Loss aversion, economic sentiments and international consumption smoothing

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Daragh Clancy
European Stability Mechanism

Lorenzo Ricci
European Stability Mechanism

European Stability Mechanism

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Daragh Clancy [1] European Stability Mechanism
Lorenzo Ricci [2] European Stability Mechanism

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Keywords: confidence, consumption smoothing, loss aversion, uncertainty.

JEL codes: E21, E71, F41, F44

1 Email: d.clancy@esm.europa.eu

2 Email: l.ricci@esm.europa.eu

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Daragh Clancy† Lorenzo Ricci‡

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†European Stability Mechanism, 6a Circuit de la Foire Internationale, L-1347 Luxembourg. Email: d.clancy@esm.europa.eu

‡European Stability Mechanism, 6a Circuit de la Foire Internationale, L-1347 Luxembourg. Email: l.ricci@esm.europa.eu

1 Introduction

Open economies experiencing country-specific (or the asymmetric effect of global) output fluctuations can smooth consumption through both domestic and cross-border trading. This provides a measure of risk sharing across different states of nature (Cole and Obstfeld, 1991) and could increase the synchronisation of international business cycles (Kose et al., 2003). Greater business cycle correlations are particularly important amongst members of a monetary union to compensate for the loss of independent monetary policy (Frankel and Rose, 1998).[1] However, starting with Backus et al. (1992), a large body of empirical evidence shows that international consumption correlations are significantly lower than unity and are even lower than cross-country output correlations. This finding represents one of the major puzzles in international economics (Obstfeld and Rogoff, 2000).

In this paper, we argue that *loss-averse* behaviour can at least partly explain this puzzle. The connection between loss aversion and international consumption smoothing is quite intuitive. Loss aversion implies that expected consumption gains induce *risk-averse* behaviour, while expected losses induce *risk-loving* behaviour (Tversky and Kahneman, 1991). Therefore, an expected decrease in future income should *initially* lead to greater consumption smoothing in the presence of loss aversion, as agents delay adjusting their consumption until they absolutely must. However, if their gamble fails and the expected fall in income materialises, the eventual adjustment in consumption is much larger. Overall, the presence of loss-averse behaviour should weaken international consumption smoothing.

Economic sentiments provide a sense of the expected direction of future aggregate income changes. Measures of economic sentiment therefore provide us with a basis upon which to test this, to the best of our knowledge, unexplored, connection between

[1] Of course, the incomplete synchronisation of international business cycles is not necessarily damaging. Callen et al. (2015) argue that a certain degree of heterogeneity across business cycles is potentially an asset, as it increases the room for international diversification. If output growth rates across countries were perfectly aligned, there would be no potential to diversify income sources across borders. Devereux and Smith (1994) demonstrate that greater international risk sharing could even result in lower economic growth.

loss aversion and international consumption smoothing. Because economic sentiment is such a nebulous concept, we decompose it into two parts: confidence and uncertainty.[2] We proxy these measures of economic sentiment using consumer sentiment surveys and the output growth errors of professional forecasters. We empirically test the importance of the strength of confidence and uncertainty *prior* to the realisation of an output fluctuation on a country's *subsequent* degree of consumption smoothing, using a panel of 20 advanced economies.[3]

We find that international consumption smoothing is weaker when an output fluctuation materialises *following* periods of weak economic sentiment. We use a test of the asymmetric response of consumption to provide evidence that this effect arises at least partly due to loss-averse behaviour. Our asymmetric test also allows us to demonstrate that loss aversion plays a greater role in international consumption smoothing than alternative theories of consumer behaviour that focus on myopia or liquidity constraints.

Our findings on the relevance of economic sentiments are robust to the inclusion of alternative determinants of international consumption smoothing, such as trade and financial openness, long-term interest rates and financial crisis periods. We also demonstrate that economic sentiments have an effect on international consumption smoothing after explicitly controlling for the state of the business cycle, global output fluctuations and the persistence of idiosyncratic output fluctuations. Overall, to the extent that greater international consumption smoothing boosts the correlation of cross-border business cycles, our results imply a desynchronisation following periods of weak economic sentiment.

[2] See Nowzohour and Stracca (2017) for a recent review of the related literature and empirical measures of economic sentiment, as well as some stylised facts (based on international evidence) regarding these measures. They describe confidence "as a subjective feeling of certainty or strong belief in positive future economic developments". They state that uncertainty "could be either the range of possible outcomes of future economic developments, and/or the lack of knowledge of the probability distribution from which future economic developments are drawn" (pp. 8). Importantly, they also note that these concepts of sentiment may be observationally equivalent.

[3] Kalemli-Ozcan et al. (2013) note that the different types of shocks experienced by countries means that the pooling of developed, emerging and underdeveloped countries in empirical estimations is not ideal. We therefore restrict our sample to only advanced economies. Future work could examine whether economic sentiments play a role in international consumption smoothing and the business cycle synchronisation of emerging economies.

Literature review:

Our paper is related to the substantial literature on international consumption risk sharing. Sørensen and Yosha (1998) demonstrate that full risk sharing implies perfect consumption smoothing. There are many suggested theoretical explanations for why risk sharing is lower than predicted by the classical one-good complete-markets model.[4] These include the presence of non-traded goods (Tesar, 1993), taste shocks (Stockman and Tesar, 1995), capital market restrictions (Baxter and Crucini, 1995), preference shocks (Sørensen and Yosha, 1998), transaction costs (Obstfeld and Rogoff, 2000), transport costs (Kraay and Ventura, 2002), insufficient financial instruments (Heathcote and Perri, 2002), productivity shocks (Corsetti et al., 2008), contract enforcement (Broner and Ventura, 2011), default risk (Bai and Zhang, 2012) and the persistence of consumption risk (Lewis and Liu, 2015).

