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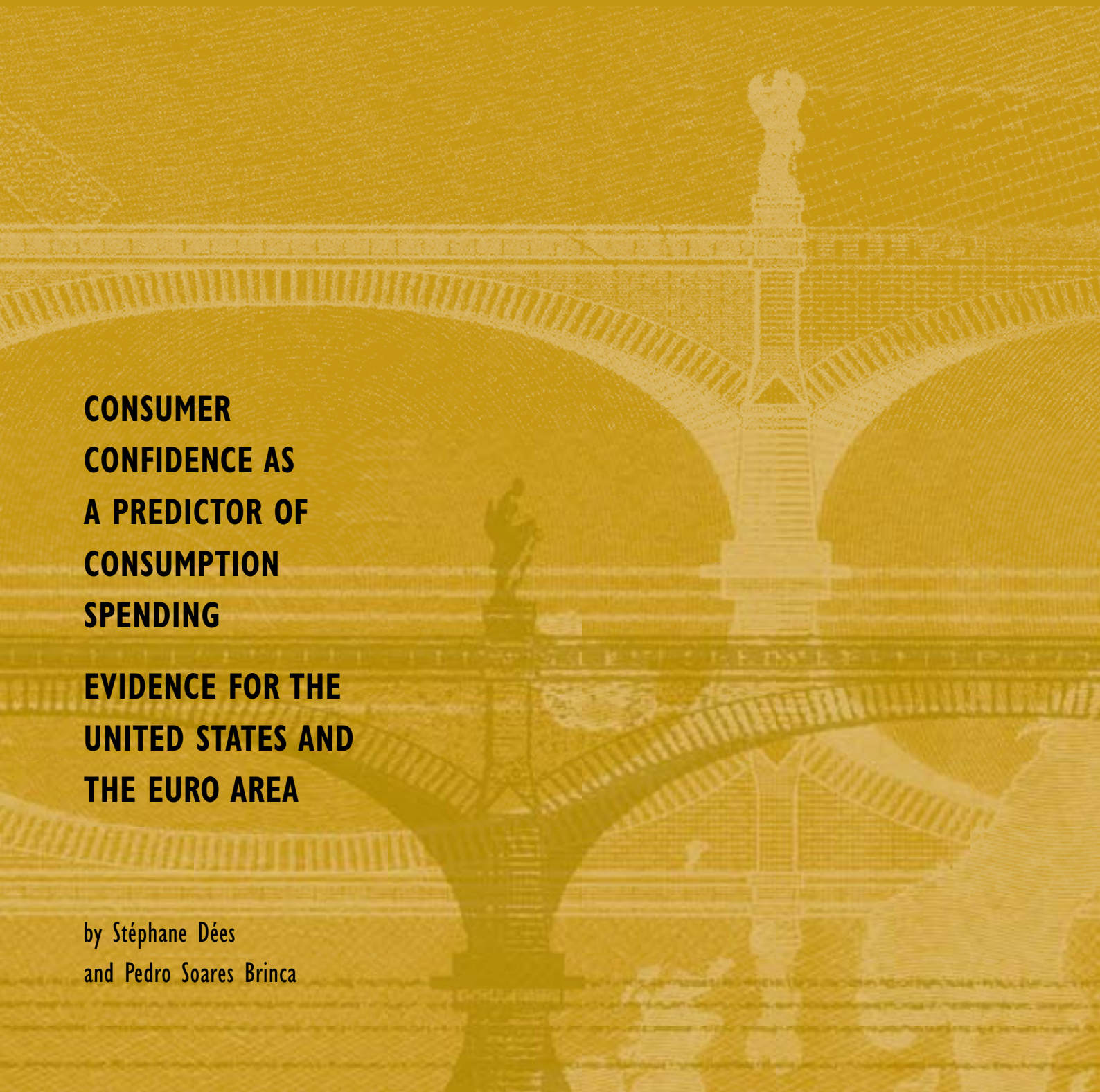

CONSUMER CONFIDENCE AS A PREDICTOR OF CONSUMPTION SPENDING

EVIDENCE FOR THE UNITED STATES AND THE EURO AREA

by Stéphane Dées
and Pedro Soares Brinca

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Abstract

For most academics and policy makers, the depth of the 2007-09 financial crisis, its longevity and its impacts on the real economy resulted from an erosion of confidence. This paper proposes to assess empirically the link between consumer sentiment and consumption expenditures for the United States and the euro area. It shows under which circumstances confidence indicators can be a good predictor of household consumption even after controlling for information in economic fundamentals. Overall, the results show that the consumer confidence index can be in certain circumstances a good predictor of consumption. In particular, out-of-sample evidence shows that the contribution of confidence in explaining consumption expenditures increases when household survey indicators feature large changes, so that confidence indicators can have some increasing predictive power during such episodes. Moreover, there is some evidence of a "confidence channel" in the international transmission of shocks, as U.S. confidence indices lead consumer sentiment in the euro area.

Keywords: Consumer Confidence, Consumption, International Linkages, Non-linear modeling.
JEL Classification : C32, E17, F37, F42.

Non-Technical Summary

The 2007-09 financial crisis led to the most severe global economic recession since the Great Depression. Most academics and policy makers agree to say that it is an erosion of confidence that has ensured the depth and the longevity of the crisis, especially as regards its impacts on the real economy.

The link between confidence and economic decisions has been widely covered in the literature, which has focused on two main aspects. First, from a theoretical viewpoint, the literature has concentrated on the conceptualisation of confidence and its role in modern theories of consumption. In particular, to explain deviations from the Permanent Income Hypothesis, confidence has been justified for "precautionary savings" arguments in the context of perceived uncertainty by households. Second, for an empirical viewpoint, the literature has been concerned on whether the confidence indicators contain any information beyond economic fundamentals. The concern is whether confidence can be explained by current and past values of variables such as income, unemployment, inflation or consumption or, in other way, whether confidence measures have any statistical significance in predicting economic outcomes once information from the variables cited above is used. While the evidence is overall rather mixed, most authors seem to, at least, find a significant statistical relationship between confidence measures and economic variables, current and future. In particular, some stress the special importance of confidence indicators in predicting periods of strong fluctuations in the economy, such as recessions and recoveries or during periods of major economic or political shocks. Such periods are usually associated with high volatility of consumer confidence, suggesting that large swings in confidence could be useful indicators of consumption.

The purpose of the paper is first to empirically assess the role of confidence in explaining household consumption in the United States and the euro area and show to what extent confidence indicators bring additional information beyond variables usually found to have some explanatory power for household real consumption expenditures (e.g. income, wealth or interest rates). Second, it will check the existence of a confidence channel in international transmission of shocks. Finally, it will identify under which circumstances confidence indicators can be a good predictor of household consumption. In particular, it will measure the contribution of confidence during periods associated with large movements in household survey indicators.

Although not providing any methodological novelty to the empirical literature, the value added of this paper concerns first the use of a relatively long and up-to-date database that in particular includes the recent financial crisis. It also provides a comparison between the United States and the euro area. Finally, it allows for international linkages in confidence.

Our empirical evidence is based on three different methodological approaches. First, an approach based on a simple consumption equation indicates that, while for the U.S. confidence indicators do not seem to help predict consumption expenditures when taking fundamentals into account, they may contain some valuable information in the euro area case. Moreover, there is some evidence of the presence of a one-way "confidence channel" between the United States and the euro area. In other words, past changes in the U.S. confidence indicators would contain information about current changes in euro area consumption. The opposite would not be true.

Second, these results are confirmed by a VAR approach, which also shows - through a historical decomposition exercise - that confidence seems to matter in some specific episodes, which in most cases corresponds to periods where there are large changes in household survey indicators, like during financial crises or geopolitical tensions for instance.

To capture better the fact that confidence might play a role only during uncertain times, a third empirical approach relies on a non-linear estimation of our consumption equation, using a threshold model. This modelling approach assumes that there is a certain (unknown) threshold in confidence index changes beyond which confidence starts impacting consumption behaviours. In-sample and out-of-sample exercises show that the contribution of confidence in explaining consumption expenditures increases when household survey indicators feature large changes, so that confidence indicators can have some increasing predictive power during such episodes.

Overall, the results show that the consumer confidence index can be in certain circumstances a good predictor of consumption. Moreover, there is some evidence of a “confidence channel” in the international transmission of shock, as U.S. confidence indices lead consumer sentiment in the euro area. Finally, the relationship between sentiment and consumption has been shown to be non linear: we can notice that models with confidence seem to outperform during periods of geopolitical tensions, like in 2003-04, or during the financial crisis.

