where ψ is the relative weight attached to real wages (if we followed the equal weight attached to each question of the index, then we would simply have $\psi = 0.5$).

Although the denominator presents the mean values $\{\bar{\phi}_z\}_{z\in\mathbb{Z}}$ rather than the effective realisations $\{\phi_z\}_{z\in\mathbb{Z}}$, the effects of sectoral shocks on (19) are qualitatively analogous to those on the average quality of consumption (18). Compared to the hypothetical state of nature where aggregation weights are deterministic, every variation in quality emphasizes (if the realised technology shock is positive) or dampens (if negative) the corresponding effect of productivity. A larger fraction of sectors where shocks are positive thus implies a value of CCP_t greater than one, whereas $CCP_t < 1$ otherwise.

6 Concluding remarks

This paper has proposed a state variable augmented specification of an otherwise standard asset pricing model. An alternative version of the stochastic discount factor has been derived, which crucially depends on the variations in the state variable. We have shown that the state variable can be proxied by consumer confidence indicators. The model has predicted that consumption growth is inversely related to variations in consumer confidence. This prediction, which is in line with the existing empirical evidence, has been tested quantitatively by calibrating the relative risk aversion (RRA) coefficient to assess whether our setting reduces the empirical drawback known as the equity premium puzzle. We have found that the model eliminates the puzzle. Our results are robust to the estimation of the RRA coefficient using the GMM methodology, to the use of different data frequencies, of various indicators of confidence, and to a number of instrument specifications.

One of the most attractive feature of this paper is perhaps the innovative representation of sectoral shocks presented here, which allows for an intuitive connection between the state variable and observed indicators of confidence. There exists substantial evidence that consumption growth and individuals' confidence are positively correlated. Observing the data suggests that there is evidence of high (low) growth rates of consumption when confidence takes larger

[26] For the complete derivation of (19), see Appendix B. Should the same argument to be applied to computing the expectations component (CCE), then all values would be taken in expectations, hence CCE would identically equal one.

(smaller) values. This fact is in line with the predictions of our intertemporal Euler equation. In conclusion, the model appears to provide a sensible theoretical explanation to the empirical evidence relating individual's confidence to consumption growth.

The "preference shock" augmented setting can be easily exploited to address other asset pricing issues, such as the evaluation of options and other derivatives, or investment. Some of these issues are already the subject of ongoing research. Another field to which our framework straightforwardly relates, notably for the fact that the state variable can also be seen as the result a price index decomposition, is monetary economics. In the light of the result of our model presented here, it is arguably sensible to conjecture that individuals' confidence may alter the transmission mechanism of monetary policy, as predicted by using a standard sticky-price model.

The flexibility of the framework presented here allows it to be used in virtually every study involving the derivation of a Euler equation, although only short-medium term models should be considered. In the short-medium run, in fact, it is reasonable to consider that a fairly stable state of nature characterizes each date. Longer time intervals, viewed as aggregations of short periods, comprise several realised state. The successive states of nature that obtain in that interval, by generating different sets of idiosyncratic shocks that typically end up offsetting one another, dampen the effects of these shocks on individuals' demand and firms' pricing, and thereof on the equilibrium. If the number of consecutive states that obtain is large enough, then such effects eventually die away, possibly making long-term preference shock augmented studies economically insignificant.

Appendices

A Exact log-linear Euler equation

Define $r^h_{t+1} = \ln(1 + r_{j,t+1})$, $h = \{a, b\}$ and $j = \{A, B\}$, $x_{t+1} = \ln(X_{t+1}/X_t)$ and $\vartheta_{t+1} = \ln(\Theta_{t+1}/\Theta_t)$. Assume that the vector of the log of the stochastic variables in (4) has a joint multinormal distribution:

$$z = \begin{bmatrix} r^a \\ x \\ \vartheta \end{bmatrix} \sim N\left(\mu = \begin{bmatrix} \mu_r \\ \mu_x \\ \mu_\vartheta \end{bmatrix}, \Sigma = \begin{bmatrix} \sigma_r^2 & \sigma_{rx} & \sigma_{r\vartheta} \\ \sigma_{rx} & \sigma_x^2 & \sigma_{x\vartheta} \\ \sigma_{r\vartheta} & \sigma_{x\vartheta} & \sigma_\vartheta^2 \end{bmatrix}\right)$$

where $\{\mu_i, \sigma_i^2\}_{i=\{r,x,\vartheta\}}$ are respectively mean and variance of variables $\{r^a, x, \vartheta\}$, and $\{\sigma_{ii'}\}_{i,i'=\{r,x,\vartheta\},\ i'\neq i}$ measure the covariances among these variables. Defining the vectors of the exponents in (4), suitably ordered, as $\tau_a' = \begin{bmatrix} 1 & -\gamma & 1-\gamma \end{bmatrix}$ and $\tau_b' = \begin{bmatrix} 0 & -\gamma & 1-\gamma \end{bmatrix}$, the Euler equation (4) becomes:

$$E_t\left[\exp\left(\tau_a' z_{t+1}\right)\right] = \exp\left(r^b_{t+1}\right) E_t\left[\exp\left(\tau_b' z_{t+1}\right)\right]$$

Recalling that the moment generating function for the Gaussian distribution is given by $M(\tau) = E_t\left[\exp\left(\tau' z\right)\right] = \exp\left(\mu'\tau + \tau'\Sigma\tau/2\right)$, and that the relevant moments are given by $\mu'\tau = \sum_i \tau_i \mu_i$ and $\tau'\Sigma\tau = \sum_i \tau_i^2\sigma_i^2 + 2\sum_{i'\neq i} \tau_i\tau_{i'}\sigma_{ii'}$, after some algebra we obtain:

$$\exp\left(r^b_{t+1}\right) = \exp\left(\mu_r + \sigma_r^2/2\right)\exp\left[-\gamma\sigma_{rx} + (1-\gamma)\,\sigma_{r\vartheta}\right]$$

Considering that $E_t\left[\exp\left(r^a_{t+1}\right)\right] = \exp\left(\mu_r + \sigma_r^2/2\right)$, taking logarithms of both sides, using the definition of correlation coefficient, i.e. $\rho_{ii'} = \sigma_{ii'}/\left(\sigma_{ii}\sigma_{i'i'}\right)^{1/2}$, $i, i' = \{r, x, \vartheta\}$ and $i' \neq i$; and rearranging, we get (5).

B Auxiliary derivations

Derivation of Equation (4).

Replace (2) into (1) to obtain:

$$U = \max_{\{j_{t+1}\}_{j=\{A,B\},\ t\in\mathbb{N}}} E_0\left\{\sum\nolimits_{t\in\mathbb{N}} \frac{\delta^t\left(\Theta_t\right)^{1-\gamma}\left[w_t + \sum_{j=\{A,B\}}\left(1 + r_{j,t}\right) j_t - j_{t+1}\right]^{1-\gamma}}{1-\gamma}\right\}.$$

The first-order condition for the solution consists of the set of simultaneous equations:

$$\begin{aligned}
\frac{\partial U}{\partial A_{t+1}} &= E_0\left\{-\left(\Theta_t\right)^{1-\gamma}\left(X_t\right)^{-\gamma} + \delta\left(1 + r_{A,t+1}\right)\left(\Theta_{t+1}\right)^{1-\gamma}\left(X_{t+1}\right)^{-\gamma}\right\} = 0,\ \forall t \in \mathbb{N}; \\
\frac{\partial U}{\partial B_{t+1}} &= E_0\left\{-\left(\Theta_t\right)^{1-\gamma}\left(X_t\right)^{-\gamma} + \delta\left(1 + r_{B,t+1}\right)\left(\Theta_{t+1}\right)^{1-\gamma}\left(X_{t+1}\right)^{-\gamma}\right\} = 0,\ \forall t \in \mathbb{N}.
\end{aligned}$$

Dividing both equations by $(\Theta_t)^{1-\gamma} (X_t)^{-\gamma}$, taking constants out of expectations, and rearranging:

$$\delta E_0 \left\{ (1 + r_{A,t+1}) \left(\frac{\Theta_{t+1}}{\Theta_t} \right)^{1-\gamma} \left(\frac{X_{t+1}}{X_t} \right)^{-\gamma} \right\} = 1; \tag{20}$$

$$\delta E_0 \left\{ (1 + r_{B,t+1}) \left(\frac{\Theta_{t+1}}{\Theta_t} \right)^{1-\gamma} \left(\frac{X_{t+1}}{X_t} \right)^{-\gamma} \right\} = 1. \tag{21}$$

Equating the left-hand sides of (20) and (21), simplifying and rearranging, (4) obtains. ■

Derivation of Equation (11).