The empirical macroeconomic literature generally focuses on quantification of the degree of international consumption risk sharing and the examination of the channels through which it takes place. A common finding is that consumption risk sharing is larger, although still imperfect, within regions of a country than between different countries (Sørensen and Yosha, 1998; Crucini, 1999; Mélitz and Zumer, 1999; Kalemli-Ozcan et al., 2003; Asdrubali and Kim, 2004). Greater country size (Head, 1995), industrial specialisation (Kalemli-Ozcan et al., 2003), trade and financial openness (Imbs, 2004), foreign direct investment flows (Albuquerque, 2003), habit formation (Fuhrer and Klein, 2006), international asset holdings (Sørensen et al., 2007) and financial globalisation (Kose et al., 2009) are all positively related to international consumption risk sharing. Fratzscher and Imbs (2009) show that international risk sharing is negatively related to the quality of borrowing institutions, while Kalemli-Ozcan et al. (2014) show that consumption risk sharing collapsed in the European countries most affected by the recent sovereign debt crisis.

Our paper adds to this empirical literature by exploring whether loss aversion is

[4] Alternatively, Brandt et al. (2006) argue that the smoothness of exchange rates implies the existence of substantial international consumption risk sharing. Fitzgerald (2012) shows that risk sharing amongst developed economies is close to optimal, considering the large costs of trade.

another mechanism that could potentially affect the degree of observed international consumption smoothing. To do so, we will use measures of economic sentiment. These capture expectations of future income changes. Many studies have demonstrated the empirical relevance of shocks to economic sentiments in propagating domestic business cycle fluctuations (Beaudry and Portier, 2006; Jaimovich and Rebelo, 2009; Barsky and Sims, 2011; Angeletos et al., 2018) and their international transmission (Jaimovich and Rebelo, 2008; Dees, 2017; Levchenko and Pandalai-Nayar, 2019). We instead examine whether *prevailing* economic sentiments affect the degree of international consumption smoothing in the face of (exogenous) country-specific output fluctuations.

The benchmark theoretical framework used as the basis for empirical tests of international consumption risk sharing assumes risk-averse behaviour by the expected-utility maximising representative agent. Obstfeld and Rogoff (1996) note that it is the concavity of the utility function that makes the expected-utility maximiser risk averse and interested in purchasing insurance to smooth their consumption. However, this behaviour is inconsistent with experimental evidence (Kahneman et al., 1991; Camerer, 1995) that people care more about reductions in their consumption, relative to a reference point, than gains. Therefore, it is unsurprising that the high degree of international consumption smoothing predicted by the benchmark theoretical model finds little empirical support.

Instead, there is empirical evidence (Shea, 1995a; Bowman et al., 1999; Foellmi et al., 2018) that aggregate consumption time series react to fluctuations in income in a manner qualitatively consistent with loss aversion. These studies broadly follow the approach used at the household level (Altonji and Siow, 1987; Shea, 1995b) to test the life cycle / permanent income hypothesis of consumption behaviour and find no evidence in favour of myopia and liqudity constraints. According to the consumption-saving model of Bowman et al. (1999), utility is concave *only* when consumption increases above a reference level and convex when consumption declines below. This implies that consumers are willing to risk greater losses in order to have a chance at avoiding losses altogether. Our measures of economic sentiment provide an insight into ex-

pected changes in aggregate income. Therefore, we use these measures as a means to assess whether loss-averse behaviour is a quantitively important factor in explaining lower-than-expected international consumption smoothing.

Our paper is structured as follows. Section 2 summarises the benchmark theoretical framework for international consumption smoothing and discusses how economic sentiments could affect the degree of smoothing observed, focusing on the potential role of loss aversion. Section 3 introduces our empirical strategy. We describe the construction and interpretation of our economic sentiment measures in Section 4. We detail the empirical results in Section 5 and summarise and conclude in Section 6.

2 Consumption smoothing

The consumption smoothing condition imposed by the intertemporal Euler equation plays a key role in modern open economy macroeconomics (Obstfeld and Rogoff, 1996). The benchmark two-country, two-period model with complete financial markets allows individuals in different countries to use the same state-contingent security prices to equate their marginal rates of substitution between current consumption and state contingent future consumption:

$$\frac{\pi(s)\beta U'[C_{H,t+1}(s)]}{U'(C_{H,t})} = \frac{\pi(s)\beta U'[C_{F,t+1}(s)]}{U'(C_{F,t})} = \frac{1}{1+r}, \tag{1}$$

where U represents utility derived from per-capita consumption C in the home (H) and foreign (F) country, s denotes different states of nature that occur with probability π and $\frac{1}{1+r}$ is the (gross) riskless interest rate from period t to period $t+1$ that reflects the relative price of a certain unit of consumption in both periods. Assuming a constant relative risk aversion utility function, it is straightforward to show that home country consumption is a constant fraction γ of world output Y_W regardless of the state of the world:

$$\frac{C_{H,t+1}(s)}{Y_{W,t+1}(s)} = \gamma = \frac{C_{H,t}}{Y_{W,t}}, \tag{2}$$

and analogously for the foreign country with a $1-\gamma$ share of world output. Therefore, consumption growth rates are the same across countries in every state and are equal to the growth rate of world output. Uncertainty over future world output means that consumption is not constant across states. However, because of international diversification, changes in consumption are entirely due to world, rather than country-specific (or the asymmetric effect of global), output fluctuations.

The role of loss aversion

The prediction of substantial international consumption smoothing in the benchmark theoretical model relies on a number of key assumptions. These include complete markets and the existence of financial products (with fully enforceable contracts) that allow agents to insure against all idiosyncratic risks.[5] These assumptions are made for analytical convenience and allow for closed-form solutions of the model environment. We focus on the effect that the typical assumption of a von Neumann-Morgenstern utility function has on international consumption smoothing.[6] Specifically, the concavity of this utility function ensures that the risk-averse representative agent purchases sufficient insurance to enable them to smooth consumption.

However, the use of this class of utility function to explain consumption behaviour has long been questioned (Koopmans, 1960; Ryder and Heal, 1973; Laibson, 1997). Prospect theory (Kahneman and Tversky, 1979) suggests that there is an *asymmetry* in the perceived losses and gains from decreases and increases in consumption. While the assumption of risk aversion is appropriate in consumption gains, it is not compatible with consumption losses (Tversky and Kahneman, 1991, 1992). This is because changes in consumption are not considered in abstract, but instead are judged relative to a reference point. Shea (1995a) was the first to provide empirical evidence of this consumption asymmetry at the aggregate level (for the United States). He did so by amending the test for the life cycle / permanent income hypothesis suggested

[5] Baxter and Crucini (1995) show that perfect consumption smoothing, but not full risk sharing, is possible even with incomplete markets.