Future research includes extensions to other countries and other variables. As surveys also report business sentiment, similar research could be done on the predictive power of confidence on investment decisions. By extension, combining consumer and business survey data could help improve the forecast of GDP fluctuations. Finally, we have only used the aggregate index of confidence surveys. Various subcomponents could be used as alternatives, as they might provide more precise information about agents’ perceptions about the future.

1 Introduction

The 2007-09 financial crisis led to the most severe global economic recession since the Great Depression. Just after the bankrupcy of Lehman Brothers, Nobel Prize Joseph Stiglitz said that this "financial crisis springs from a catastrophic collapse in confidence"[1]. While it remains difficult to assert whether the collapse of confidence was the cause or the consequence of the financial crisis, most academics and policy makers agree to say that it is this erosion of confidence that has ensured the depth and the longevity of the crisis, especially as regards its impacts on the real economy.

The link between confidence and economic decisions has been widely covered in the literature, which has focused on two main aspects. First, from a theoretical viewpoint, the literature has concentrated on the conceptualisation of confidence and its role in modern theories of consumption. If consumers were to behave according to the Permanent Income Hypothesis (PIH), no information known to the consumer when the consumption choice was made could have any predictive power for how consumption will change in future periods (Hall, 1978). Any deviation from the PIH can be theoretically justified by liquidity constraints or uncertainty relative to future income. This uncertainty can then lead households to decrease their current consumption and build precautionary savings to face a possible drop in their income. Against this background, consumer confidence indices could be helpful as they might capture information about expected income. Another approach to consumption relates to the existence of "animal spirits" (Katona, 1975 or Eppright et al., 1998). Consumer expenditures could be influenced by non-economic factors, such as political tensions or wars, that would affect the willingness of households to consume by increasing perceived uncertainty (Acemoglu and Scott 1994).

Second, for an empirical viewpoint, the literature has been concerned on whether the confidence indicators contain any information beyond economic fundamentals. The concern is whether confidence can be explained by current and past values of variables such as income, unemployment, inflation or consumption or, in other way, whether confidence measures have any statistical significance in predicting economic outcomes once information from the variables cited above is used. While the evidence is overall rather mixed, most authors seem to, at least, find a significant statistical relationship between confidence measures and economic variables, current and future.[2] In particular, some stress the special importance of confidence indicators in predicting periods of strong fluctuations in the economy, such as recessions and recoveries (Howrey, 2001; Haugh, 2005)

[1] See J.E. Stiglitz, "The fruit of hypocrisy", The Guardian, 16 September 2008, http://www.guardian.co.uk/commentisfree/2008/sep/16/economics.wallstreet

[2] Many authors find that consumer confidence can reduce forecast errors made by models including traditional macroeconomic variables: Ludvigson (2004) or Wilcox (2007) for the U.S.; Kwan and Cotsomitis (2006) for Canada; Easaw and Heravi (2004) for the UK. However, Smith (2009) using real-time data for the UK shows that including consumer sentiment in a VAR model to predict consumer expenditures does not improve its forecast accuracy. Similarly, Al-Eyd et al. (2008) show that confidence effects on consumption are weak when other key determinants of consumption are taken into account across five major OECD countries. Claveria et al. (2007) show that despite survey indicators provide useful information for improving forecasts of many euro area macroeconomic variables, such improvements are significant in a limited number of cases.

and others (Garner 1991 and Throop 1992) suggest that they could be helpful during periods of major economic or political shocks. Such periods are usually associated with high volatility of consumer confidence, suggesting that large swings in confidence could be useful indicators of consumption. Carrol et al. (1994), for instance, cite consumer confidence as the leading cause for the US 1990-91 recession.

The purpose of the paper is first to empirically assess the role of confidence in explaining household consumption in the United States and the euro area and show to what extent confidence indicators bring additional information beyond variables usually found to have some explanatory power for household real consumption expenditures (e.g. income, wealth or interest rates). Second, it will check the existence of a confidence channel in international transmission of shocks. Finally, it will identify under which circumstances confidence indicators can be a good predictor of household consumption. In particular, it will measure the contribution of confidence during periods associated with large movements in household survey indicators. Although not providing any methodological novelty to the empirical literature, the value added of this paper concerns first the use of a relatively long and up-to-date database that in particular includes the recent financial crisis. It also provides a comparison between the United States and the euro area. Finally, it allows for international linkages in confidence.

There is an important caveat to stress upfront as regards the measurement of confidence. Household sentiment is a personal and subjective assessment of the environment (current and future) in which agents take economic decisions. Moreover, as shown for instance by Dominitz and Manski (2004), the consumer sentiment indices might suffer from measurement errors as survey questions are very often ambiguous for the respondent and too much qualitative to be used for quantitative assessment. Here, like in most previous research, we assume that confidence indices derived from surveys are a relatively good proxy of households' perceptions about their economic environment and could be used as explanatory variables of their consumption expenditures.

Empirically, as shown for instance by Carrol et al. (1994), measures of consumer confidence are highly correlated with real consumption. A plot of the series for the United States (Figure 1) and the euro area (Figure 2) shows indeed some comovement between the (log) change in real consumption and the absolute change in consumer confidence index. In the United States, the correlation between real consumption growth and the change in consumer sentiment (measured by the University of Michigan Consumer Sentiment Index) is rather high. While it is the highest when computed contemporaneously (0.28), the correlation between lagged consumer confidence and consumption remains however relatively elevated (0.25 with a one-period lag and 0.24 with a two-period lag), indicating some potential leading properties for consumer sentiment. In the euro area, the correlation between confidence and consumption is the highest when confidence is lagged by one period (0.42). The correlation remains also large for higher lags (0.20 for a 2-period lag and 0.21 for a 4-period lag).

Figure 1: United States: Consumption growth (rhs) and change in confidence (lhs)

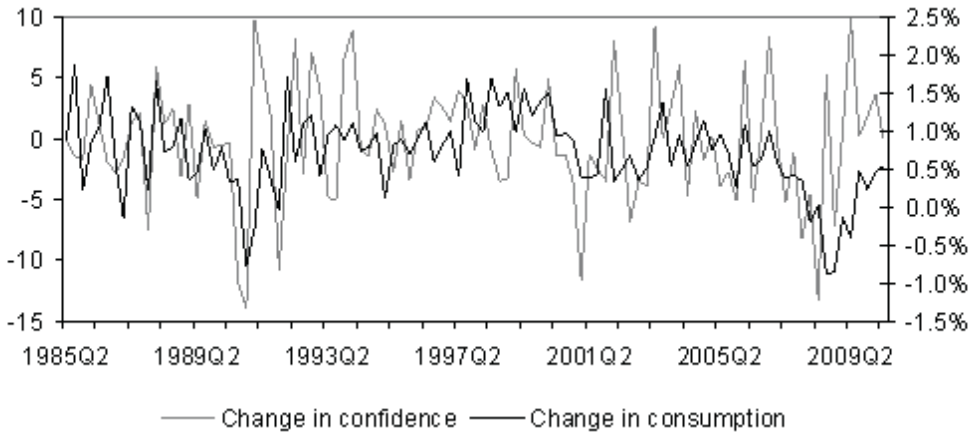
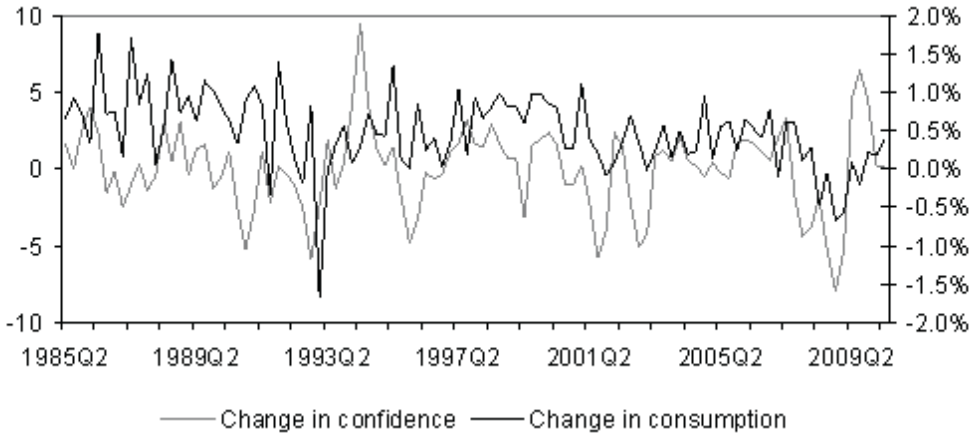
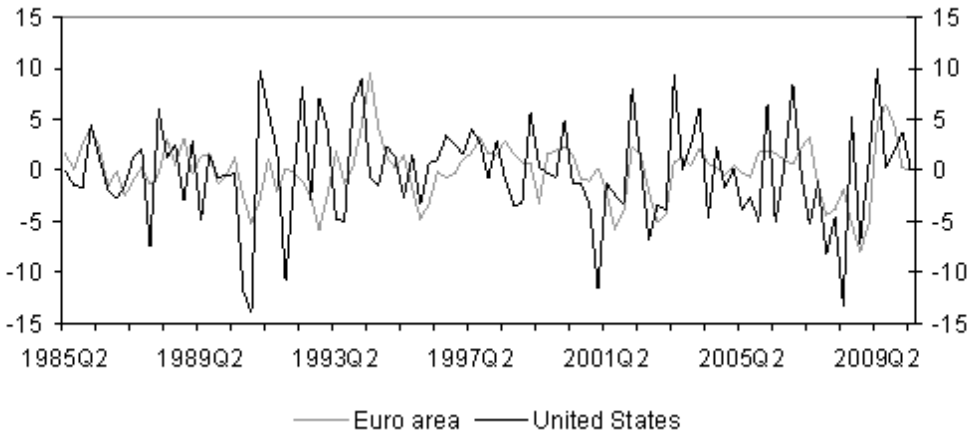