The representative household chooses, by appropriately setting the quantity $x_{z,t}$ of consumption for each good $z \in \mathbb{Z}$, the optimal composition of the commodity bundle C_t, taking the resources S_t devoted to consumption as given. Since utility (8) is a monotonic function of consumption, the static budget constraint (9) holds with equality. The Lagrangian therefore reads:

$$\mathcal{L}_t = \max_{\{x_{z,t}\}_{z\in\mathbb{Z}}} \left[\int_{\mathbb{Z}} q_{z,t} (x_{z,t})^{\alpha} dz \right]^{\frac{1}{\alpha}} + \lambda_t \left(S_t - \int_{\mathbb{Z}} p_{z,t} x_{z,t} dz \right),$$

where λ_t is the Lagrange multiplier associated to $\mathcal{L}_t$. The first-order condition for the solution consists of the set of simultaneous equations:

$$\frac{\partial \mathcal{L}_t}{\partial \lambda_t} = S_t - \int_{\mathbb{Z}} p_{z,t} x_{z,t} dz = 0;$$

$$\frac{\partial \mathcal{L}_t}{\partial x_{z,t}} = \left[\int_{\mathbb{Z}} q_{v,t} (x_{v,t})^{\alpha} dv \right]^{\frac{1}{\alpha}-1} q_{z,t} (x_{z,t})^{\alpha-1} - \lambda_t p_{z,t} = 0, \ \forall z \in \mathbb{Z}. \tag{22}$$

Consider the first-order condition (22) for a generic commodity z. Raising both sides to the power $-\alpha (1-\alpha)^{-1}$, integrating across varieties, and rearranging:

$$\left[\int_{\mathbb{Z}} q_{v,t} (x_{v,t})^{\alpha} dv \right]^{-1} \int_{\mathbb{Z}} q_{z,t} (x_{z,t})^{\alpha} dz = (\lambda_t)^{-\frac{\alpha}{1-\alpha}} \int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha}} (p_{z,t})^{-\frac{\alpha}{1-\alpha}} dz.$$

After some basic algebra, defining the Lagrange multiplier λ_t as the reciprocal of the price deflator yields:

$$P_t = \left(\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha}} (p_{z,t})^{-\frac{\alpha}{1-\alpha}} dz \right)^{-\frac{1-\alpha}{\alpha}} \tag{23}$$

Raise both sides of the first order condition (22) to the power $(1-\alpha)^{-1}$ and rearrange to get:

$$x_{z,t} = (q_{z,t})^{\frac{1}{1-\alpha}} (\lambda_t p_{z,t})^{-\frac{1}{1-\alpha}} \left[\int_{\mathbb{Z}} q_{v,t} (x_{v,t})^{\alpha} dv \right]^{\frac{1}{\alpha}}$$

Using (8), and (23), after some basic algebra, the demand for each commodity $z \in \mathbb{Z}$ can be expressed by:

$$x_{z,t} = (q_{z,t})^{\frac{1}{1-\alpha}} \left(\frac{p_{z,t}}{P_t} \right)^{-\frac{1}{1-\alpha}} C_t. \tag{24}$$

Inverting (24) to isolate $p_{z,t}$, (11) obtains. ■

Derivation of Equation (12).

Multiply both sides of the first-order condition (22) for $x_{z,t}$, integrate across varieties, and rearrange to have:

$$\left[\int_{\mathbb{Z}} q_{v,t}\left(x_{v,t}\right)^{\alpha} dv\right]^{\frac{1}{\alpha}} = \lambda_t \int_{\mathbb{Z}} p_{z,t} x_{z,t} dz$$

Using (8) and (11), (12) obtains. ■

Derivation of Equation (14).

Disregarding the effect of each atomless firm's decision on economy's aggregates, differentiating (13) with respect of $l_{z,t}$ and equating the resulting expression to zero yields:

$$\alpha\zeta q_{z,t} P_t \left(C_t\right)^{1-\alpha} \left(\phi_{z,t}\right)^{\alpha} \left(l_{z,t}\right)^{\alpha\zeta-1} - w_t^n = 0.$$

the first order condition for the solution of problem (13) thus reads:

$$w_t^n = \alpha\zeta q_{z,t} \left(\phi_{z,t}\right)^{\alpha} P_t \left(C_t\right)^{1-\alpha} \left(l_{z,t}\right)^{\alpha\zeta-1}. \tag{25}$$

Isolating $l_{z,t}$:

$$l_{z,t} = \left(q_{z,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} \left[\alpha\zeta P_t \left(C_t\right)^{1-\alpha}\right]^{\frac{1}{1-\alpha\zeta}} \left(w_t^n\right)^{-\frac{1}{1-\alpha\zeta}}, \tag{26}$$

integrating across varieties:

$$\int_{\mathbb{Z}} l_{z,t} dz = \left[\int_{\mathbb{Z}} \left(q_{z,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz\right] \left[\alpha\zeta P_t \left(C_t\right)^{1-\alpha}\right]^{\frac{1}{1-\alpha\zeta}} \left(w_t^n\right)^{-\frac{1}{1-\alpha\zeta}} = 1,$$

and isolating w_t yields:

$$w_t^n = \alpha\zeta \left(\Psi_t\right)^{1-\alpha\zeta} P_t \left(C_t\right)^{1-\alpha}, \tag{27}$$

where $\Psi_t \equiv \int_{\mathbb{Z}} \left(\theta_z\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz$. Nesting (27) back in (26), after some algebra:

$$\begin{aligned} l_{z,t}^* &= \left(q_{z,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} \left[\alpha\zeta P_t \left(C_t\right)^{1-\alpha}\right]^{\frac{1}{1-\alpha\zeta}} \left(\alpha\zeta \left(\Psi_t\right)^{1-\alpha\zeta} P_t \left(X_t^x\right)^{1-\alpha}\right)^{-\frac{1}{1-\alpha\zeta}} \\ &= \left(q_{z,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} \left(\Psi_t\right)^{-1} \end{aligned}$$

gives *labour services* employed by firm z:

$$l_{z,t}^* = \frac{\left(q_{z,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}}}{\int_{\mathbb{Z}} \left(q_{v,t}\right)^{\frac{1}{1-\alpha\zeta}} \left(\phi_{v,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dv} \tag{28}$$

Replacing (28) in (7), and considering the market clearing condition $x_{z,t}^* = y_{z,t}^*$, the equilibrium allocation (14) obtains. ■

Derivation of Equation (15).

Raising both sides of (14) to the power α and multiplying by $q_{z,t}$:

$$q_{z,t}\left(x^*_{z,t}\right)^{\alpha} = (\Psi_t)^{-\alpha\zeta}\,(q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}}$$

Integrating across varieties, raising both sides to the power $1/\alpha$, using (8) and the definition of Ψ_t:

$$\begin{aligned} C^*_t &= \left[\int_{\mathbb{Z}} q_{z,t}\left(x^*_{z,t}\right)^{\alpha} dz\right]^{\frac{1}{\alpha}} = \left[(\Psi_t)^{-\alpha\zeta}\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz\right]^{\frac{1}{\alpha}} \\ &= \left[(\Psi_t)^{-\alpha\zeta}\,\Psi_t\right]^{\frac{1}{\alpha}} \end{aligned}$$

we obtain the equilibrium value of aggregate consumption (15). ■

Derivation of Equation (19).