[6] See Van Wincoop (1994, 1999) for studies assessing the impact of nonexpected utility and habit formation preferences on international risk sharing.

by Campbell and Mankiw (1990) to examine consumption smoothing for positive and negative expected income fluctuations.

Bowman et al. (1999) expand upon the theoretical underpinnings of this asymmetry, and provide empirical evidence of its relevance in explaining consumption smoothing in five advanced economies (Canada, France, West Germany, Japan and the United States). Rosenblatt-Wisch (2008) provide evidence of loss-averse behaviour in US aggregate macroeconomic time series. Santoro et al. (2014) embed loss aversion in a general equilibrium framework and demonstrate that this behaviour can rationalise the asymmetric effect of monetary policy on output and prices. More recently, and most closely related to our study, Foellmi et al. (2018) examine the differences in the degree of loss aversion across a broad range of OECD countries. They find it is negatively related to per-capita income (GDP) and consumption levels. They also provide some evidence (in the form of bivariate correlations) of a higher degree of consumption smoothing in countries with higher degrees of loss aversion. These results are in line with the theoretical predictions of Foellmi et al. (2011).

We use economic sentiments as a means to test whether loss aversion can help explain the lower-than-expected degree of international consumption smoothing. The importance of economic sentiment in driving business cycle fluctuations has long been recognised (Pigou, 1929; Keynes, 1936). We instead analyse the role of economic sentiments as *amplifiers* of output fluctuations via their effect on international consumption smoothing, rather than being the *source* of the fluctuation itself.

Economic sentiments provide a sense of the expected direction of future aggregate income changes. Weak sentiments signalling an expected decrease in future income should initially lead to greater consumption smoothing in the presence of loss aversion, as agents delay adjusting their consumption (possibly to avoid falling below a reference level) until they absolutely must. As such, countries display risk-loving tendencies when faced with potential consumption losses. However, if their gamble fails and the expected fall in income materialises, the eventual adjustment in consumption is larger. Therefore, in the presence of loss-averse behaviour, international consump-

tion smoothing should be weaker for negative output fluctuations that follow periods of weak economic sentiments.[7]

3 Empirical strategy

Our empirical strategy to ascertain whether loss aversion affects the degree of international consumption smoothing in our panel of advanced economies builds upon the framework developed by Asdrubali et al. (1996). This approach has served as a benchmark for a large number of empirical studies in this and connected literatures (Sørensen and Yosha, 1998; Mélitz and Zumer, 1999; Sørensen et al., 2007; Kose et al., 2009) and allows us to test the degree of consumption smoothing. In particular, we estimate the following panel regression:

$$\Delta \log c_{i,t} = \nu_t + \mu_i + \beta_1 \Delta \log y_{i,t} + \varepsilon_{i,t}, \tag{3}$$

where $c_{i,t}$ and $y_{i,t}$ denote the per-capita consumption and output of country i in year t. We include time fixed effects ν_t to control for any other undiversifiable aggregate fluctuations.[8] The inclusion of country fixed effects μ_i ensures that we account for all country-specific influences. We estimate the model using a two-step generalised least squares (GLS) procedure with heteroskedastic and autocorrelation robust standard errors.[9]

In this specification, the β_1 coefficient captures the average degree of consumption

[7] Throughout our analysis, we define periods of weak economic sentiment as occurring if confidence is low and/or uncertainty is high. We chose our definition because the mechanism through which loss aversion affects consumption behaviour relies on uncertainty. However, it could be that low confidence with more certainty (i.e. lower uncertainty) has a larger effect on the degree of international consumption smoothing. We therefore used a model specification that includes triple interactions to test this and found that it is not the case. The results are available upon request.

[8] Idiosyncratic components can be also estimated as the deviation of consumption and output from their OECD aggregations (Ostergaard et al., 2002). This methodology is equivalent to estimating equation (3) with time dummies (Ventura, 2003).

[9] The presence of heteroscedasticity and serial correlation in our data means that we follow Sørensen and Yosha (1998)'s use of the Generalised Least Squares (GLS) estimator rather than Ordinary Least Squares (OLS). However, we perform robustness tests using alternative estimators such as OLS with panel-corrected standard errors (Beck and Katz, 1994), an Arellano-Bond dynamic panel (Arellano and Bond, 1991) and an interactive fixed effect panel (Bai, 2009). Our results are not altered using these alternative estimators. We provide these results in Appendix A.

smoothing following countries' idiosyncratic (or the asymmetric response to global) output fluctuations at time t. Sørensen and Yosha (1998) note that, according to the benchmark theoretical framework discussed earlier, this coefficient is equal to zero if consumption in an individual country does not vary with idiosyncratic output fluctuations. In the case of a non-zero coefficient, larger coefficients signal less consumption smoothing. This framework can also be used to examine the *channels* through which consumption is smoothed.[10] Because our interest lies in assessing whether loss-averse behaviour plays a role in the *total* degree of international consumption smoothing, our main analysis does not further disaggregate amongst the various channels.

We extend the benchmark empirical model in Eqs. (3) to examine the role of loss aversion on the degree of international consumption smoothing. We test this connection using measures of economic sentiment as a indication of expected income changes. We first examine the effect that economic sentiments have on the degree of international consumption smoothing, without establishing the exact mechanism behind this relationship. To do so, we include the interaction of the idiosyncratic component of output with the prevailing strength of our economic sentiment measures, $\theta_{i,t-1}$, in the panel regression:

$$\Delta \log c_{i,t} = \nu_t + \mu_i + \beta_1 \Delta \log y_{i,t} + \beta_2 \Delta \log y_{i,t} \times \theta_{i,t-1} + \beta_3 \theta_{i,t-1} + \varepsilon_{i,t}, \tag{4}$$

where β_2 captures the degree of consumption smoothing that depends on the level of economic sentiment in the period *before* the country-specific output fluctuation hits. We include our economic sentiment variable with a lag to avoid contemporaneous correlations with the idiosyncratic output fluctuations. A positive β_2 coefficient suggests that, on average, weaker economic sentiments in the period prior to the realisation of

[10] A common finding from the empirical literature is that the "credit channel" is the primary (and in many cases, the only) source of international consumption risk sharing (Sørensen and Yosha, 1998; Asdrubali and Kim, 2004, 2008a,b). This use of borrowing and lending to smooth consumption in the face of temporary output fluctuations is consistent with the permanent income hypothesis proposed by Friedman (1957). The empirical evidence suggests that *intra-temporal* risk sharing through income insurance mechanisms playing a relatively minor role. For completeness, we also assess the role of ex-ante and ex-post smoothing channels and find that confidence and uncertainty play very little role in the degree of smoothing achieved via income insurance mechanisms. See Section 5.3 for details.

a country-specific output fluctuation leads to a worsening in consumption smoothing. We also include the lagged economic sentiment variable separately to ensure that our β_2 is not biased and to capture the linear relation between lagged economic sentiment and international consumption smoothing.