Figure 2: Euro area: Consumption growth (rhs) and change in confidence (lhs)



Another aspect that has been neglected in the literature is the cross-country correlation of confidence indicators (Figure 3). Here again, the correlation between the changes in US and euro area confidence is relatively large (0.27 contemporaneously). Changes in US confidence seem to lead in some periods changes in the euro area confidence. The correlation between the two variables is the highest when the euro area confidence is lagged by two periods (0.32).

Figure 3: Change in confidence in the United States (rhs) and the euro area (lhs)



These comovements do not preclude however any causal link between confidence indicators across countries and between confidence and consumption. Confidence indicators could also be just a good proxy for other fundamental variables.

Overall, the results show that the consumer confidence index can be in certain circumstances a good predictor of consumption. In particular, out-of-sample evidence shows that the contribution of confidence in explaining consumption expenditures increases when household survey indicators feature large changes, so that confidence indicators can have some increasing predictive power during such episodes. Moreover, there is some evidence of a "confidence channel" in the international transmission of shock, as U.S. confidence indices lead consumer sentiment in the euro area.

The rest of the paper is organised as follows. Section 2 gives a brief description of the data used in this paper. Section 3 describes the empirical framework used for our research and reports results from both univariate and multivariate analyses. Section 4 extends the previous analysis by proposing a non-linear approach in order to isolate periods where confidence explains significantly more consumption developments. Section 5 contains some concluding remarks.

2 Data

The dataset used covers the period from the first quarter of 1985 to the second quarter of 2010. The observations are seasonally adjusted though no detrending or business cycle adjustments are made. Since we are agnostic with respect to which are the mechanisms driving any statistical relation, we abstain from applying any economic theory motivated technique in order to filter the series from phenomena such as business cycles or trends. Real personal consumption series are taken from the national account sources (BEA for the United States - NIPA table 1.1.6 (millions of chained 2005 dollars) and Eurostat for the euro area). For the euro area, national account series are available from 1995 only. To backdate the series, we use the rates of growth of the series in the Area Wide Model database (AWM, see Fagan et al., 2001 for details).

Concerning the confidence indicators, a comprehensive description for the U.S. case can be found in Bram and Ludvigson (1998). As the authors note the University of Michigan's Consumer Sentiment Index (UMCSI) and the Conference Board's Consumer Confidence Index (CBCCI) are the most widely followed measures of U.S. consumer confidence. They both consist of five survey questions where respondents are asked to assess current conditions and to reveal expectations about the future. With respect to the current conditions the surveys differ somewhat: while the UMCSI surveys consumers about major expenditures and changes in the respondant's financial situation, the CBCCI inquiries focus on job availability and current business conditions. It is then possible that both indexes may at times send mixed signals about consumer confidence depending on the relative performance of the variables that may be more relevant towards expenditures decisions and current balances, with respect to the factors that determine unemployment and other labor market related issues. As the main results are robust whatever index used, we present here only those based on the UMCSI. Results based on the CBCCI are available upon request.

For the euro area, we use the index constructed by the Directorate General for Economic and Financial Affairs of the European Commission, which conducts regular harmonised surveys for different sectors of the economies in the European Union (EU) and in the applicant countries. They are addressed to representatives of the industry (manufacturing), the services, retail trade and construction sectors, as well as to consumers (ECCCI).

The explanatory variables that we will treat later as "economic fundamentals" are variables usually found to have some predictive power to explain changes in consumption. They include real disposable income, financial and housing wealth, real stock prices, short-term interest rates, unemployment rate and real oil prices. For the United States, as Bram and Ludvigson (1998), we use data from the National Product Income Accounts, produced by the Bureau of Economic Analysis of the Department of Commerce. To proxy real income, we use real wages and supplements net of transfers using the NIPA table 2.1 - items Wages and salary disbursements minus Personal current transfer receipts and then adjusted by the personal consumption expenditures deflator taken from NIPA table 1.1.9 (2005 = 100). For interest rates, we use the quarterly averages of the 3 month treasure bill rate, available from the Board of Governors of the Federal Reserve System. Compared with Bram and Ludvigson (1998), we have a relatively rich set of wealth variables. Besides the traditional Standard and Poor's 500 composite index, we also make use of Financial and Real Estate Wealth stocks. Finally the unemployment rate is obtained from the Bureau of the Labor statistics and we take the average of Brent, Dubai and WTI as oil prices. All nominal variables are deflated making use of the above referred consumption deflator.

With respect to the data related to the euro area variables, they are taken from the Area-Wide Model Database. The historical data are based on the aggregation of available country information when the original AWM database was compiled. The main source for the country information is Eurostat, complemented by the OECD National Accounts, the OECD Main economic indicators, the BIS and the AMECO databases. The data, as well as methodology notes are available at http://www.eabcn.org/data/awm/index.htm. Also, for the stock market we use the EuroArea

Share Real Price Index.

3 Do confidence indicators bring additional information beyond economic fundamantals?

We start our empirical analysis by running unit root ans casality test. Thereafter, we estimate a simple consumption equation where a confidence indicator is considered as an explanatory variable for consumption together with standard variables used in the empirical literature on consumption expenditures. Finally, we estimate a VAR model to derive impulse response functions and historical decomposition.

3.1 Unit root and Granger causality tests

We first perform Augmented Dickey-Fuller tests in order to determine the order of integration of the variables. For the United States, most variables are integrated of order one or I(1). Unexpectedly, the natural logarithm of real personal consumption expenditure appears be I(2). However, graphical inspection and theoretical insights should put some caution in this pure statistical analysis, as there is no theory that may suggest such an outcome. In the empirical part, we will therefore ignore this odd outcome, as trend stationarity or even integrated of order one processes seem to be the most theoretical sound data generator process for variables as income and consumption. For the euro area, all variables, including consumption, are found to be I(1).

We then study Granger causality among the various variables of our dataset. Table 1 presents the results of the Granger causality analysis with 5 lags. P-values reported for the probability of Row **NOT** Granger-causing Column. Rejections of the null hypothesis for 5% significance level are in bold. For the United States, consumption is Granger-caused by wealth and equity prices. For the euro area, consumption is Granger-caused by confidence and interest rates only.

We also perform the Granger causality tests for confidence. In the United States, confidence is Granger-caused by financial wealth and equity prices, while in the euro area, unemployment rate, interest rates and foreign confidence are the only variables that Granger cause domestic confidence.

The results of the Granger causality tests are somewhat informative. They confirm that wealth effects might be stronger in the United States than in the euro area. In the U.S. case, wealth seems not only to cause consumption but also consumer confidence. Also, confidence seems to influence consumption in the euro area while no causal link can be found in the U.S. case. Finally, the causality found between U.S. confidence and euro area confidence indicates possible confidence linkages between the two economic areas. These results remain however very partial. The estimation of consumption models together with a dynamic analysis are necessary to understand better the role of the various possible determinants of consumption expenditures and their complex dynamic relationships.

3.2 Estimation of a simple model for consumption

We extend our causality analysis with the estimation of a very simple model where the change in (ln) consumption ($\Delta \ln C_t$) only depends on the change in confidence indicators ($\Delta conf_t$),

$$\Delta \ln C_t = \alpha + \sum_{i=1}^{q} \beta_i \Delta conf_{t-i} + \epsilon_i \tag{1}$$

where ϵ_i is the error term.

Table 2 presents the results for both the United States and the euro area. The lag order (q) is determined using standard information criteria and 2 lags are found to be optimal for all models estimated. Using only the past changes in consumer confidence indicators could explain 8% and 10% of the variation of consumption changes in the U.S. and the euro area respectively.