From (27), using (15), the equilibrium wage obtains:

$$\begin{aligned} w^n_t &= \alpha\zeta\,(C^*_t)^{\alpha} P_t\,(C^*_t)^{1-\alpha} = \alpha\zeta P_t C^*_t \\ &= \alpha\zeta P_t\left[\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz\right]^{\frac{1-\alpha\zeta}{\alpha}} \end{aligned} \tag{29}$$

Hence wages in real terms are:

$$w_t \equiv \frac{w^n_t}{P_t} = \alpha\zeta\left[\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz\right]^{\frac{1-\alpha\zeta}{\alpha}} \tag{30}$$

From (11), using (14) and the definition of Ψ_t, the equilibrium price obtains:

$$\begin{aligned} p_{z,t} &= (q_{z,t})^{\frac{1-\zeta}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{-\frac{1-\alpha}{1-\alpha\zeta}} P_t\,(C^*_t)^{\frac{1-\alpha}{1-\alpha\zeta}} \\ &= (q_{z,t})^{\frac{1-\zeta}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{-\frac{1-\alpha}{1-\alpha\zeta}}\left[\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz\right]^{\frac{1-\alpha}{\alpha}} P_t. \end{aligned} \tag{31}$$

From the definition of profits, i.e. $\pi_{z,t} = p_{z,t}x_{z,t} - w^n_t l_{z,t}$, using (14), (28), (29) and (31), after some algebra:

$$\begin{aligned} \pi_{z,t} &= (q_{z,t})^{\frac{1-\zeta}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{-\frac{1-\alpha}{1-\alpha\zeta}} P_t\,(C^*_t)^{\frac{1-\alpha}{1-\alpha\zeta}}\,(q_{z,t})^{\frac{\zeta}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{1}{1-\alpha\zeta}}\,(C^*_t)^{-\frac{\alpha\zeta}{1-\alpha\zeta}} - \\ &\quad -\alpha\zeta\,(C^*_t)^{\alpha} P_t\,(C^*_t)^{1-\alpha}\,\alpha\zeta P_t C^*_t\,(q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}}\,(C^*_t)^{-\frac{\alpha}{1-\alpha\zeta}} \\ &= (q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} P_t\,(C^*_t)^{\frac{1-\alpha\zeta-a}{1-\alpha\zeta}} - \alpha\zeta\,(q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} P_t\,(C^*_t)^{\frac{1-\alpha\zeta-a}{1-\alpha\zeta}} \end{aligned}$$

profits are:

$$\begin{aligned} \pi_{z,t} &= (1-\alpha\zeta)\,(q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} P_t\,(C^*_t)^{\frac{1-\alpha\zeta-a}{1-\alpha\zeta}} \\ &= (1-\alpha\zeta)\,(q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}}\left[\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha\zeta}}\left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz\right]^{\frac{1-\alpha\zeta-a}{\alpha}} P_t \end{aligned} \tag{32}$$

Integrating across varieties, and rearranging:

$$\frac{\Pi_t}{P_t} = \frac{1}{P_t}\int_{\mathbb{Z}} \pi_{z,t} dz = (1-\alpha\zeta)\left[\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz\right]^{1+\frac{1-\alpha\zeta-a}{\alpha}}$$

aggregate profits in real terms obtain:

$$\frac{\Pi_t}{P_t} = (1-\alpha\zeta)\left[\int_{\mathbb{Z}} (q_{z,t})^{\frac{1}{1-\alpha\zeta}} \left(\phi_{z,t}\right)^{\frac{\alpha}{1-\alpha\zeta}} dz\right]^{\frac{1-\alpha\zeta}{\alpha}} \tag{33}$$

Using (30) and (33) as a base to compute $\bar{w}$ and $\bar{\Pi}/\bar{P}$, and then into the expression $CS_t = \psi\left(w_t/\bar{w}\right) + (1-\psi)\left(\Pi_t/P_t\right)/\left(\bar{\Pi}/\bar{P}\right)$, (19) obtains. ■

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Table 1. Monthly forecast of Consumer Confidence Present situation component.

Dependent Variable: Current CCP

Regressor	Coefficient
Lagged CCP	0.976*** (0.000)
Lagged CCE	0.027*** (0.001)
R-squared	0.98
Observations	427

Source. Authors' calculations based on the dataset described in Section 4.

Table 2. Quarterly forecast of Consumer Confidence Present situation component.

Dependent Variable: Current CCP

Regressor	Coefficient
Lagged CCP	0.915*** (0.021)
Lagged CCE	0.090*** (0.023)
R-squared	0.94
Observations	183

Source. Authors' calculations based on the dataset described in Section 4.

Table 3. Yearly forecast of Consumer Confidence Present situation component.

Dependent Variable: Current CCP

Regressor	Coefficient
Lagged CCP	0.565*** (0.107)
Lagged CCE	0.447*** (0.121)
R-squared	0.63
Observations	45

Source. Authors' calculations based on the dataset described in Section 4.

Notes. Stardard errors are reported in parenthesis. Triple asterisks (***) denotes rejection of the null hypothesis (coeff = 0) at 1% significance level.

Table 4. Descriptive statistics.

monthly data					
	consumption growth factor	excess return factor	consumer confidence variation factor	present situation variation factor	consumer sentiment variation factor
mean	1.002	1.004	1.002	1.003	1.001
std.dev	0.006	0.037	0.085	0.088	0.051

quarterly data					
	consumption growth factor	excess return factor	consumer confidence variation factor	present situation variation factor	consumer sentiment variation factor
mean	1.007	1.012	1.004	1.008	1.002
std.dev	0.008	0.078	0.126	0.163	0.071

yearly data					
	consumption growth factor	excess return factor	consumer confidence variation factor	present situation variation factor	consumer sentiment variation factor
mean	1.026	1.050	1.002	1.061	1.001
std.dev	0.021	0.167	0.187	0.423	0.106

Source. Authors' calculations based on the dataset (common sample: 419 monthly, 183 quartely, and 45 yearly observations) described in Section 4.

Table 5. Correlations spreadsheet.

monthly data

	excess return factor	consumer confidence variation factor	present situation variation factor	consumer sentiment variation factor
consumption growth factor	0.191	0.240	0.213	0.128
excess return factor		0.380	0.220	0.352
consumer confidence variation factor			0.715	0.553
present situation variation factor				0.300

quarterly data

	excess return factor	consumer confidence variation factor	present situation variation factor	consumer sentiment variation factor
consumption growth factor	0.168	0.324	0.368	0.314
excess return factor		0.307	0.091	0.327
consumer confidence variation factor			0.683	0.771
present situation variation factor				0.462

yearly data

	excess return factor	consumer confidence variation factor	present situation variation factor	consumer sentiment variation factor
consumption growth factor	0.172	0.687	0.655	0.495
excess return factor		0.299	0.070	0.494
consumer confidence variation factor			0.850	0.776
present situation variation factor				0.502

Source. Authors' calculations based on the dataset (common sample: 419 monthly, 183 quartely, and 45 yearly observations) described in Section 4.

Table 6. Calibration of eq. (6).

Coefficient	Frequency		
	Monthly	Quarterly	Yearly
γ	**95**	**113**	**84**

Source. Authors' calculations based on the dataset (common sample) described in Section 4.

Table 7. Calibration of eq. (5) using CC to proxy the state variable Θ.

Coefficient	Frequency		
	Monthly	Quarterly	Yearly
γ	**4.2**	**4.8**	**6**

Source. Authors' calculations based on the dataset (common sample) described in Section 4.

Table 8. Calibration of eq. (5) using CCP to proxy the state variable Θ.

Coefficient	Frequency		
	Monthly	Quarterly	Yearly
γ	**6.2**	**10.5**	**9.9**

Source. Authors' calculations based on the dataset (common sample) described in Section 4.

Table 9. Calibration of eq. (5) using CS to proxy the state variable Θ.

Coefficient	Frequency		
	Monthly	Quarterly	Yearly
γ	**6.6**	**7.2**	**6.3**

Source. Authors' calculations based on the dataset (common sample) described in Section 4.

Notes. The first column reports the result obtained by calibrating the model using monthly data (419 observations). The second and the third column report those obtained using quarterly (183) and yearly data (45), respectively.

Table 10. GMM estimations of eq. (4) with the state variable Θ = 1 in all periods, using monthly data.

instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit
N	N	**116.82**	NA	NA	NA	4	N	**121.21**	0.00	0.983	!	6	N	**106.74**	0.03	0.855		4,6	N	**126.14**	0.06	0.971	!
N	2	**74.48**	0.77	0.381	°°	4	2	**81.50**	1.82	0.403	°°	6	2	**74.53**	0.77	0.681	°	4,6	2	**83.19**	2.08	0.555	°
N	3	**80.96**	0.27	0.607	°	4	3	**84.60**	0.92	0.630	°	6	3	**80.706**	0.27	0.874		4,6	3	**83.143**	1.31	0.727	
N	2,3	**75.65**	0.89	0.640	°	4	2,3	**76.56**	2.02	0.568	°	6	2,3	**74.58**	0.83	0.843		4,6	2,3	**75.053**	2.34	0.673	°
1	1	**76.30**	23.62	0.000	***	1,2	1,2	**98.38**	21.77	0.000	***	1-4	1-4	**99.424**	24.32	0.002	***	1-6	1-6	**55.725**	42.90	0.000	***

Source. Authors' calculations based on the dataset described in Section 4 (641 to 647 observations, depending on lags length).