To assess whether loss aversion is the mechanism through which economic sentiments affect the degree of international consumption smoothing, we incorporate a modified version of the asymmetric test proposed by Shea (1995a) into the Asdrubali et al. (1996) framework. Specifically, we test for an asymmetric response of international consumption smoothing by constructing two distinct series based on $\Delta \log y_{i,t}$. Following Cover (1992), we use a nonlinear interactive variable to represent the positive and negative of $\Delta \log y_{i,t}$:[11]

$$neg_{i,t} = -\frac{1}{2}\left[\mid \Delta \log y_{i,t} \mid -\Delta \log y_{i,t}\right];$$

while

$$pos_{i,t} = \frac{1}{2}\left[\mid \Delta \log y_{i,t} \mid +\Delta \log y_{i,t}\right].$$

We then modify Eqs. (4) in order to examine whether positive and negative idiosyncratic output fluctuations have symmetric effects on international consumption smoothing depending on the strength of economic sentiment prior to the realisation of the fluctuation:

$$\Delta \log c_{i,t} = \nu_t + \mu_i + \beta_1 \Delta \log pos_{i,t} + \beta_2 \Delta \log neg_{i,t} + \beta_3 \Delta \log sign_{i,t} \times \theta_{i,t-1} + \beta_4 \theta_{i,t-1} + \varepsilon_{i,t}, \quad (5)$$

where $sign_{i,t}$ is alternatively $pos_{i,t}$ or $neg_{i,t}$ depending on the hypothesis we are test-

[11] An equivalent approach, also used by Cover (1992), is that the series neg is defined as the output fluctuation if it is negative, otherwise zero: $neg_{i,t} = \min(\Delta \log y_{i,t}, zero)$. The series pos equals the output fluctuation if the fluctuation is positive, otherwise zero: $pos_{i,t} = \max(\Delta \log y_{i,t}, zero)$. Pierucci and Ventura (2010) examine the asymmetric effect of risk sharing by assessing the differential responses to positive and negative realisations of GDP.

ing.[12] Eqs. (5) provides a simple test of alternative hypotheses of consumption behaviour.[13] A finding of no statistical difference in international consumption smoothing following positive and negative output fluctuations ($\beta_1^{pos} = \beta_2^{neg}$) would be consistent with standard rational-expectations behaviour or *myopia*. Given that *liquidity constraints* should only impede borrowing but not saving (Shea, 1995a), if they are present, international consumption smoothing should be weaker for expected income increases than decreases. We can access if this is the case from testing $\beta_1^{pos} + \beta_3^{pos} = \beta_2^{neg}$, where a rejection of the null hypothesis means that the degree of international consumption smoothing is at least somewhat affected by liquidity constraints.

Finally, we can test whether *loss aversion* affects international consumption smoothing by assessing $\beta_2^{neg} + \beta_3^{neg} = \beta_1^{pos}$, where a rejection indicates that consumption smoothing is weaker for expected income decreases than increases. We can gain some further insights into the possible presence of loss aversion by examining the effect of prevailing sentiments alone (*i.e.* not interacted with subsequent output fluctuations). By checking the estimated signs of β_3^{neg} and β_4 from Eqs. (5), we can assess whether the initial adjustment of consumption is consistent with subsequent behaviour *after* expectations were realised (or not). Specifically, a positive (and significant) coefficient for β_3^{neg} and a negative (and significant) β_4 provide evidence of loss-averse behaviour.

4 Measures of economic sentiment

We assess whether loss aversion affects the degree of international consumption smoothing in a set of 20 advanced (OECD) economies: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the

[12] We also tested a model specification that includes the interactions of *both* positive and negative output fluctuations with prevailing economic sentiment. Our results are robust to this alternative specification, and are available from the authors upon request.

[13] In addition to the tests of myopia, liquidity constraints and loss aversion, we also test for evidence supporting *precautionary savings*. We do so by decomposing consumption smoothing into *ex-ante* and *ex-post* channels. If precautionary savings were the dominant mechanism through which economic sentiments affect international consumption smoothing, the ex-ante channel should be more prominent than the ex-post channel. We find that this is not case. See Section 5.3 for details.

United States. Our sample includes the majority of the world's advanced economies and the time period is sufficiently long to permit a detailed economic analysis.[14]

We aim to maximise data consistency across countries. We therefore collect most of our variables from the OECD's Economic Outlook database (Table 1). We retrieve output (gross domestic product) and consumption (household final consumption expenditure) from the annual national accounts main aggregate. We use consumer price indices and the populations of the countries to transform our series into real per-capita terms. We use annual growth rates to characterise the business cycle because of difficulties identifying them using filtering techniques (Canova and Ravn, 1996; Canova, 1998). Our maximum sample runs from 1970 to 2015, and contains substantial cyclical variation across time and countries.

Economic sentiments capture the expected direction of future income changes, allowing us to formally test the connection between loss aversion and international consumption smoothing. Given the wide-ranging interpretations of what constitutes economic sentiments, we empirically test two of the more widely-agreed upon components: confidence and uncertainty. As these are latent variables, we use observable proxies in their place. Our confidence measure is based on the OECD's consumer opinion (tendency) surveys, which provide qualitative information on households' assessments of the current economic situation and expectations for the immediate future.[15] Consumers are questioned about their perceptions of the economic situation now compared with the recent past, their intentions concerning major purposes and their expectations for the immediate future.[16]

[14]To make sure that no one country is driving our results, we rerun our analysis excluding one country at a time. This should also reduce the impact of any outliers. Our results are robust to the exclusion of any given country in the sample. The results are available upon request.