We then compare this simple model with alternatives that include a set of fundamental variables. We study three different sets of fundamentals. The first (Z_t^1) only includes past changes in consumption together with past changes in (ln) real disposable income ($\Delta \ln Y_t$). The second one (Z_t^2) also includes changes in wealth (both financial and housing wealth $-$ $\Delta \ln W_t-$). The third set of fundamentals (Z_t^3) includes variables that might influence consumption behaviours even though no theory includes them directly as fundamentals. These variables are the log-changes in real equity prices ($\Delta \ln q$), the changes in short-term interest rates (Δi), in unemployment rate (Δu) and in (ln) real oil prices ($\Delta \ln roil$). For each set of fundamentals, we compare the $\overline{R}^2$ of the model (Eq. 2) with that of an alternative version that also includes the changes in confidence indicators (Eq. 3).

$$\Delta \ln C_t = \alpha + \sum_{i=1}^{q} \gamma_i Z_{t-i}^k + \epsilon_i, \text{ for } k = 1, 2, 3. \tag{2}$$

$$\Delta \ln C_t = \alpha + \sum_{i=1}^{q} \beta_i \Delta conf_{t-i} + \sum_{i=1}^{q} \gamma_i Z_{t-i}^k + \epsilon_i, \text{ for } k = 1, 2, 3. \tag{3}$$

As shown by Table 2, expanding the set of fundamentals increases the $\overline{R}^2$. While Z_t^1 already explains 18% of the linear variation in U.S. consumption expenditure changes, the $\overline{R}^2$ increases to 35% with Z_t^2 and 42% with Z_t^3. For the euro area, the $\overline{R}^2$ are surprisingly lower with Z_t^1 and Z_t^2 (9% and 7% respectively). The $\overline{R}^2$ increases however to 16% when using Z_t^3.

Differences between the two economic areas are even more striking when adding confidence indicators to the models. While for the United States, including confidence indicators does not increase the goodness of fit of the model, it improves that of the euro area. Indeed, in the U.S. case, the $\overline{R}^2$ are similar for models (3) and (2), except for the case when we compare the Z_t^1 model with one with just confidence. For the euro area the best model is the one including confidence indicators together with Z_t^3, explaining almost 18% of the linear variation in consumption expenditure changes. While the $\overline{R}^2$ might appear low given the number of variables used, it is important to notice that

no contemporaneous variables are used in these estimations, since we focus on the predictive power of variables at a one-period ahead horizon.

Finally, we consider a last model that include on top of the largest set of fundamentals (Z_t^3) and the domestic confidence indicators, the corresponding foreign fundamentals (Z_t^{3*}). As before, we test if adding the confidence indicators abroad ($conf_t^*$, i.e. euro area confidence in the U.S. model and U.S. confidence in the euro area model) improves the fit by comparing the $\overline{R}^2$ of (4) and (5).

$$\Delta \ln C_t = \alpha + \sum_{i=1}^{q} \beta_i \Delta conf_{t-i} + \sum_{i=1}^{q} \gamma_i Z_{t-i}^3 + \sum_{i=1}^{q} \delta_i \Delta Z_{t-i}^{3*} + \epsilon_i \tag{4}$$

$$\Delta \ln C_t = \alpha + \sum_{i=1}^{q} \beta_i \Delta conf_{t-i} + \sum_{i=1}^{q} \gamma_i Z_{t-i}^3 + \sum_{i=1}^{q} \delta_i \Delta Z_{t-i}^{3*} \sum_{i=1}^{2} \lambda_i \Delta conf_{t-i}^* + \epsilon_i \tag{5}$$

Here again while adding euro area variables (with or without euro area confidence) does not improve the U.S. model's goodness-of-fit, the euro area one improves when adding U.S. fundamentals (the $\overline{R}^2$ rises from 18% to 27%) and improves even further when adding U.S. confidence (the $\overline{R}^2$ rises to 30%). This result undelines the role of U.S. developments to predict euro area ones. As shown by Giannone et al. (2009) the U.S. business cycle is leading the euro area business cycle. The increase in the predictive power in the euro area models when including U.S. variables then reflects the fact the U.S. consumers perceive earlier than the euro area consumers a change in the business cycle. Moreover, the further increase in the fit between (4) and (5) suggests the existence of a "confidence channel" that reflects the fact that news spreads across the globe quickly. A change in the U.S. confidence, anticipating a future change in the business cycle, might then affect domestic confidence, which in turn has an impact on domestic business cycle. This result is in line with a recent study by Fei (2011) who finds empirical evidence of the existence of a confidence channel from "large countries" to "smaller countries". Even after having controlled for domestic macroeconomic causes of confidence level variations, the level of confidence of agents in large countries does have an influence on the level of confidence of agents in smaller countries.

Although this analysis remains relatively simple, it helps to draw some tentative conclusions. First, while for the U.S. confidence indicators do not seem to help predicting consumption expenditures when taking fundamentals into account, they may contain some valuable information in the euro area case. Second, the results of model (5) indicates the presence of a one-way "confidence linkage" between the United States and the euro area. In other words, past changes in the U.S. confidence indicators would contain information about current changes in euro area consumption. The opposite would not be true. This result is not necessarily surprising, given the importance the release of U.S. confidence indicators has in the economic press and on financial markets. This is less so when euro area confidence indicators are released.

3.3 VAR analysis

We now set up a VAR modelling framework to help us analyse the dynamics of the impacts of a shock to confidence on consumption expenditures through impulse response functions. In a first step, we estimate country-specific VAR models using the same variables as in the univariate estimations above. This allows us to test the statistical significance of the confidence indicators through the error bounds of the impulse response functions. We also estimate models where a foreign confidence indicator is added to the set of domestic fundamentals, in order to find evidence of any "confidence linkage" between the United States and the euro area. In a second step, we compute historical forecast error variance decomposition to graphically see how the contribution of confidence shocks has changed over time.

We estimate first the preferred model for U.S. consumption (Eq. (3)) in a VAR setting, using the largest set of fundamentals (Z_t^3).

We therefore have the following VAR model to estimate:

$$y_t = \sum_{i=1}^{q} A_i y_{t-i} + \mu_i, \tag{6}$$

$$\text{where } y = \begin{pmatrix} \Delta \ln C_t \\ \Delta conf_t \\ Z_t^3 \end{pmatrix} \tag{7}$$

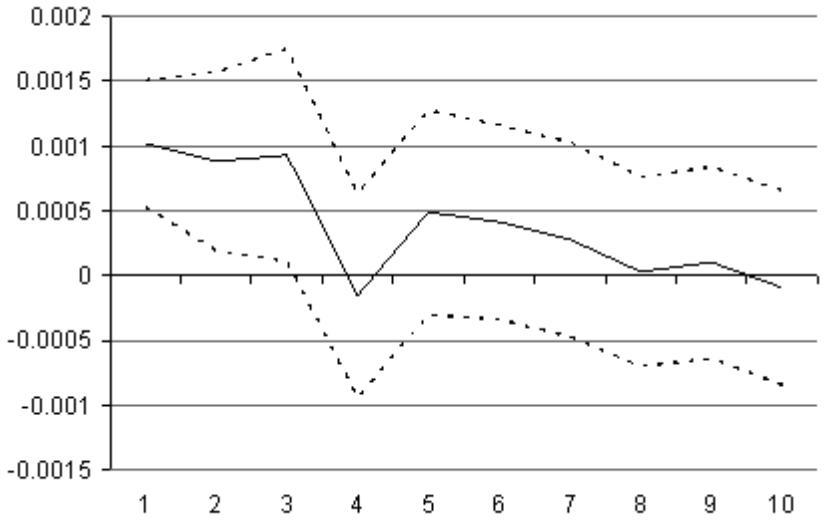
and μ_i is a vector of orthogonalised shocks. The orthogonolasition is done via a Choleski approach using the following ordering (as Bram and Ludvigson, 1998): confidence, financial variables, interest rates, wealth, consumption and income. Here again, the optimal lag order (q) is found to be equal to 2 according to standard information criteria.[3]

Figure 4 shows the impulse response functions of a shock to confidence on real consumption in the United States. The impulse responses of the confidence shocks appear significant for two periods ahead but insignificant at the 95% level for future periods. The variance decomposition (not shown here) also shows some effect of confidence on consumption (slightly more than 10% of the variance would be due to confidence), though the confidence bounds[4] shows that the degree of significance remains borderline.

[3] The lag order was selected by using various criteria, including the Sequential modified LR test statistic, Final prediction error, Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion. Although the final selection has remained subjective - since the various criteria often give conflicting results -, we decided to keep the same lag order whatever model considered for the sake of comparability and consistency.