Table 11. GMM estimations of eq. (4) with the state variable Θ = 1 in all periods, using quarterly data.

instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit
N	N	**48.667**	NA	NA	NA	6	N	**56.11**	2.58	0.108	°°°	8	N	**64.55**	2.53	0.112	°°°	6,8	N	**67.32**	2.52	0.284	°°°
N	1	**71.376**	2.67	0.102	°°°	6	1	**72.11**	2.65	0.265	°°°	8	1	**74.46**	2.60	0.273	°°°	6,8	1	**74.66**	2.60	0.458	°°
N	5	**49.22**	2.65	0.103	°°°	6	5	**55.82**	2.60	0.273	°°°	8	5	**61.60**	2.55	0.280	°°°	6,8	5	**64.41**	2.53	0.470	°°
N	1,5	**71.37**	2.68	0.262	°°°	6	1,5	**72.39**	2.66	0.447	°°	8	1,5	**72.72**	2.65	0.450	°°	6,8	1,5	**73.20**	2.64	0.620	°
1	1	**91.54**	4.06	0.131	°°°	1,2	1,2	**98.98**	5.45	0.245	°°°	1-3	1-3	**85.11**	5.61	0.469	°°	1-4	1-4	**78.26**	11.12	0.195	°°°

Source. Authors' calculations based on the dataset described in Section 4 (209 to 214 observations, depending on lags length).

Table 12. GMM estimations of eq. (4) with the state variable Θ = 1 in all periods, using yearly data.

instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit	instr (lags) EP	GCE	γ	J-stat	p-val	fit
N	N	**46.33**	NA	NA	NA	1	N	**48.92**	0.69	0.405	°°	2	N	**42.45**	1.91	0.167	°°°	1,2	N	**46.76**	2.01	0.366	°°
N	2	**48.48**	2.25	0.133	°°°	1	2	**47.61**	2.19	0.334	°°	2	2	**44.60**	3.08	0.214	°°°	1,2	2	**44.55**	3.08	0.380	°°
N	3	**37.80**	0.87	0.351	°°	1	3	**37.61**	0.87	0.646	°	2	3	**44.48**	2.46	0.293	°°°	1,2	3	**44.11**	2.50	0.475	°°
N	2,3	**38.94**	3.40	0.182	°°°	1	2,3	**46.62**	3.23	0.358	°°	2	2,3	**40.93**	3.45	0.327	°°	1,2	2,3	**40.57**	3.53	0.473	°°
1	1	**26.36**	4.34	0.114	°°°	1,2	1,2	**74.45**	5.13	0.274	°°°	1,2	1-3	**34.33**	3.94	0.558	°	1-3	1-3	**161.31**	12.39	0.054	*

Source. Authors' calculations based on the dataset described in Section 4 (49 to 52 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 13. GMM estimations of eq. (4) using CC to proxy the state variable Θ, using monthly data.

instr (lags)							instr (lags)							instr (lags)							instr (lags)						
EP	GCE	GCC	γ	J-stat	p-val	fit	EP	GCE	GCC	γ	J-stat	p-val	fit	EP	GCE	GCC	γ	J-stat	p-val	fit	EP	GCE	GCC	γ	J-stat	p-val	fit
N	N	N	**3.60**	NA	NA	NA	N	2	N	**3.58**	0.01	0.911	!	N	3	N	**3.56**	0.33	0.566	°	N	2,3	N	**3.57**	0.26	0.879	
N	N	1	**3.77**	0.08	0.777		N	2	1	**3.76**	0.12	0.942	!	N	3	1	**3.81**	0.34	0.845		N	2,3	1	**3.82**	0.41	0.939	!
N	N	2	**3.82**	0.05	0.829		N	2	2	**3.70**	0.04	0.979	!	N	3	2	**3.63**	0.33	0.846		N	2,3	2	**3.52**	0.29	0.961	!
N	N	1,2	**4.08**	0.09	0.954	!	N	2	1,2	**4.02**	0.21	0.976	!	N	3	1,2	**3.90**	0.34	0.953	!	N	2,3	1,2	**3.88**	0.41	0.981	!
2	N	N	**3.55**	0.43	0.512	°	2	2	N	**3.44**	0.57	0.751		2	3	N	**3.53**	0.69	0.709		2	2,3	N	**3.48**	0.79	0.852	
2	N	1	**3.65**	0.44	0.801		2	2	1	**3.63**	0.51	0.916	!	2	3	1	**3.65**	0.70	0.873		2	2,3	1	**3.64**	0.83	0.935	!
2	N	2	**3.67**	0.95	0.621	°	2	2	2	**3.71**	0.74	0.864		2	3	2	**3.64**	0.80	0.850		2	2,3	2	**3.58**	0.90	0.924	!
2	N	1,2	**4.05**	0.67	0.880		2	2	1,2	**4.04**	0.77	0.943	!	2	3	1,2	**3.94**	0.79	0.939	!	2	2,3	1,2	**3.92**	0.91	0.969	!
6	N	N	**3.62**	0.01	0.925	!	6	2	N	**3.61**	0.02	0.989	!	6	3	N	**3.60**	0.24	0.889		6	2,3	N	**3.56**	0.26	0.967	!
6	N	1	**3.80**	0.09	0.956	!	6	2	1	**3.79**	0.13	0.988	!	6	3	1	**3.77**	0.34	0.953	!	6	2,3	1	**3.78**	0.41	0.982	!
6	N	2	**3.71**	0.03	0.985	!	6	2	2	**3.70**	0.05	0.997	!	6	3	2	**3.59**	0.25	0.969	!	6	2,3	2	**3.55**	0.30	0.990	!
6	N	1,2	**4.01**	0.16	0.984	!	6	2	1,2	**4.01**	0.21	0.995	!	6	3	1,2	**3.88**	0.33	0.988	!	6	2,3	1,2	**3.86**	0.41	0.995	!
2,6	N	N	**3.49**	0.52	0.771		2,6	2	N	**3.46**	0.58	0.901	!	2,6	3	N	**3.46**	0.74	0.864		2,6	2,3	N	**3.42**	0.84	0.933	!
2,6	N	1	**3.69**	0.47	0.926	!	2,6	2	1	**3.67**	0.54	0.969	!	2,6	3	1	**3.63**	0.69	0.953	!	2,6	2,3	1	**3.62**	0.82	0.976	!
2,6	N	2	**3.75**	0.67	0.879		2,6	2	2	**3.71**	0.74	0.946	!	2,6	3	2	**3.64**	0.80	0.938	!	2,6	2,3	2	**3.58**	0.90	0.970	!
2,6	N	1,2	**4.03**	0.67	0.955	!	2,6	2	1,2	**4.02**	0.77	0.979	!	2,6	3	1,2	**3.92**	0.79	0.978	!	2,6	2,3	1,2	**3.90**	0.91	0.989	!
1	1	1	**4.92**	11.17	0.011	**	1,2	1,2	1,2	**2.07**	21.57	0.001	***	1-4	1-4	1-4	**2.98**	23.97	0.021	**	1-6	1-6	1-6	**1.35**	37.15	0.005	***

Source. Authors' calculations based on the dataset described in Section 4 (420 to 426 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 14. GMM estimations of eq. (4) using CC to proxy the state variable Θ, using quarterly data.