[15]The surveys, therefore, have both a contemporaneous and a forward-looking component. There is substantial empirical evidence that consumer surveys are useful predictors for consumption growth (Acemoglu and Scott, 1994; Bram and Ludvigson, 1998; Ludvigson, 2004). As we are testing the effect of prevailing economic sentiments on the degree of international consumption smoothing, we prefer to use the contemporaneous component as this reflects consumers' perceptions on the realised (but still unknown to the survey respondent) state of the economy (Merella and Satchell, 2014). However, as a robustness check, we repeat our analysis with the forward-looking component for countries where it was available. Although this substantially reduces the number of years in our sample, our results are qualitatively unchanged. The results of these robustness tests are presented in Table 13.

[16]As our regressions are based on annual data, we compute the yearly average of the OECD's consumer survey that is provided at monthly or quarterly frequency (depending on the country). The

Responses in these surveys are relative to a "normal" state, so a respondent reports whether their confidence has increased sharply / increased slightly / remained the same / fallen slightly / fallen sharply. The time series of these surveys only present the balance. This is computed by ignoring the "same" answers and taking the difference between the percentage of respondents giving favourable and unfavourable answers. This can make it difficult to interpret the meaning of the estimated coefficients from regressions using the raw consumer confidence series. We therefore use the consumer confidence indices to construct an indicator variable for confidence $\theta_{i,t}$ that varies between 0 and 1 according to the strength of consumer confidence s_{it}:

$$\theta_{it} = \frac{\exp\left(-\gamma s_{i,t}\right)}{1 + \exp\left(-\gamma s_{i,t}\right)}, \ \gamma > 0, \tag{6}$$

where s_{it} is a two-year moving average of the (raw) consumer confidence indicator and a *higher* $\theta_{i,t}$ represents *lower* confidence (*i.e. weaker* sentiment). Auerbach and Gorodnichenko (2012) use this approach to define the state of the business cycle when assessing the state-dependency of fiscal multipliers. In the absence of any prior knowledge of what value γ should take, we calibrate it to 1.5. This is the same value used by Auerbach and Gorodnichenko (2012) to ensure their measure of the US business cycle indicates a recession about 20 percent of the time.[17]

We plot our constructed confidence measure for each country in our sample in Figure 1. There is substantial heterogeneity in the confidence series across countries and time. Our confidence measure tends to be high during economic downturns, such as in the European periphery during the recent sovereign debt crisis and in Finland during the early-1990s banking crisis. It tends to be low during economic expansions, such as in the euro area following the introduction of the new currency and in Japan during the late 1980s real-estate boom.

The other component of economic sentiment we examine is uncertainty. There is

OECD choose surveys from each country so as to maximise cross-country consistency. Despite this, they may not all be exactly equivalent. For all EU countries, the use of a harmonised consumer survey methodology ensures they are fully comparable across all EU countries.

[17] Our results are robust to reasonable variations in the value of γ.

considerable evidence on the importance of uncertainty in business cycle fluctuations (Bloom, 2009; Basu and Bundick, 2017). We proxy uncertainty with the output growth errors of professional forecasters.[18] Forecasts are quite literally the expectations for future economic activity of those making the forecasts. Analysing these errors can allow one to assess the degree of uncertainty regarding the current (for nowcasts) and future (for forecasts) economic situation. More specifically, we use the output (GDP) growth errors from the International Monetary Fund's World Economic Outlook. This ensures extensive cross-country coverage and relatively long time series.[19] Each vintage (published in the Spring and Fall of each year) contains forecasts for the current year and year ahead. Spring forecasts are performed at the beginning of the year without exhaustive information for the previous year for some countries. We therefore use the Fall forecasts as they contain the final release data from the previous year. Our sample of output growth errors runs from 1990 to 2015 for all countries.

We construct our measure of uncertainty using the absolute value of current year output growth errors. This ensures consistency with the time period covered by our confidence measure. To facilitate interpretation of the estimated coefficients, we transform the output growth errors into an indicator variable that varies between 0 and 1 following the same procedure as in Eq. (6). We set up our uncertainty series such that larger values indicate larger errors and higher uncertainty and therefore weaker economic sentiments. Low values indicate periods of low uncertainty (*i.e.* stronger sentiment). This also has the benefit of easing comparisons with the results from our confidence measure.

Figure 2 demonstrates that our uncertainty measure also displays considerable heterogeneity across countries and time. Our measure tends to be high during economic

[18] For our analysis using quarterly data (see Section 5.5), we also used the economic uncertainty index (Bloom, 2009). Our results are robust to this alternative measure of uncertainty. However, the coverage (in terms of business cycle fluctuations and countries included) is more limited than the consensus forecast data used for the regressions reported in this paper. The results are available from the authors upon request.

[19] Blanchard and Leigh (2013), Blanchard et al. (2017) and Di Bella and Grigoli (2018) also exploit IMF output growth errors as a measure of expectations. Similar to our consumer confidence measure, our analysis differs from the existing literature by using uncertainty as an amplifier of an output fluctuation rather than the source of the disturbance itself.

downturns, such as in the United States in the global financial crisis and in the European periphery during the sovereign debt crisis. Our measure tends to be low during normal times, when the economy is neither expanding nor contracting by a large amount.

5 Results

We report the results from the regressions in Eqs. (3) and (4) in Table 3. The first column contains the results from the benchmark empirical model. As is commonplace in the literature, the predictions of the benchmark theoretical framework also do not find empirical support in our sample. We find that a large proportion (around 60%) of output fluctuations go unsmoothed.

The second and third columns of Table 3 contain the results from our extended model with the interaction between our economic sentiment measures and idiosyncratic output fluctuations (as well as the lagged level of the economic sentiment measures).[20] We find that weak prevailing economic sentiment on its own slightly *improves* consumption smoothing. This is in line with the results of Foellmi et al. (2018). However, when we interact prevailing economic sentiments with *subsequent* output fluctuations, we find that consumption smoothing is significantly worse: there is quite a large adjustment of consumption.