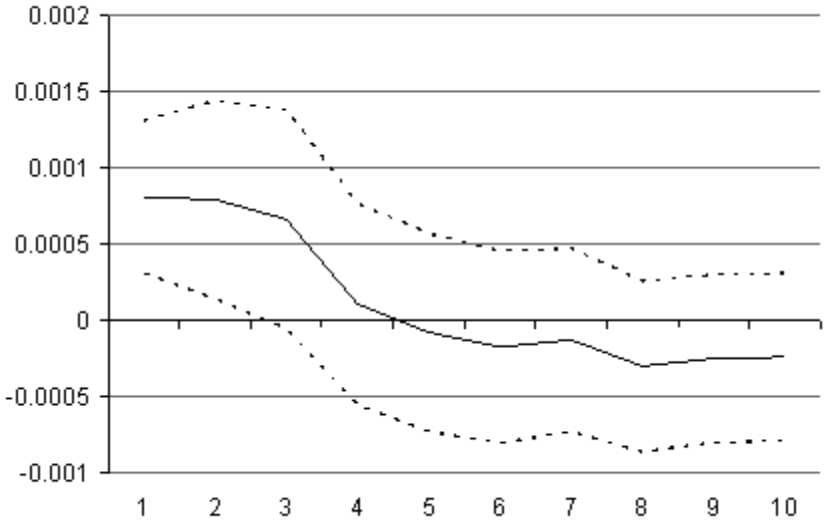
[4] The 95% confidence bounds are boostrapped, 1000 draws.

Figure 4: United States: Responses to a 1 sd innovation in confidence on consumption growth with 95% error bounds



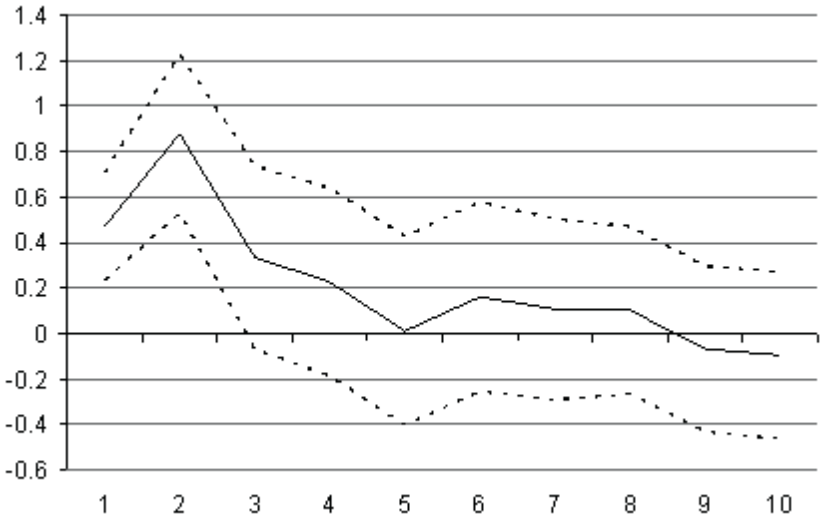
For the euro area (Figure 5), a shock to confidence has some short-term, significant impact on consumption. Nonetheless, as for the United States, there is no long-run significant correlation between confidence and consumption growth. Variance decomposition (not shown here) also shows that around 15% of the variance would be explained by confidence shocks.

Figure 5: Euro area: Responses to a 1 sd innovation in confidence on consumption growth with 95% error bounds



As with the simple models, we also add to our set of fundamental variables the foreign variables corresponding to Z_t^{3*} as well as the change in foreign confidence ($\Delta conf_t^*$). This allows us to check to what extent foreign confidence could have some impact on domestic confidence, while controling for the foreign influences going through the linkages between foreign and domestic fundamentals. While for the United States, a shock to euro area confidence has no impact on neither U.S. confidence nor U.S. consumption, the impact of a U.S. confidence shock has some significant impact on the euro area confidence in the short run (Figure 6), thus confirming the existence of a "confidence channel" between the U.S. and euro area economies.

Figure 6: Euro area: Responses to a 1 sd innovation in US confidence on EA confidence with 95% error bounds



We use next the historical decomposition technique to describe the relative importance of shocks to confidence and shocks to the other fundamental variables. As first explained by Burbidge and Harrison (1985), the historical decomposition is based on the reorganization of the moving average representation of (6):

$$y_t = \sum_{i=0}^{\infty} C_i \mu_{t-i} \tag{8}$$

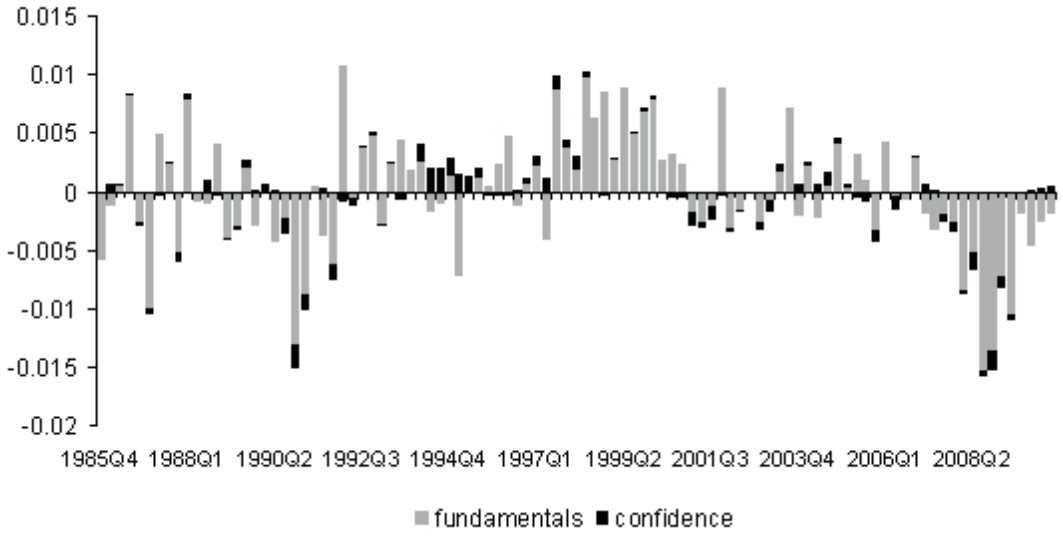
where y is a column vector of the endogenous variables, C is the moving average matrix implied by the estimated coefficients and μ a vector of innovations (the non-forecastable components of y,). For a particular period $t+j$, Equation (8) can be written as:

$$y_{t+j} = \sum_{i=0}^{j-1} C_i \mu_{t+j-i} + \sum_{i=j}^{\infty} C_i \mu_{t+j-i} \tag{9}$$

which represents the historical decomposition. This decomposition has two types of terms. The far right side term represents the expectation of y_{t+j} given information available at time t, the "base projection" of the vector y. The first term on the right-hand side shows the difference between the actual series and the base projection due to the structural innovations in the variables subsequent to period t; that is, it shows that the gap between an actual series and its base projections the sum of the (weighted) contributions of the structural innovations to the individual series in the analysis. Thus, the actual data at period $t+j$ are the sum of the base projection and the weighted structural innovations to the system variables. As indicated above, these structural innovations are assumed orthogonal to one another. Overall, the historical decomposition allows us to quantify the relative importance of specific shocks to each variable. In our case, the historical decomposition allows us to determine the relative importance for real consumption expenditures, either in a particular quarter or over some longer time period, of a shock to confidence or to a fundamental variable.

Figures 7 and 8 show respectively for the US and the euro area the contributions to the deviations between actual consumption and its VAR-based forecasts of shocks to confidence and the set of fundamental variables (Z_t^3). As expected the confidence shocks play a relatively small role on average relative to shocks to fundamentals. However, there are periods during which confidence seems to play an important role.