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	N	N	**5.08**	NA	NA	NA	N	1	N	**6.48**	0.07	0.788	
N	N	1	**4.33**	0.27	0.600	°	N	1	1	**6.75**	0.75	0.687	°
N	N	4	**4.80**	0.00	0.988	!	N	1	4	**5.79**	0.06	0.969	!
N	N	1,4	**3.88**	0.36	0.836		N	1	1,4	**5.56**	0.93	0.818	
2	N	N	**3.76**	0.63	0.428	°°	2	1	N	**4.55**	1.22	0.543	°
2	N	1	**2.54**	1.94	0.380	°°	2	1	1	**2.91**	4.11	0.249	°°°
2	N	4	**3.73**	0.64	0.725		2	1	4	**4.74**	1.14	0.768	
2	N	1,4	**2.56**	1.94	0.585	°	2	1	1,4	**3.24**	3.88	0.422	°°
3	N	N	**3.17**	2.00	0.157	°°°	3	1	N	**3.74**	2.18	0.336	°°
3	N	1	**2.79**	2.15	0.341	°°	3	1	1	**4.76**	3.25	0.355	°°
3	N	4	**3.17**	2.29	0.318	°°	3	1	4	**4.77**	2.62	0.454	°°
3	N	1,4	**2.98**	2.32	0.509	°	3	1	1,4	**5.20**	3.33	0.504	°
2,3	N	N	**2.89**	2.08	0.354	°°	2,3	1	N	**3.61**	2.22	0.527	°
2,3	N	1	**2.25**	2.63	0.452	°°	2,3	1	1	**3.58**	4.07	0.397	°°
2,3	N	4	**3.00**	2.46	0.483	°°	2,3	1	4	**4.06**	2.96	0.564	°
2,3	N	1,4	**2.44**	2.86	0.581	°	2,3	1	1,4	**3.79**	4.20	0.522	°
1	1	1	**4.06**	6.02	0.111	°°°	1,2	1,2	1,2	**0.76**	9.36	0.154	°°°

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	4	N	**4.05**	0.71	0.401	°°	N	1,4	N	**5.54**	2.56	0.278	°°°
N	4	1	**3.79**	1.17	0.558	°	N	1,4	1	**5.31**	6.75	0.080	*
N	4	4	**3.68**	1.04	0.595	°	N	1,4	4	**6.06**	2.17	0.537	°
N	4	1,4	**3.38**	1.69	0.640	°	N	1,4	1,4	**6.16**	3.97	0.410	°°
2	4	N	**3.30**	1.64	0.439	°°	2	1,4	N	**4.40**	4.24	0.237	°°°
2	4	1	**2.71**	3.08	0.380	°°	2	1,4	1	**3.63**	9.36	0.053	*
2	4	4	**3.21**	1.71	0.635	°	2	1,4	4	**4.73**	3.74	0.442	°°
2	4	1,4	**2.53**	3.49	0.480	°°	2	1,4	1,4	**3.93**	7.89	0.162	°°°
3	4	N	**2.77**	3.78	0.151	°°°	3	1,4	N	**3.83**	4.59	0.204	°°°
3	4	1	**2.75**	4.19	0.241	°°°	3	1,4	1	**5.35**	6.08	0.193	°°°
3	4	4	**2.79**	3.71	0.295	°°°	3	1,4	4	**4.82**	4.66	0.324	°°
3	4	1,4	**2.75**	4.11	0.392	°°	3	1,4	1,4	**5.93**	5.18	0.395	°°
2,3	4	N	**2.62**	4.02	0.259	°°°	2,3	1,4	N	**3.87**	4.54	0.338	°°
2,3	4	1	**2.37**	5.31	0.257	°°°	2,3	1,4	1	**3.82**	8.47	0.132	°°°
2,3	4	4	**2.64**	3.99	0.407	°°	2,3	1,4	4	**4.31**	4.51	0.479	°°
2,3	4	1,4	**2.34**	5.34	0.375	°°	2,3	1,4	1,4	**3.87**	7.97	0.240	°°°
1-3	1-3	1-3	**0.62**	11.70	0.231	°°°	1-4	1-4	1-4	**2.41**	15.95	0.194	°°°

Source. Authors' calculations based on the dataset described in Section 4 (178 to 182 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 15. GMM estimations of eq. (4) using CC to proxy the state variable Θ, using yearly data.

instr (lags)			γ	J-stat	p-val	fit	instr (lags)			γ	J-stat	p-val	fit	instr (lags)			γ	J-stat	p-val	fit	instr (lags)			γ	J-stat	p-val	fit
EP	GCE	GCC					EP	GCE	GCC					EP	GCE	GCC					EP	GCE	GCC				
N	N	N	**3.68**	NA	NA	NA	N	1	N	**2.09**	2.30	0.129	°°°	N	2	N	**3.14**	1.54	0.215	°°°	N	1,2	N	**2.13**	4.22	0.121	°°°
N	N	1	**3.67**	1.24	0.265	°°°	N	1	1	**2.84**	3.95	0.139	°°°	N	2	1	**2.73**	2.46	0.292	°°°	N	1,2	1	**2.42**	3.59	0.309	°°
N	N	2	**3.11**	0.71	0.398	°°	N	1	2	**4.21**	3.18	0.204	°°°	N	2	2	**3.30**	1.54	0.463	°°	N	1,2	2	**2.54**	3.88	0.275	°°°
N	N	1,2	**3.68**	1.23	0.542	°	N	1	1,2	**3.17**	4.64	0.200	°°°	N	2	1,2	**2.86**	2.90	0.407	°°	N	1,2	1,2	**2.56**	3.85	0.427	°°
1	N	N	**3.33**	0.34	0.563	°	1	1	N	**3.21**	3.07	0.215	°°°	1	2	N	**3.37**	1.70	0.427	°°	1	1,2	N	**2.30**	4.93	0.177	°°°
1	N	1	**2.75**	3.21	0.201	°°°	1	1	1	**2.42**	4.43	0.219	°°°	1	2	1	**2.69**	3.51	0.320	°°	1	1,2	1	**2.47**	4.46	0.347	°°
1	N	2	**2.74**	2.30	0.317	°°	1	1	2	**3.94**	2.59	0.458	°°	1	2	2	**3.06**	2.50	0.475	°°	1	1,2	2	**4.22**	2.51	0.643	°
1	N	1,2	**2.69**	2.78	0.426	°°	1	1	1,2	**3.72**	2.93	0.569	°	1	2	1,2	**2.76**	3.80	0.434	°°	1	1,2	1,2	**2.55**	4.63	0.463	°°
2	N	N	**3.58**	1.52	0.218	°°°	2	1	N	**2.14**	4.08	0.130	°°°	2	2	N	**3.09**	2.97	0.226	°°°	2	1,2	N	**2.48**	4.30	0.231	°°°
2	N	1	**3.21**	1.72	0.423	°°	2	1	1	**2.59**	3.68	0.298	°°°	2	2	1	**3.03**	3.02	0.389	°°	2	1,2	1	**2.77**	3.66	0.454	°°
2	N	2	**3.35**	1.57	0.455	°°	2	1	2	**2.29**	3.63	0.305	°°	2	2	2	**3.79**	2.84	0.417	°°	2	1,2	2	**3.34**	3.85	0.427	°°
2	N	1,2	**3.13**	1.78	0.619	°	2	1	1,2	**2.62**	3.78	0.436	°°	2	2	1,2	**3.42**	3.83	0.430	°°	2	1,2	1,2	**3.35**	3.95	0.557	°
1,2	N	N	**3.61**	1.98	0.372	°°	1,2	1	N	**2.48**	5.17	0.160	°°°	1,2	2	N	**3.21**	3.26	0.354	°°	1,2	1,2	N	**2.59**	5.07	0.280	°°°
1,2	N	1	**2.98**	3.31	0.347	°°	1,2	1	1	**2.65**	4.63	0.327	°°	1,2	2	1	**2.91**	4.10	0.393	°°	1,2	1,2	1	**2.75**	4.57	0.471	°°
1,2	N	2	**3.36**	2.31	0.511	°	1,2	1	2	**4.10**	2.47	0.649	°	1,2	2	2	**3.72**	2.99	0.559	°	1,2	1,2	2	**3.21**	4.29	0.509	°
1,2	N	1,2	**2.95**	3.37	0.498	°°	1,2	1	1,2	**2.67**	4.75	0.448	°°	1,2	2	1,2	**3.20**	4.60	0.467	°°	1,2	1,2	1,2	**3.19**	4.60	0.596	°

Source. Authors' calculations based on the dataset described in Section 4 (42 to 44 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 16. GMM estimations of eq. (4) using CCP to proxy the state variable Θ, using monthly data.