Carroll (2003) demonstrates that households' expectations are derived in part by news reports of the views of professional forecasters. This suggests there may be a link between our measures of economic sentiment. To make sure that our measures are independently relevant, we estimate our regressions with both measures of economic sentiment (and their interactions with output) included simultaneously. The fourth column of Table 3 shows that these measures are both statistically significant drivers of the degree of international consumption smoothing. Therefore, both measures have a distinct role to play and are worth investigating separately. To the extent that greater

[20] Our results are robust to the use of alternative measures of consumer confidence and uncertainty. The results are presented in Table 13. See Appendix B for more details.

international consumption smoothing boosts the correlation of cross-border business cycles, our results imply a desynchronisation following periods of weak economic sentiment.

The point estimates presented so far represent the *average* degree of international consumption smoothing over our sample period. We assess how these point estimates have evolved through time using 10-year rolling regressions of Eqs (3) and (4). We find that international consumption smoothing tends to strengthen during periods of economic expansion and worsen during economic downturns.[21] This is the case for the benchmark model and the model specifications that control for prevailing economic sentiments. However, our analysis reveals that controlling for economic sentiments amplifies these swings in the degree of international consumption smoothing.

We now examine *why* weak economic sentiments worsen international consumption smoothing following subsequent output fluctuations. To do so, we modify Eqs. (3) and (4) to (alternatively) include $neg_{i,t}$ and $pos_{i,t}$ instead of $\Delta \log y_{i,t}$. This asymmetric test allows us to assess the mechanism through which economic sentiments affect international consumption smoothing. Tables 4 and 5 detail the asymmetric test results using confidence and uncertainty respectively as our measures of sentiment. Our estimated coefficients (in the first column) are statistically different, and therefore negative output fluctuations have a greater effect on the degree of consumption smoothing than positive output fluctuations. This lack of symmetry in the responses indicates that weak international consumption smoothing does not arise from rational-expectations or myopic behaviour.

Columns (2) and (3) in Tables 4 and 5 show positive and negative output fluctuations respectively interacted with prevailing economic sentiments. As explained in Section 3, we consider Column (2) as a test for evidence supporting liquidity constraints, while Column (3) tests for the presence of loss aversion. When controlling for prevailing economic sentiments, we find that the adjustment in consumption following positive output fluctuations are much smaller than those from a negative fluctuation.

[21] As a robustness test, we control for the state of the business cycle in assessing the effect of economic sentiments on international consumption smoothing. See Section 5.2 for details.

Our F-tests confirm this finding for confidence, suggesting that the large adjustment in consumption is the result of loss-averse behaviour rather than due to the presence of liquidity constraints. The evidence is not as clear cut for uncertainty, suggesting that this measure of sentiment may be capturing both loss averse behaviour and the existence of liquidity constraints.

Overall, our results provide evidence for the importance of loss aversion in the lower-than-expected degree of observed international consumption smoothing. This could be due to, for example, cross-country differences in consumption reference levels. However, our empirical approach does not allow us to identify the exact reason for the loss-averse behaviour. By failing to reduce consumption in anticipation of income reductions, the adjustment in consumption when the decrease materialises is far greater (*i.e.* consumption smoothing is even weaker). Loss aversion, therefore, provides a partial explanation for the international consumption correlation puzzle.

5.1 Consumption smoothing dynamics

We also assess the *dynamics* of consumption smoothing of idiosyncratic output fluctuations, depending on prevailing economic sentiments. This will also allow us to explicitly control for persistence in consumption smoothing. Asdrubali and Kim (2004) show the importance that the dynamic response to output shocks has on international risk sharing and consumption smoothing using impulse response functions from vector autoregressions (VARs). We instead employ an equivalent approach proposed by Jordà (2005). He demonstrates that an impulse response function estimated via *local projections* is robust to a misspecification of the data generating process. It can accommodate the nonlinearities in our model specification that would be impractical or infeasible using a VAR. These nonlinearities can be estimated in a simple univariate framework, preserving valuable degrees of freedom.[22] Local projections are based on sequential regressions of the endogenous variable shifted forward:

[22] Although the local projection method allows for more flexibility by imposing weaker assumptions on the dynamics, its nonparametric nature comes at an efficiency cost.

$$\Delta \log c_{i,t+h} = \mu_i^h + \beta_{1,1}^h \Delta \log y_{i,t} + \beta_{2,1}^h \Delta \log y_{i,t} \times \theta_{i,t-1} + \beta_{3,p}^h \theta_{i,t-1} + \beta_{4,p}^h \Delta \log c_{i,t-1} + ...$$
$$\beta_{1,p}^h \Delta \log y_{i,t-p} + \beta_{2,p}^h \Delta \log y_{i,t-p} \times \theta_{i,t-1-p} + \beta_{3,p}^h \theta_{i,t-1-p} + \beta_{4,p}^h \Delta \log c_{i,t-1-p} + \varepsilon_{i,t+h}, \quad (7)$$

where the effect of idiosyncratic output fluctuations on consumption smoothing at horizon h are given by $\beta_{1,1}^h + \beta_{2,1}^h \theta_{i,t-1}$. Therefore, the persistence in the degree of international consumption smoothing following an output fluctuation is also a function of economic sentiments in the period prior the fluctuation materialising.[23]

Figure 4 shows the impulse response functions estimated using the local projections method. All output fluctuations are scaled to be 1% of GDP and the figures report the impulse responses for four years after. Our standard error bands represent the 90% confidence level.

The top-left and bottom left panels represent the dynamics of consumption smoothing following an output fluctuation that materialises after a period of weak economic sentiment (*i.e.* low confidence and high uncertainty). The top-right and bottom-right panels show the response when economic sentiment was weak prior to the realisation of the output fluctuation. We define weak sentiment as corresponding to the 90^{th} percentile of our economic sentiment measures. We define strong sentiment as corresponding to the 10^{th} percentile of our economic sentiment measures, with these impulse response functions (IRFs) plotted on the top-left and bottom-left panels of Figure 4.

We find less consumption smoothing on impact following a period of weak economic sentiment.[24] This is in line with the results from our static analysis. Thereafter,

[23] We also include a time trend, country fixed effects and two lags (p) of the variables in our dynamic regressions. We selected the lag order (p) by looking at different statistics, such as the Bayesian Information Criterion and Akaike's Information Criterion. Our results are qualitatively robust to the use of alternative lag structures. Due to the inherent serial correlation in the local projections approach, we use Newey-West standard errors.