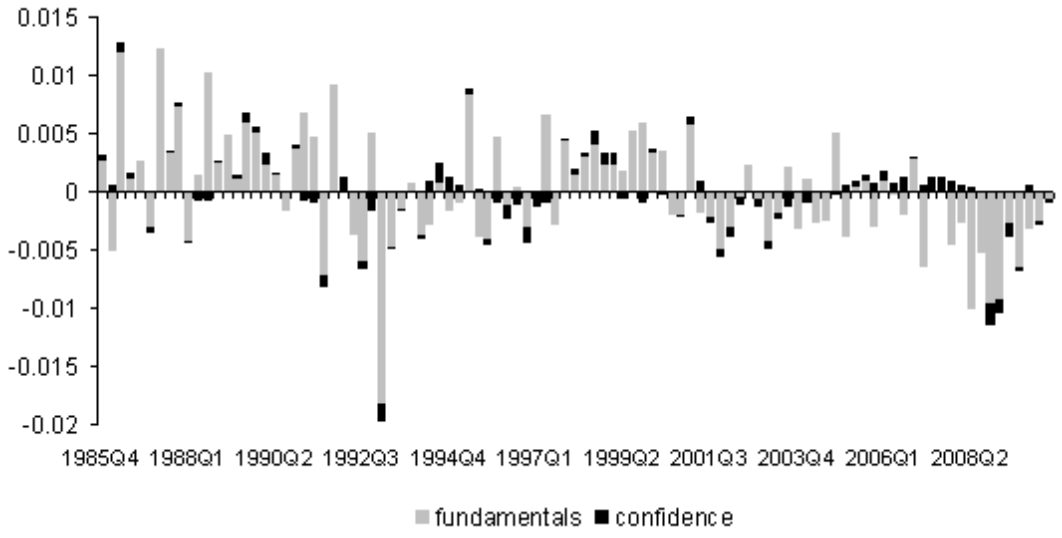
Figure 7: Historical forecast error decomposition – United States



Looking at the U.S. results first (Figure 7), we can notice that while the contribution of confidence shocks tends to oscillate around zero, such shocks had larger negative influence to forecast errors during very specific episodes. We can try to map such negative contributions to particular events that are likely to have affected consumer confidence. For instance, confidence shocks contribute negatively to forecast errors during geopolitical tensions or US military interventions in the

Middle East in early 1990s and in 2001-02. Negatively contributions also appear clearly during the 2007-09 financial crisis (2008Q2 following Bear Stearns and 2008Q4 following Lehman Brothers).

Figure 8: Historical forecast error decomposition – Euro area



Concerning the euro area (Figure 8), confidence shock contributions are clearly negative during recessions and financial crises (like in 1992-93 or 2008-09), going therefore in the same direction as shocks to fundamentals and even anticipating them sometimes (like in the early 1990s). Negative confidence shock contributions are however sometimes absorbed by positive contributions of other shocks, like during the Asian crisis in 1997 or at the turn of the millenium. On the contrary, strong positive contributions can also be found in 1994 at the time where contributions to shocks to fundamentals were clearly negative. Similarly, confidence shocks contributed positively in 2006-07, counterbalancing negative contributions by shocks to fundamentals.

Overall, the historical contribution exercise shows that confidence seems to matter in some specific episodes, which in most cases corresponds to periods where there are large changes in household survey indicators, like during financial crises or geopolitical tensions for instance.

4 Isolating periods in which confidence matters

To capture better the fact that confidence might play a role only in some particular circumstances, we perform a non-linear estimation of our consumption equation, assuming that there is a certain (unknown) threshold in confidence index changes beyond which confidence starts impacting consumption behaviours. We present first the threshold estimation approach before showing evidence for the U.S. and the euro area consumption, both in sample and out of sample.

4.1 A threshold model

In this exercise we try to test to what extent removing low frequency observations from the confidence indicators can improve the goodness of fit of the forecasting equations. Following Desroches and Gosselin (2002), we use the following criterion to censor observations:

$$\Delta conf_t^C = \begin{cases} 0 \; if \; |\Delta conf_t| < \theta \\ \Delta conf_t \; otherwise \end{cases} \tag{10}$$

This produces a series of confidence vectors ($conf_t^C$), each of them that will have their observations censored i.e. set to zero, if their absolute change is below a determined threshold. By letting θ go from zero to its highest possible value i.e. $\max|\Delta conf_t|$, we produce a number of different confidence vectors equal to the total sample size. We then estimate our models using each one of this vectors and look for the one with the best performance, thus being able to find the optimum θ i.e. the threshold for which by setting all changes in confidence to zero below this value, we maximize the fit of the model (as described below in the text).

By following the above threshold methodology, we test the assumption that small changes in confidence do not matter much to explain future consumption expenditures but that large confidence shocks is likely to bring some extra information beyond economic fundamentals. This can be understood as a study of a particular type of non-linear behavior of confidence with respect to consumption growth or as a structural break test to the standard linear relation estimated in the previous sections.

As before, we will estimate a series of models, first with confidence alone, and then adding the set of controls. If we use lagged consumption in the estimation, then autocorrelation of the residuals will render the OLS estimates biased and inconsistent. As Bram and Ludvigson (1998) point out, due to the nature of consumption and its composition between durables and non-durables, we should expect a consumption regression to include moving average components which then render OLS as an inadequate estimation procedure in the presence of lagged dependent variables. Instead of adding more lags to remove the residual autocorrelation (as usually done), we prefer adding a MA component under the argument that this is the correct specification to assume once consumption expenditures includes durables. In general, all the specifications we use in our estimations will be particular cases of what are known in the literature as ARMAX, auto-regressive moving average with external regressors models:

$$X_t = \varepsilon_t + \sum_{i=1}^{p} \varphi_i X_{t-i} + \sum_{i=1}^{q} \theta_i \varepsilon_{t-i} + \sum_{i=1}^{b} \eta_i d_{t-i}$$

As said before, as long as $\varphi_i = 0, \; \forall \; i$, an estimation procedure using ordinary least squares will produce consistent estimates. The Newey-West procedure will assymptotically correct any heteroscedastic structure in the residuals. However, as long as $\varphi_i \neq 0$, we need to use an alternative estimation method and we use an iterative procedure that minimizes a robustified quadratic

prediction error criterion (see Ljung, 1999). Initial parameter values are constructed resorting to a special-four stage LS-IV algorithm.

However, regardless of the adequate estimation procedure to each of the cases, the approach is still the same. We aim at finding, for each model, the confidence vector that will maximize a measure of fit (which would be to maximize R^2 for the OLS case, and minimize the Final Prediction Error (FPE) when minimizing the robustified quadratic prediction error criterion). We then report some summary statistics concerning the estimated model and have a focus both on the timing of the censored confidence observations for the optimal confidence vector and the magnitude of the threshold below which it was optimal to set to zero all observations from the confidence vector.

4.2 In-sample evidence

As above, we first estimate models relating consumption and confidence before estimating models that also include other fundamentals.

The first threshold model to be tested is similar to Eq. (1) except that we limit the lag order to one, include a moving average component and two lags of the dependent variable. We limit the lag order of the confidence measure to one as this variable is subject to censoring Although having two thresholds (one for each lag of the confidence measure) would not be technically impossible, it would complicate the analysis.

$$\Delta \ln C_t = \alpha + \sum_{i=i}^{2} \Delta \ln C_{t-i} + \beta \Delta conf_{t-1}^{C} + \epsilon_t + \rho \epsilon_{t-1} \tag{11}$$

where the upperscript C stands for "censored" i.e. some observations were set to zero. This forecast performance of this model is tested against two alternatives: a model without confidence and a model where confidence is not censored. Results are reported in Table 3 (Column A) for the United States and Table 4 (Column A) for the euro area.

For the United States, the FPE is about 3% smaller when censoring observations according to our threshold algorithm than when we do not censor observations at all. Both point estimates seem to be similar and their statistical significance is well above 99%. From an optimization perspective, 43 out of 101 observations are censored. The optimal threshold found is of 2.4 which from a model fitting perspective means that it is optimal to set all confidence changes to zero if they are found to be below that value.

For the euro area, the number of observations that are censored in the optimal regression is of 41 (Table 4 - Column A). the FPE is about 12% smaller when censoring observations according to our threshold algorithm than when we do not censor observations at all. The point estimate of the coefficient of the censored confidence variable is close to its uncensored counterpart, and statistically significance is well above 99% for both, though the coefficient of confidence in the threshold model was found to have slightly higher statistical significance. The optimal threshold was found to be of 1.4, well below the standard deviation for confidence of 2.9204.