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	N	N	**5.72**	NA	NA	NA	N	1	N	**7.27**	0.15	0.694	°	N	2	N	**4.75**	0.20	0.655	°	N	1,2	N	**4.91**	2.81	0.245	°°°
N	N	1	**4.72**	0.11	0.744		N	1	1	**3.60**	3.13	0.209	°°°	N	2	1	**4.63**	0.20	0.903	!	N	1,2	1	**2.88**	4.61	0.203	°°°
N	N	5	**5.69**	0.00	0.954	!	N	1	5	**6.96**	0.26	0.880		N	2	5	**4.79**	0.22	0.897		N	1,2	5	**3.68**	4.15	0.245	°°°
N	N	1,5	**4.84**	0.14	0.932	!	N	1	1,5	**3.64**	3.43	0.330	°°	N	2	1,5	**4.76**	0.22	0.975	!	N	1,2	1,5	**2.97**	4.80	0.308	°°
2	N	N	**5.34**	0.02	0.898		2	1	N	**5.46**	1.49	0.475	°°	2	2	N	**5.09**	0.23	0.893		2	1,2	N	**5.55**	2.35	0.503	°
2	N	1	**4.80**	0.14	0.934	!	2	1	1	**3.71**	3.16	0.368	°°	2	2	1	**4.74**	0.29	0.962	!	2	1,2	1	**2.92**	5.13	0.274	°°°
2	N	5	**5.37**	0.02	0.988	!	2	1	5	**5.49**	1.59	0.662	°	2	2	5	**5.09**	0.23	0.973	!	2	1,2	5	**4.34**	3.77	0.438	°°
2	N	1,5	**4.95**	0.19	0.979	!	2	1	1,5	**3.79**	3.54	0.472	°°	2	2	1,5	**4.87**	0.29	0.991	!	2	1,2	1,5	**3.03**	5.30	0.380	°°
6	N	N	**5.26**	0.18	0.674	°	6	1	N	**6.68**	0.39	0.822		6	2	N	**4.62**	0.40	0.819		6	1,2	N	**5.18**	2.58	0.461	°°
6	N	1	**4.54**	0.29	0.866		6	1	1	**3.55**	3.18	0.365	°°	6	2	1	**4.45**	0.39	0.942	!	6	1,2	1	**2.82**	4.67	0.323	°°
6	N	5	**5.34**	0.19	0.908	!	6	1	5	**6.57**	0.47	0.925	!	6	2	5	**4.62**	0.44	0.931	!	6	1,2	5	**3.68**	4.11	0.391	°°
6	N	1,5	**4.62**	0.35	0.950	!	6	1	1,5	**3.56**	3.50	0.478	°°	6	2	1,5	**4.54**	0.44	0.979	!	6	1,2	1,5	**2.91**	4.86	0.433	°°
2,6	N	N	**5.10**	0.18	0.913	!	2,6	1	N	**5.41**	1.53	0.675	°	2,6	2	N	**4.91**	0.41	0.937	!	2,6	1,2	N	**5.57**	2.31	0.679	°
2,6	N	1	**4.62**	0.35	0.950	!	2,6	1	1	**3.65**	3.22	0.522	°	2,6	2	1	**4.54**	0.54	0.970	!	2,6	1,2	1	**2.84**	5.23	0.388	°°
2,6	N	5	**5.15**	0.21	0.976	!	2,6	1	5	**5.43**	1.63	0.803		2,6	2	5	**4.82**	0.47	0.976	!	2,6	1,2	5	**4.30**	3.76	0.585	°
2,6	N	1,5	**4.73**	0.45	0.978	!	2,6	1	1,5	**3.69**	3.63	0.604	°	2,6	2	1,5	**4.64**	0.58	0.989	!	2,6	1,2	1,5	**2.94**	5.41	0.492	°°
1	1	1	**1.70**	16.29	0.001	***	1,2	1,2	1,2	**-0.32**	24.40	0.000	***	1-4	1-4	1-4	**2.62**	31.31	0.002	***	1-6	1-6	1-6	**3.67**	38.85	0.003	***

Source. Authors' calculations based on the dataset described in Section 4 (420 to 426 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 17. GMM estimations of eq. (4) using CCP to proxy the state variable Θ, using quarterly data.

instr (lags)								instr (lags)								instr (lags)								instr (lags)							
EP	GCE	GCC	γ	J-stat	p-val	fit		EP	GCE	GCC	γ	J-stat	p-val	fit		EP	GCE	GCC	γ	J-stat	p-val	fit		EP	GCE	GCC	γ	J-stat	p-val	fit	
N	N	N	**4.08**	NA	NA	NA		N	1	N	**4.59**	0.27	0.601	°		N	6	N	**3.59**	0.77	0.381	°°		N	1,6	N	**4.30**	0.45	0.799		
N	N	2	**2.43**	2.48	0.115	°°°		N	1	2	**3.04**	2.47	0.290	°°°		N	6	2	**2.15**	3.30	0.192	°°°		N	1,6	2	**3.70**	3.42	0.331	°°	
N	N	4	**2.87**	1.23	0.268	°°°		N	1	4	**4.64**	0.39	0.824			N	6	4	**2.71**	1.38	0.502	°		N	1,6	4	**4.15**	0.69	0.875		
N	N	2,4	**2.09**	3.12	0.210	°°°		N	1	2,4	**3.06**	3.40	0.333	°°		N	6	2,4	**1.96**	3.37	0.338	°°		N	1,6	2,4	**3.26**	3.55	0.471	°°	
2	N	N	**2.65**	1.97	0.161	°°°		2	1	N	**4.63**	0.67	0.714			2	6	N	**2.68**	1.93	0.380	°°		2	1,6	N	**4.33**	0.85	0.837		
2	N	2	**2.17**	2.91	0.234	°°°		2	1	2	**3.24**	2.98	0.394	°°		2	6	2	**2.35**	2.95	0.399	°°		2	1,6	2	**3.77**	3.60	0.463	°°	
2	N	4	**2.97**	1.15	0.562	°		2	1	4	**4.37**	0.73	0.867			2	6	4	**2.85**	1.27	0.735			2	1,6	4	**4.09**	0.97	0.914	!	
2	N	2,4	**2.28**	3.15	0.370	°°		2	1	2,4	**3.10**	3.34	0.502	°		2	6	2,4	**2.37**	2.98	0.561	°		2	1,6	2,4	**3.49**	3.51	0.622	°	
3	N	N	**2.52**	2.53	0.111	°°°		3	1	N	**3.04**	2.34	0.311	°°		3	6	N	**2.36**	3.06	0.217	°°°		3	1,6	N	**3.29**	2.62	0.454	°°	
3	N	2	**2.32**	2.75	0.253	°°°		3	1	2	**2.89**	2.63	0.452	°°		3	6	2	**2.15**	3.57	0.312	°°		3	1,6	2	**3.22**	3.44	0.487	°°	
3	N	4	**2.07**	3.06	0.217	°°°		3	1	4	**2.92**	3.17	0.366	°°		3	6	4	**2.10**	3.11	0.375	°°		3	1,6	4	**3.01**	3.20	0.525	°	
3	N	2,4	**1.94**	3.45	0.327	°°		3	1	2,4	**2.80**	3.70	0.447	°°		3	6	2,4	**1.96**	3.62	0.460	°°		3	1,6	2,4	**2.97**	3.90	0.564	°	
2,3	N	N	**1.83**	3.70	0.158	°°°		2,3	1	N	**2.67**	3.64	0.304	°°		2,3	6	N	**1.88**	4.01	0.260	°°°		2,3	1,6	N	**3.08**	3.97	0.409	°°	
2,3	N	2	**1.82**	3.64	0.302	°°		2,3	1	2	**2.80**	3.54	0.472	°°		2,3	6	2	**1.93**	3.97	0.410	°°		2,3	1,6	2	**3.24**	4.53	0.477	°°	
2,3	N	4	**1.91**	3.73	0.292	°°°		2,3	1	4	**2.79**	3.41	0.491	°°		2,3	6	4	**1.98**	3.24	0.519	°		2,3	1,6	4	**2.94**	3.55	0.616	°	
2,3	N	2,4	**2.01**	3.76	0.439	°°		2,3	1	2,4	**2.75**	3.75	0.586	°		2,3	6	2,4	**1.97**	3.61	0.607	°		2,3	1,6	2,4	**2.93**	4.01	0.676	°	
1	1	1	**1.37**	8.81	0.032	**		1,2	1,2	1,2	**0.74**	9.36	0.154	°°°		1-3	1-3	1-3	**0.47**	11.23	0.260	°°°		1-4	1-4	1-4	**0.33**	17.29	0.139	°°°	

Source. Authors' calculations based on the dataset described in Section 4 (178 to 182 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 18. GMM estimations of eq. (4) using CCP to proxy the state variable Θ, using yearly data.