[24] We also compared the differences between the weak and strong sentiment IRFs following the approach of Broner et al. (2018). We find a statistically significant difference on impact. However, the difference between the degree of consumption smoothing following periods of strong and weak economic sentiment becomes statistically insignificant at the first projection horizon (*i.e.* after one year). The results are available from the authors upon request.

there is no discernible difference in consumption smoothing following a period of high or low consumer confidence, with an output fluctuation being fully smoothed in three years regardless. However, our results indicate that output fluctuations that occur following a period of low uncertainty take longer (three years instead of two) to fully smooth than fluctuations occurring after a period of high uncertainty.

5.2 Confounding factors

We test the robustness of our findings by including alternative determinants of international consumption smoothing found in the literature into our empirical framework.[25] Formally, we adjust Eqs. (4):

$$\Delta \log c_{i,t} = \nu_t + \mu_i + \beta_1 \Delta \log y_{i,t} + \beta_2 \Delta \log y_{i,t} \times \theta_{i,t-1} + \beta_3 \theta_{i,t-1} + \beta_j \Delta \log y_{i,t} \times \Omega_{i,t-1} + \beta_k \Omega_{i,t-1} + \varepsilon_{it}, \quad (8)$$

where Ω represents additional explanatory variables (added one at a time) including trade and financial openness, interest rates and periods of financial crisis. We control for trade openness using the sum of exports and imports to gross domestic product (Dejuan and Luengo-Prado, 2006) and financial openness using the Chinn–Ito index (Chinn and Ito, 2008). We use long-term interest rates from the OECD economic database and a financial crisis dummy from the Laeven and Valencia (2013) database, with updates from Detken et al. (2014). We display our results in Table 6. The coefficients on our economic sentiment variables (*i.e.* both in levels and interacted with output) are not significantly altered by the introduction of these additional explanatory variables.

It is also possible that our sentiment measures simply reflect the state of the business cycle. Chauvet and Guo (2003) provide empirical evidence of the differing responses of economic agents to consumer (and business) confidence shocks, depending

[25] Because our dynamic analysis demonstrated that the effect on consumption smoothing from prevailing economic sentiments is predominantly on impact, our robustness tests focus on the static model.

on the state of the economy. Our rolling regressions results in Figure 3 showed that the effect of economic sentiments on the degree of international consumption smoothing varies with the business cycle. To make sure there is an independent effect on international consumption smoothing from our sentiment measures, we include a business cycle indicator as an explanatory variable in our regressions. We follow Auerbach and Gorodnichenko (2012) and create an index of the business cycle $z_{i,t}$ based on a backward-looking (Alloza, 2017) three-year moving average of the output growth rate. Normalising the variable to have zero mean and unit variance allows us to interpret the variable as a measure of the probability of being in a recession at time t based on a measure of the state of the business cycle. As with all the other explanatory variables, we include the business cycle indicator with a lag to avoid contemporaneous correlations with the idiosyncratic output fluctuations.

We find that our results are not significantly altered by controlling for the state of the business cycle. Our results are therefore quite robust to a range of confounding factors found to be important in the literature. Economic sentiment, be it confidence or uncertainty, in the period prior to the realisation of an output fluctuation plays an important role in the degree of international consumption smoothing.

5.3 Consumption smoothing channels

Our results thus far demonstrate that economic sentiments affect the degree to which output fluctuations are absorbed, and provide evidence that this finding is due to the presence of loss aversion. Our empirical approach, however, does not disentangle the exact channels through which this (stronger or weaker, depending on the prevailing economic sentiment) consumption smoothing takes place. It could be that expected future income changes spur agents to use *ex-ante* insurance mechanisms, such as portfolio diversifications and net international transfers, rather than using *ex-post* smoothing mechanisms as we have implicitly assumed until now. Following Asdrubali et al. (1996), many studies have used a variance decomposition scheme to quantify the de-

gree of risk sharing achieved through different channels.[26]

Given that the focus of our paper is not on the individual channels, we limit our decomposition to the *aggregate* ex-ante income smoothing and ex-post consumption smoothing channels. The ex-ante channel is represented by the difference between output (GDP) and disposable income (GDI) growth, that the literature further decomposes into smoothing via net factor income and net international transfers.[27] The ex-post channel decouples consumption and GDI and represents intertemporal consumption smoothing through saving and dissaving. We run the following regression to measure the importance of economic sentiments for the *ex-ante* smoothing channel:

$$\Delta \log y_{i,t} - \Delta \log inc_{i,t} = \nu_t + \mu_i + \beta_1 \Delta \log y_{i,t} + \beta_2 \Delta \log y_{i,t} \times \theta_{i,t-1} + \beta_3 \theta_{i,t-1} + \varepsilon_{i,t}, \quad (9)$$

where $\Delta \log inc_{i,t}$ is the change in the logarithm of real per-capita disposable income. We measure the effect of prevailing economic sentiments on *ex-post* smoothing channel through the following regression:

$$\Delta \log inc_{i,t} - \Delta \log c_{i,t} = \nu_t + \mu_i + \beta_1 \Delta \log y_{i,t} + \beta_2 \Delta \log y_{i,t} \times \theta_{i,t-1} + \beta_3 \theta_{i,t-1} + \varepsilon_{i,t}. \quad (10)$$

The sum of the two channels should be equal to one minus the coefficients from the aggregate smoothing found in section 3. Table 9 reports our results. We find that only a small share of output fluctuations are smoothed by the ex-ante channel and that economic sentiments seem to matter little for its effectiveness. This suggests that economic sentiments do not affect international consumption smoothing via ex-ante insurance mechanisms that could be more closely related to precautionary saving motives. Prevailing economic sentiments predominantly have an effect on the degree of

[26] See Asdrubali et al. (2018) for a recent survey of this literature, as well as several advancements in the empirical approach.

[27] We also tested the effect of prevailing economic sentiments on the effectiveness of smoothing via these more disaggregated channels. Our results are robust to the level of disaggregation of the channels and are available from the authors upon request.

international consumption smoothing via the ex-post channel, which provides some further support for our contention that this effect arises due to lumpy consumption adjustment as a result of loss-averse behaviour.