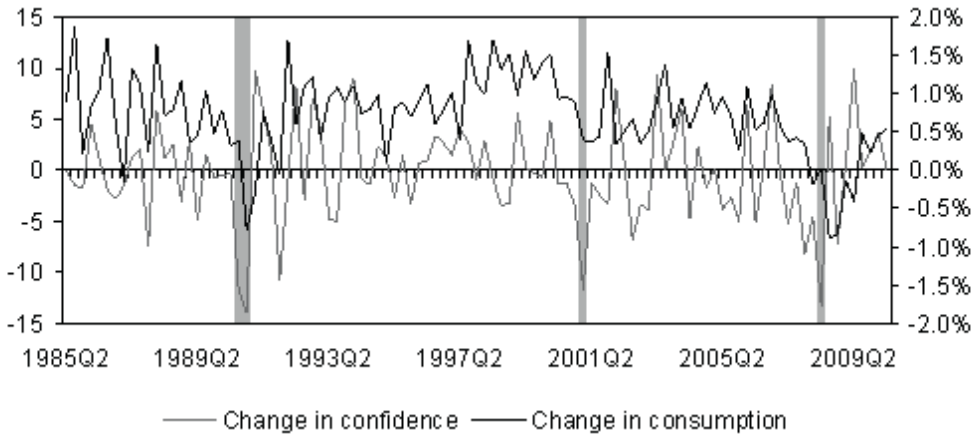
The second threshold model introduces the series of economic fundamentals that have been used before (Z_t^3). The same lag length is used for all the fundamental variables. To remain consistent with the previous analysis, we use two lags. This lag order is also consistent with standard information criteria. As before, confidence measure is lagged only by one period. The specification is the one below. Notice that Z_t^3 also include two lags of the dependent variable. Also, we include a moving average component as previously mentioned.

$$\Delta \ln C_t = \alpha + \beta \Delta conf_{t-1}^{C} + \sum_{i=1}^{2} \boldsymbol{\gamma} Z_{t-i}^{3} + \epsilon_t + \rho \epsilon_{t-1}$$

Results are reported in Table 3 (Column B) for the United States and Table 4 (Column B) for the euro area.

For the U.S. case, we find that the threshold model has an improvement of fit relative to the model including uncensored confidence indicators. The residuals (one-step ahead prediction errors) are 12% smaller. The point estimate of the censored confidence vector coefficient is more than 3 times larger than the one for the uncensored model and significant at the 95% level. Many more confidence observations are now censored as only 4 are left uncensored, which is in line with our previous findings (i.e. confidence is indeed not robust to the inclusion of fundamentals). The optimal threshold is found to be equal to 11.7, i.e. larger than two standard deviations of confidence. The point that in the context of this model, "extreme" confidence changes are the ones that matter the most is therefore reinforced. As shown by Figure 10, the periods where confidence is uncensored corresponds to the beginnings of recession.

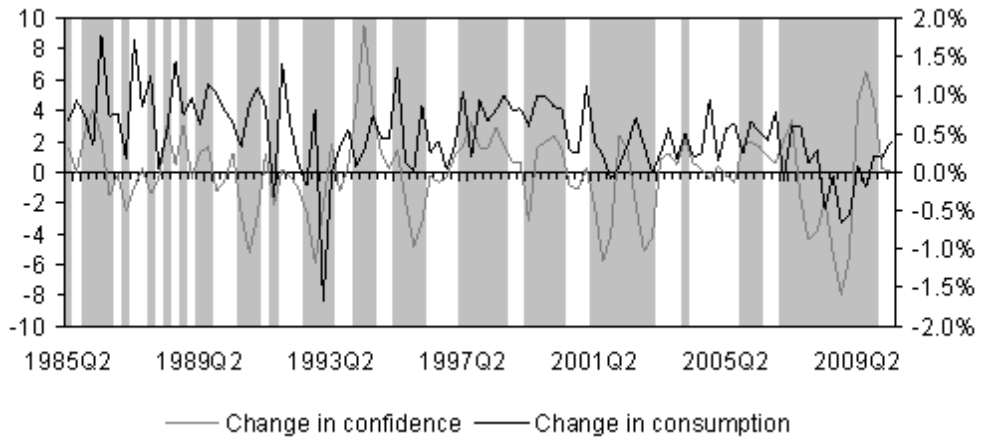
Figure 10: United States: Consumption growth (rhs) and change in confidence (lhs).
(Grey areas show periods where confidence is uncensored)



For the euro area, the results do not change much, in line to our previous findings that the information contained in confidence is comparably more robust to the inclusion of economic fundamentals than in the U.S. case. There is only a modest improvement in the fit of the FPEs relative

to the model with uncensored confidence indicators. The point estimate of the censored confidence variable slightly exceeds the uncensored one and they are significant at 99%. Too many observations were left uncensored for us to try to map them into some historical events, but it is worth noting that the time where confidence is uncensored for the larger consecutive number of periods is precisely the 2007-09 years.[5]

Figure 11: Euro area: Consumption growth (rhs) and change in confidence (lhs).
(Grey areas show periods where confidence is uncensored)

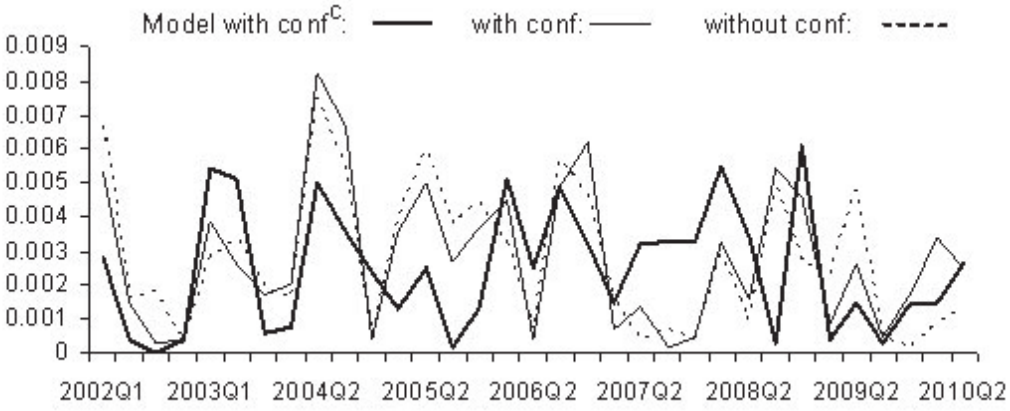


4.3 Out-of-sample evidence

Finally, we perform some out-of-sample analysis to check to what extent and in which circumstances the threshold models outperform models where the confidence vector is subject to no censoring or not included at all. Each exercise is performed both for the United States and the euro area and consists of one-step ahead forecasts over the period 2002Q1-2010Q2. These forecasts are obtained using models, whose parameters are estimated using data up to t-1. Root mean square errors are computed and used as comparison between models.

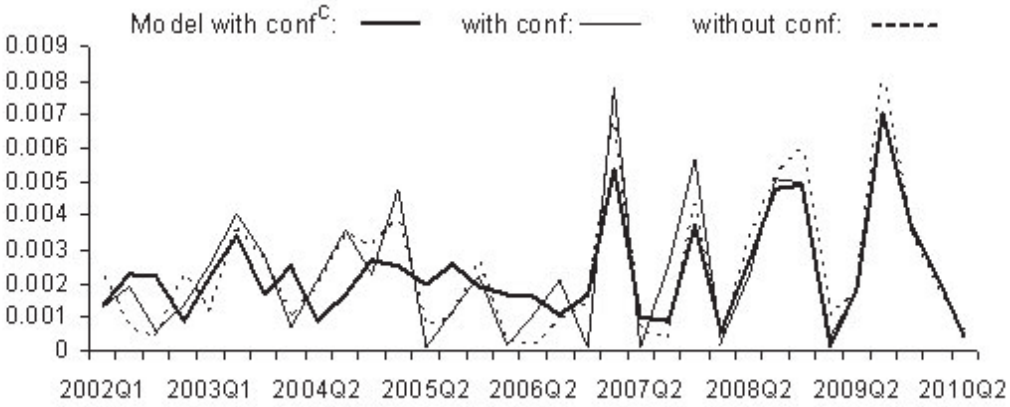
[5] We have also estimated a third threshold model, which includes a foreign confidence indicator among the explanatory variables. In the U.S. case, adding euro area confidence as a regressor does not affect the number of censored regressions. With respect to the euro area, by adding two lags of the U.S. confidence measure, 7 more euro area confidence observations are censored. Moreover, the model fit increases when compared with their counterpart without U.S. confidence, thus reinforcing previous findings of some linkages between U.S. confidence and euro area variables. Results are available upon request.

Figure 12 - United States: Absolute forecast errors



Note: "Model with conf^C" corresponds to the threshold model with censored confidence; "Model with conf" corresponds to the model with uncensored confidence; "Model without conf" corresponds to the model without confidence.

Figure 13 - Euro area: Absolute forecast errors



Note: "Model with conf^C" corresponds to the threshold model with censored confidence; "Model with conf" corresponds to the model with uncensored confidence; "Model without conf" corresponds to the model without confidence.

Although it is difficult to graphically discern a model that systematically produces smaller forecast errors (Figure 12 for the United States and Figure 13 for the euro area), we can notice that models with confidence seem to outperform during periods of geopolitical tensions, like in 2003-4, or during the financial crisis. When computing the RMSEs of the three models (Table 5), they are all smaller than the standard deviation of the US consumption measure for the period under analysis. The same applies for the euro area.