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	N	N	**1.12**	NA	NA	NA	N	3	N	**1.19**	2.85	0.091	*	N	4	N	**1.35**	3.28	0.070	*	N	3,4	N	**1.34**	3.27	0.195	°°°
N	N	2	**1.15**	3.17	0.075	*	N	3	2	**1.23**	3.18	0.204	°°°	N	4	2	**1.25**	3.38	0.184	°°°	N	3,4	2	**1.17**	3.41	0.333	°°
N	N	3	**1.02**	3.14	0.076	*	N	3	3	**1.03**	3.59	0.166	°°°	N	4	3	**1.00**	3.73	0.155	°°°	N	3,4	3	**1.02**	4.00	0.261	°°°
N	N	2,3	**1.02**	3.20	0.202	°°°	N	3	2,3	**1.06**	3.81	0.283	°°°	N	4	2,3	**0.97**	3.93	0.269	°°°	N	3,4	2,3	**1.00**	4.02	0.403	°°
1	N	N	**1.35**	2.63	0.105	°°°	1	3	N	**1.56**	2.78	0.249	°°°	1	4	N	**1.25**	2.64	0.267	°°°	1	3,4	N	**1.78**	3.13	0.372	°°
1	N	2	**1.36**	3.25	0.197	°°°	1	3	2	**1.63**	3.12	0.374	°°	1	4	2	**1.72**	3.41	0.332	°°	1	3,4	2	**1.73**	3.86	0.425	°°
1	N	3	**1.39**	2.80	0.246	°°°	1	3	3	**1.38**	3.78	0.286	°°°	1	4	3	**1.75**	4.19	0.242	°°°	1	3,4	3	**1.54**	4.87	0.301	°°
1	N	2,3	**1.56**	3.39	0.335	°°	1	3	2,3	**1.30**	3.98	0.408	°°	1	4	2,3	**1.65**	4.75	0.313	°°	1	3,4	2,3	**1.59**	4.96	0.421	°°
2	N	N	**1.14**	3.69	0.055	*	2	3	N	**1.43**	4.53	0.104	°°°	2	4	N	**1.53**	4.71	0.095	*	2	3,4	N	**1.71**	4.81	0.186	°°°
2	N	2	**1.23**	3.93	0.140	°°°	2	3	2	**1.73**	4.03	0.258	°°°	2	4	2	**1.39**	4.79	0.188	°°°	2	3,4	2	**1.65**	4.49	0.343	°°
2	N	3	**1.20**	3.35	0.187	°°°	2	3	3	**1.30**	4.45	0.217	°°°	2	4	3	**1.32**	4.43	0.218	°°°	2	3,4	3	**1.37**	5.51	0.239	°°°
2	N	2,3	**1.26**	3.47	0.324	°°	2	3	2,3	**1.49**	5.69	0.223	°°°	2	4	2,3	**1.26**	4.59	0.332	°°	2	3,4	2,3	**1.45**	6.01	0.305	°°
1,2	N	N	**1.71**	3.13	0.209	°°°	1,2	3	N	**2.16**	3.91	0.271	°°°	1,2	4	N	**2.25**	4.08	0.252	°°°	1,2	3,4	N	**2.48**	4.45	0.348	°°
1,2	N	2	**1.84**	3.59	0.310	°°	1,2	3	2	**2.16**	3.81	0.433	°°	1,2	4	2	**2.36**	4.71	0.318	°°	1,2	3,4	2	**2.41**	4.69	0.454	°°
1,2	N	3	**1.77**	2.90	0.407	°°	1,2	3	3	**1.95**	4.04	0.401	°°	1,2	4	3	**2.07**	3.81	0.432	°°	1,2	3,4	3	**2.20**	4.72	0.451	°°
1,2	N	2,3	**1.83**	3.40	0.492	°°	1,2	3	2,3	**1.97**	4.39	0.495	°°	1,2	4	2,3	**2.34**	4.19	0.522	°	1,2	3,4	2,3	**2.28**	4.64	0.591	°
1	1	1	**0.81**	6.72	0.081	*	1,2	1,2	1,2	**1.06**	8.08	0.232	°°°	1,3	1,3	1,3	**1.05**	8.56	0.200	°°°	1,4	1,4	1,4	**0.53**	6.90	0.330	°°

Source. Authors' calculations based on the dataset described in Section 4 (40 to 44 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 19. GMM estimations of eq. (4) using CS to proxy the state variable Θ, using monthly data.

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	N	N	**6.00**	NA	NA	NA
N	N	3	**6.02**	0.07	0.787	
N	N	4	**5.67**	0.03	0.852	
N	N	3,4	**5.86**	0.28	0.869	
2	N	N	**6.04**	0.33	0.567	°
2	N	3	**6.05**	0.42	0.810	
2	N	4	**5.71**	0.40	0.817	
2	N	3,4	**5.61**	0.64	0.888	
6	N	N	**6.07**	0.04	0.850	
6	N	3	**6.07**	0.09	0.957	!
6	N	4	**5.91**	0.12	0.941	!
6	N	3,4	**5.91**	0.38	0.945	!
2,6	N	N	**5.97**	0.41	0.815	
2,6	N	3	**5.96**	0.47	0.926	!
2,6	N	4	**5.80**	0.46	0.927	!
2,6	N	3,4	**5.88**	0.52	0.972	!
1	1	1	**12.25**	9.27	0.026	**

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	2	N	**5.79**	0.09	0.770	
N	2	3	**5.73**	0.21	0.900	!
N	2	4	**5.50**	0.28	0.868	
N	2	3,4	**5.68**	0.53	0.913	!
2	2	N	**5.74**	0.51	0.775	
2	2	3	**5.63**	0.73	0.866	
2	2	4	**5.38**	0.77	0.857	
2	2	3,4	**5.51**	0.82	0.936	!
6	2	N	**5.85**	0.13	0.938	!
6	2	3	**5.88**	0.24	0.970	!
6	2	4	**5.69**	0.35	0.951	!
6	2	3,4	**5.78**	0.43	0.980	!
2,6	2	N	**5.73**	0.61	0.895	
2,6	2	3	**5.66**	0.76	0.944	!
2,6	2	4	**5.47**	0.84	0.933	!
2,6	2	3,4	**5.54**	0.89	0.971	!
1,2	1,2	1,2	**12.34**	12.57	0.050	*

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	4	N	**6.05**	0.38	0.538	°
N	4	3	**6.01**	0.40	0.819	
N	4	4	**5.91**	0.78	0.676	°
N	4	3,4	**5.98**	1.04	0.792	
2	4	N	**5.97**	0.71	0.702	
2	4	3	**5.91**	0.72	0.869	
2	4	4	**5.81**	0.98	0.805	
2	4	3,4	**5.83**	0.98	0.912	!
6	4	N	**6.08**	0.41	0.815	
6	4	3	**6.01**	0.40	0.940	!
6	4	4	**5.94**	0.79	0.851	
6	4	3,4	**5.96**	0.79	0.939	!
2,6	4	N	**5.99**	0.71	0.871	
2,6	4	3	**5.92**	0.72	0.949	!
2,6	4	4	**5.86**	1.00	0.910	!
2,6	4	3,4	**5.87**	1.00	0.963	!
1-4	1-4	1-4	**13.31**	22.46	0.033	**

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	2,4	N	**5.78**	0.51	0.776	
N	2,4	3	**5.79**	0.60	0.896	
N	2,4	4	**5.46**	1.07	0.783	
N	2,4	3,4	**5.44**	1.06	0.900	!
2	2,4	N	**5.71**	0.93	0.819	
2	2,4	3	**5.58**	1.05	0.902	!
2	2,4	4	**5.45**	1.42	0.841	
2	2,4	3,4	**5.46**	1.42	0.922	!
6	2,4	N	**5.91**	0.53	0.911	!
6	2,4	3	**5.80**	0.60	0.963	!
6	2,4	4	**5.69**	1.11	0.893	
6	2,4	3,4	**5.70**	1.11	0.953	!
2,6	2,4	N	**5.73**	0.94	0.919	!
2,6	2,4	3	**5.60**	1.06	0.958	!
2,6	2,4	4	**5.50**	1.44	0.919	!
2,6	2,4	3,4	**5.50**	1.44	0.963	!
1-6	1-6	1-6	**10.37**	31.24	0.027	**

Source. Authors' calculations based on the dataset described in Section 4 (413 to 419 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 20. GMM estimations of eq. (4) using CS to proxy the state variable Θ, using quarterly data.

instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit	instr (lags) EP	GCE	GCC	γ	J-stat	p-val	fit
N	N	N	**10.76**	NA	NA	NA	N	1	N	**11.12**	0.00	0.957	!	N	3	N	**22.18**	0.00	0.961	!	N	1,3	N	**10.30**	2.21	0.330	°°
N	N	3	**12.48**	0.06	0.804		N	1	3	**11.59**	0.15	0.928	!	N	3	3	**9.51**	2.24	0.326	°°	N	1,3	3	**10.78**	2.09	0.553	°
N	N	4	**9.31**	0.12	0.729		N	1	4	**11.26**	0.27	0.872		N	3	4	**8.85**	3.36	0.186	°°°	N	1,3	4	**11.36**	2.43	0.488	°°
N	N	3,4	**10.96**	0.27	0.874		N	1	3,4	**11.56**	0.29	0.962	!	N	3	3,4	**9.29**	3.18	0.365	°°	N	1,3	3,4	**10.88**	2.68	0.613	°
2	N	N	**10.65**	0.08	0.772		2	1	N	**11.44**	0.09	0.956	!	2	3	N	**8.35**	8.35	0.281	°°°	2	1,3	N	**10.60**	2.18	0.536	°
2	N	3	**12.62**	0.14	0.930	!	2	1	3	**11.77**	0.21	0.975	!	2	3	3	**9.05**	9.05	0.500	°	2	1,3	3	**8.90**	2.42	0.659	°
2	N	4	**9.29**	0.22	0.895		2	1	4	**11.69**	0.42	0.936	!	2	3	4	**8.83**	3.39	0.335	°°	2	1,3	4	**11.89**	2.33	0.675	°
2	N	3,4	**10.88**	0.36	0.948	!	2	1	3,4	**11.81**	0.42	0.418	°°	2	3	3,4	**9.00**	2.88	0.578	°	2	1,3	3,4	**11.20**	2.69	0.748	
4	N	N	**11.05**	0.05	0.826		4	1	N	**11.14**	0.05	0.976	!	4	3	N	**21.30**	0.06	0.970	!	4	1,3	N	**10.33**	2.24	0.523	°
4	N	3	**12.54**	0.08	0.962	!	4	1	3	**11.56**	0.16	0.984	!	4	3	3	**12.55**	1.33	0.722		4	1,3	3	**10.73**	2.11	0.715	
4	N	4	**9.52**	0.21	0.900	!	4	1	4	**11.37**	0.34	0.952	!	4	3	4	**9.18**	3.30	0.347	°°	4	1,3	4	**11.51**	2.44	0.656	°
4	N	3,4	**10.79**	0.29	0.961	!	4	1	3,4	**11.46**	0.34	0.987	!	4	3	3,4	**9.00**	3.39	0.495	°°	4	1,3	3,4	**10.57**	3.00	0.700	°
2,4	N	N	**10.96**	0.13	0.936	!	2,4	1	N	**11.45**	0.13	0.988	!	2,4	3	N	**21.61**	0.06	0.996	!	2,4	1,3	N	**10.62**	2.20	0.700	°
2,4	N	3	**12.46**	0.18	0.982	!	2,4	1	3	**11.73**	0.22	0.994	!	2,4	3	3	**9.00**	2.39	0.665	°	2,4	1,3	3	**10.90**	2.10	0.835	
2,4	N	4	**9.49**	0.30	0.960	!	2,4	1	4	**11.80**	0.48	0.975	!	2,4	3	4	**9.16**	3.33	0.504	°	2,4	1,3	4	**12.06**	2.32	0.803	
2,4	N	3,4	**10.70**	0.38	0.984	!	2,4	1	3,4	**11.70**	0.49	0.993	!	2,4	3	3,4	**8.95**	3.43	0.635	°	2,4	1,3	3,4	**10.89**	3.04	0.804	
1	1	1	**11.21**	2.33	0.506	°	1,2	1,2	1,2	**6.84**	8.20	0.224	°°°	1-3	1-3	1-3	**11.76**	3.93	0.916	!	1-4	1-4	1-4	**9.96**	9.96	0.561	°

Source. Authors' calculations based on the dataset described in Section 4 208 to 212 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.

Table 21. GMM estimations of eq. (4) using CS to proxy the state variable Θ, using yearly data.

instr (lags)							instr (lags)							instr (lags)							instr (lags)						
EP	GCE	GCC	γ	J-stat	p-val	fit	EP	GCE	GCC	γ	J-stat	p-val	fit	EP	GCE	GCC	γ	J-stat	p-val	fit	EP	GCE	GCC	γ	J-stat	p-val	fit
N	N	N	**5.68**	NA	NA	NA	N	1	N	**4.98**	1.19	0.276	°°°	N	2	N	**5.41**	0.60	0.440	°°	N	1,2	N	**5.12**	1.21	0.547	°
N	N	1	**5.64**	0.01	0.923	!	N	1	1	**5.07**	1.17	0.558	°	N	2	1	**5.25**	0.88	0.644	°	N	1,2	1	**5.16**	1.19	0.757	
N	N	2	**5.62**	0.22	0.640	°	N	1	2	**5.03**	1.17	0.557	°	N	2	2	**5.40**	0.67	0.717		N	1,2	2	**5.15**	1.21	0.752	
N	N	1,2	**5.58**	0.23	0.889		N	1	1,2	**5.08**	1.17	0.761		N	2	1,2	**5.27**	0.88	0.830		N	1,2	1,2	**5.17**	1.20	0.879	
1	N	N	**4.75**	1.16	0.281	°°°	1	1	N	**5.02**	1.83	0.400	°°	1	2	N	**5.32**	1.22	0.544	°	1	1,2	N	**5.02**	2.19	0.535	°
1	N	1	**5.27**	0.99	0.611	°	1	1	1	**4.91**	1.97	0.578	°	1	2	1	**5.06**	1.95	0.584	°	1	1,2	1	**4.99**	2.27	0.686	°
1	N	2	**4.86**	1.31	0.520	°	1	1	2	**5.09**	1.85	0.604	°	1	2	2	**5.30**	1.28	0.733		1	1,2	2	**5.00**	2.28	0.685	°
1	N	1,2	**5.30**	1.07	0.785		1	1	1,2	**4.87**	2.05	0.726		1	2	1,2	**5.06**	1.95	0.745		1	1,2	1,2	**4.96**	2.38	0.795	
2	N	N	**5.40**	1.71	0.191	°°°	2	1	N	**4.95**	2.30	0.316	°°	2	2	N	**5.21**	2.35	0.309	°°	2	1,2	N	**5.12**	2.43	0.487	°°
2	N	1	**5.39**	1.70	0.427	°°	2	1	1	**5.01**	2.25	0.522	°	2	2	1	**5.13**	2.43	0.488	°°	2	1,2	1	**5.13**	2.43	0.657	°
2	N	2	**5.40**	1.77	0.413	°°	2	1	2	**4.89**	2.45	0.484	°°	2	2	2	**5.24**	2.66	0.448	°°	2	1,2	2	**5.09**	2.94	0.567	°
2	N	1,2	**5.39**	1.76	0.623	°	2	1	1,2	**4.95**	2.48	0.647	°	2	2	1,2	**5.09**	3.02	0.554	°	2	1,2	1,2	**5.07**	3.05	0.692	°
1,2	N	N	**5.33**	2.24	0.326	°°	1,2	1	N	**4.95**	2.83	0.419	°°	1,2	2	N	**5.14**	2.96	0.398	°°	1,2	1,2	N	**5.03**	3.17	0.530	°
1,2	N	1	**5.19**	2.43	0.487	°°	1,2	1	1	**4.85**	2.95	0.566	°	1,2	2	1	**4.97**	3.41	0.492	°°	1,2	1,2	1	**4.97**	3.40	0.638	°
1,2	N	2	**5.28**	2.46	0.483	°°	1,2	1	2	**4.77**	3.37	0.499	°°	1,2	2	2	**5.14**	3.39	0.495	°°	1,2	1,2	2	**4.95**	3.94	0.558	°
1,2	N	1,2	**5.13**	2.64	0.619	°	1,2	1	1,2	**4.72**	3.41	0.637	°	1,2	2	1,2	**4.88**	4.41	0.492	°°	1,2	1,2	1,2	**4.87**	4.41	0.621	°

Source. Authors' calculations based on the dataset described in Section 4 (50 to 52 observations, depending on lags length).

Notes. All tables consists of four panels. In each panel, the first two columns report the lags used to instrument the regression. The third column report the value of the estimaed coefficient of interest. Columns 4 and 5 report the relevant J-statistic and its associated p-value. The last column reports the joint rejection of instruments validity at 1% (***), 5% (**), 10% (*), 30% (°°°), 50% (°°), 70% (°) or 90% (!) significance level.