In relative terms, the threshold models result in a smaller relative RMSE (0.897 for the United States and 0.892 for the euro area) than the model with uncensored confidence (slightly above 1) or the simple model with no confidence (normalized to 1). Forecast accuracy tests (based on Clark and West, 2007) show that the threshold models provide significant improvements compared with a model without confidence for both the U.S. and the euro area. These results show that the improvement in forecast accuracy due to nonlinearity is statistically significant.

5 Conclusions

This paper has proposed an empirical assessment of the link between consumer sentiment and consumption expenditures for the United States and the euro area. Overall, the results show that the consumer confidence index can be in certain circumstances a good predictor of consumption. In particular, out-of-sample evidence shows that the contribution of confidence in explaining consumption expenditures increases when household survey indicators feature large changes, so that confidence indicators can have some increasing predictive power during such episodes. Moreover, there is some evidence of a "confidence channel" in the international transmission of shock, as U.S. confidence indices lead consumer sentiment in the euro area.

Future research includes extensions to other countries. In the euro area case, in particular, it would be interesting to verify whether the conclusions at the area level are confirmed at the level of the different countries. For instance, our results contrast with those found by Al-Eyd et al. (2008), who do not find consumer confidence to be a good predictor for consumption for the three largest euro area countries (Germany, Italy and France). It would then be worth understanding whether aggregation could be responsible for these differences. Moreover, extensions could concern other variables. As surveys also report business sentiment, similar research could be done on the predictive power of confidence on investment decisions. By extension, combining consumer and business survey data could help improve the forecast of GDP fluctuations.[6] Finally, we have only used the aggregate index of confidence surveys. Various subcomponents could be used as alternatives, as they might provide more precise information about agents' perceptions about the future.

[6] Taylor and McNabb (2007) provde some evidence for Europe that both consumer and business confidence indicators are procyclical and generally play a significant role in predicting business cycle downturns.

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Tables and charts

Table 1: Granger causality tests

	United States		Euro area	
	$\Delta conf$	$\Delta \ln C$	$\Delta conf$	$\Delta \ln C$
$\Delta conf$	-	0.06	-	**0.00**
$\Delta \ln C$	0.27	-	0.37	-
$\Delta \ln Y$	0.27	0.64	0.10	0.63
$\Delta \ln W$	-	-	0.25	0.25
$\Delta \ln W^f$	**0.01**	**0.02**	-	-
$\Delta \ln W^h$	0.37	**0.00**	-	-
$\Delta \ln q$	**0.07**	**0.01**	0.66	0.22
Δi	0.77	0.65	**0.01**	**0.00**
Δu	0.33	0.56	**0.01**	0.97
$\Delta roil$	0.26	0.10	0.29	0.42
$\Delta conf^*$	0.19	0.39	**0.00**	0.21

Notes: $conf$: confidence index; C: real consumption expenditures; Y: real disposable income; W: wealth; q: real equity prices; i: short-term interest rates; u: unemployment rate; $roil$: real oil price; $conf^*$: foreign confidence. Δ indicate first differences. P-values reported for the probability of Row NOT Granger-causing Column. Analysis performed using 4 lags. For the euro area, only total wealth is available, whereas for the United States, both financial wealth (W^f) and housing wealth (W^h) are used as fundamentals.

Table 2: Univariate specifications

Equation	$\overline{R}^2$ United States	Eurc
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \beta_i \Delta conf_{t-i}$	0.08	0.
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \gamma_i \Delta Z^1_{t-i}$	0.18	0.
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \beta_i \Delta conf_{t-i} + \sum_{i=1}^{2} \gamma_i \Delta Z^1_{t-i}$	0.20	0.
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \gamma_i \Delta Z^2_{t-i}$	0.35	0.
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \beta_i \Delta conf_{t-i} + \sum_{i=1}^{2} \gamma_i \Delta Z^2_{t-i}$	0.34	0.
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \gamma_i \Delta Z^3_{t-i}$	0.42	0.
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \beta_i \Delta conf_{t-i} + \sum_{i=1}^{2} \gamma_i \Delta Z^3_{t-i}$	0.42	0.
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \beta_i \Delta conf_{t-i} + \sum_{i=1}^{2} \gamma_i \Delta Z^3_{t-i} + \sum_{i=1}^{2} \delta_i \Delta Z^{3*}_{t-i}$	0.42	0.
$\Delta \ln C_t = \alpha + \sum_{i=1}^{2} \beta_i \Delta conf_{t-i} + \sum_{i=1}^{2} \gamma_i \Delta Z^3_{t-i} + \sum_{i=1}^{2} \delta_i \Delta Z^{3*}_{t-i} + \sum_{i=1}^{2} \lambda_i \Delta conf^*_{t-i}$	0.41	0.

Notes: $Z^1_t = (\Delta \ln C_t, \Delta \ln Y_t)$, $Z^2_t = (\Delta \ln C_t, \Delta \ln Y_t, \Delta \ln W_t)$, $Z^3_t = (\Delta \ln C_t, \Delta \ln Y_t, \Delta \ln W_t, \Delta \ln q, \Delta i, \Delta u, \Delta \ln roil)$. "*" for foreign variables. For the definition of the variables, see Table 1 notes.

Table 3: United States: In-sample forecasting exercise

Models	(A) Without Z_t^3	(B) With Z_t^3
Final Prediction Error (FPE)		
Without confidence (1)	2.6173e-005	1.9822e-005
With $conf_t$ (2)	2.1865e-005	1.9685e-005
With $conf_t^C$ (3)	2.1202e-005	1.7312e-005
(2)/(1) × 100	83.54	99.31
(3)/(2) × 100	96.97	87.95
Coefficients (β)		
With $conf_t$	0.00029283	0.00020333
(t-stat)	*(3.6158)*	*(1.867)*
With $conf_t^C$	0.00033459	0.00070706
(t-stat)	*(4.9437)*	*(4.257)*
θ^*	2.4333	11.6667
censored obs for θ^*	43	97
memo		
$\sigma\,(conf.\ measure) = 4.8995$		
total observations = 101		

Notes: $Z_t^3 = (\Delta \ln C_t, \Delta \ln Y_t, \Delta \ln W_t, \Delta \ln q, \Delta i, \Delta u, \Delta \ln roil)$. For the definition of the variables, see Table 1 notes. Model with conf_t corresponds to the model with uncensored confidence; Model with conf_t^C corresponds to the threshold model with censored confidence. $\theta^*$is the value of the threshold. $\sigma\,(conf.\ measure)$ reports the standard deviation of the confidence index over the estimation period.

Table 4: Euro area: In-sample forecasting exercise

Models	(A) Without Z_t^3	(B) With Z_t^3
Final Prediction Error (FPE)		
Without confidence (1)	2.4193e-005	2.2698e-005
With $conf_t$ (2)	2.1134e-005	2.1539e-005
With $conf_t^C$ (3)	1.8582e-005	2.1257e-005
(2)/(1) × 100	83.35	94.89
(3)/(2) × 100	87.92	98.69
Coefficients (β)		
With $conf_t$	0.00042918	0.00042991
(t-stat)	*(4.1572)*	*(2.4025)*
With $conf_t^C$	0.00037916	0.00047505
(t-stat)	*(5.3078)*	*(2.5942)*
θ^*	1.4	1.3
censored obs for θ^*	41	40
memo		
$\sigma\,(conf.\ measure) = 2.8075$		
total observations = 101		

Notes: $Z_t^3 = (\Delta \ln C_t, \Delta \ln Y_t, \Delta \ln W_t, \Delta \ln q, \Delta i, \Delta u, \Delta \ln roil)$. For the definition of the variables, see Table 1 notes. Model with conf_t corresponds to the model with uncensored confidence; Model with conf_t^C corresponds to the threshold model with censored confidence. $\theta^*$is the value of the threshold. $\sigma\,(conf.\ measure)$ reports the standard deviation of the confidence index over the estimation period.

Table 5: Out-of-sample forecasting exercise over 2002Q1-2010Q2

	United States	Euro area
Equation	Root Mean Square Error	
Without confidence (1)	0.0034	0.0031
With $conf_t$ (2)	0.0035	0.0031
With $conf_t^C$ (3)	0.0031	0.0028
$\sigma\,(\Delta \ln (consumption))$	0.0051	0.0038
(2)/(1)	1.0259	1.0203
(t-stat)	*(0.7553)*	*(0.3957)*
(3)/(1)	0.8967*	0.8993*
(t-stat)	*(3.0019)*	*(3.8884)*

Notes: Model with conf_t corresponds to the model with uncensored confidence; Model with conf_t^C corresponds to the threshold model with censored confidence. $\sigma\,(\Delta \ln(consumption))$ reports the standard deviation of the (log) change in consumption over the estimation period. * Equal predictive power test rejected at 95% (rejection if t-stat higher than 1.65) - See Clark and West (2007).