5.4 Global factors

Our approach thus far has focused on idiosyncratic output fluctuations. However, it is also possible that these country-specific output fluctuations are actually best described as the response to global (or aggregate or common) factors. Kalemli-Ozcan et al. (2013) note that cross-sectional patterns, though informative, do not identify causal effects, as they might be driven by global shocks and/or unobserved country-pair heterogeneity. Kose et al. (2003) estimate a dynamic factor model and find that world and region-specific factors account for a larger share of output growth fluctuations, while country-specific factors explain more of the consumption growth than the common factors. Stock and Watson (2005) attribute the reduction in output volatility during the 1980s and 1990s to a reduction in the magnitude of common international shocks. Kose et al. (2012) use a dynamic factor model to decompose output fluctuations into a global factor, factors specific to country groups, and country-specific factors. They find that the international business cycle is largely driven by the global factor. Jos Jansen and Stokman (2014) shows that output developments will be more correlated if common shocks happen to be predominant, while they will be more asymmetric if idiosyncratic shocks are the most important.

Our approach so far using time fixed effects can only properly capture comovement if global factors have the *same* effect across countries. Otherwise, our estimated coefficients are inconsistent because our specification may not take into account the potentially heterogeneous transmission channel of global output fluctuations. To assess the importance of this issue for our results, we can extract global factors directly from consumption and output by cross-country aggregation. Since the idiosyncratic components are driven by non-pervasive (*i.e.* country-specific) fluctuations, by worldwide aggregation they are ruled out and only the common factors influencing our variables

in all countries remain.

We extract a global factor from our macroeconomic variables using a linear panel model with the (unknown) factors as interactive fixed effects (Bai, 2009).[28] The interaction between the state and time fixed effects captures the heterogeneity in the data in a more flexible way, since it allows for common time-varying factors to affect the cross-sectional units with individual specificity. Figure 5 shows the percentage of the variance of consumption and output explained by the global factor. The impact of this factor varies considerably across countries.

In the fourth column of Table 8, we report the results from the regressions with the interactive fixed effect. They are broadly similar to our other results. This indicates that our measures of economic sentiment affect the degree of international consumption smoothing following country-specific output fluctuations, even after explicitly controlling for individual country responses to a global factor.

5.5 Fluctuation persistence

The permanent income hypothesis predicts that agents' capacity to smooth consumption weakens in response to *persistent* shocks (Friedman, 1957). Becker and Hoffmann (2006) demonstrate the importance of the persistence of shocks in quantifying the degree of consumption risk sharing. Asdrubali et al. (1996) find that consumption smoothing (via credit markets) is considerably lower following more persistent shocks. Corsetti et al. (2012) use spectral analysis to assess international consumption risk sharing at different frequencies. We assess whether the effect of economic sentiments on international consumption smoothing is stronger in the face of less persistent output fluctuations.

To do so, we assemble a quarterly dataset. By following the same estimation procedure as before, by construction the output fluctuations are less persistent (quarterly rather than annual frequency). To maintain consistency with the annual data, we re-

[28] Bai (2009) estimates a model: $Y_{i,t} = X_{i,t}\beta + \mu_{i,t}$ and $\mu_{i,t} = \Lambda_i' F_t + \varepsilon_{i,t}$, where Λ_i' is a vector of factor loadings and F_t is a vector of common factors. Giannone and Lenza (2010) also use a similar approach to analyse the Feldstein-Horioka puzzle.

trieve most of our variables from the OECD's Economic Outlook database (see Table 1 for details). Respondents to consumer tendency surveys in many countries are requested to take seasonal factors into consideration in their qualitative opinions. In spite of this, the OECD provide seasonally-adjusted series due to the residual seasonality that remains in a number of series. The series published for EU member and candidate countries are seasonally adjusted by the European Commission using the DAINTIES seasonal adjustment method. Consumer confidence series for other countries are seasonally adjusted by their national statistical institutes or by the OECD, if their seasonal pattern is found to be significant. The X-12 Reg-ARIMA method is used by the OECD for seasonal adjustment. As before, we use real private consumption expenditure and real gross domestic product divided by population as our variables of interest. We transform our quarterly growth rate variables into annual rates of change.

For our uncertainty measure, we now use current year output growth errors from Consensus Forecasts, rather than those from the IMF. However, Loungani (2001) shows a high degree of similarity between private sector growth forecasts and those of international organisations.[29] Consensus Forecasts produce output growth estimates at a monthly frequency, ensuring that we have a different observation for each quarter. This information is summarised with the mean forecast. Our sample runs from 1990 to 2015 for all countries in our annual sample except for Austria, Denmark and New Zealand. Similar to the annual IMF series of output growth errors, we transform the *absolute* value of the output growth errors from Consensus Forecasts into a variable varying between 0 and 1.[30]

In Table 10, we report the results from the regressions in Eqs. (3) and (4) estimated using quarterly data.[31] Our findings for the confidence measure are broadly consistent with the annual results, with low confidence greatly weakening the degree of consumption smoothing following an output fluctuation. However, we find no evidence

[29]Some deviations could occur because of strategic behaviour from the private sectors forecasters, but Frenkel et al. (2013) find that this strategic behaviour only lasts roughly three months.

[30]In our quarterly framework, $s_{i,t}$, from Eqs. (6) is an eight-quarter moving average.

[31]The quarterly frequency allows us to estimate the model using OLS with panel-corrected standard errors. Our results are robust to estimation using GLS. The results are available from the authors upon request

that the degree of uncertainty prior to an output fluctuation affects international consumption smoothing after it materialises. This suggests that uncertainty only plays a role in the degree of international consumption smoothing following persistent output fluctuations.[32]

The consumption smoothing dynamics for our quarterly sample are provided in Figure 6. As with the annual results, we plot the IRFs for strong economic sentiment (*i.e.* high confidence and low uncertainty) on the left-hand side. These are represented by the 10^{th} percentile of our economic sentiment measures. The IRFs for weak economic sentiment (*i.e.* low confidence and high uncertainty) are on the right-hand side. These are represented by the 90^{th} percentile of our economic sentiment measures. It appears that weak economic sentiments worsen the degree of international consumption smoothing on impact, but this difference fades quickly.

6 Conclusions

The substantial empirical evidence that international consumption smoothing is weaker than predicted by theory represents a major puzzle in international economics. We assess whether loss aversion can partly explain this puzzle. The risk-loving behaviour induced by loss aversion means that expected income declines are met with a smaller initial adjustment in consumption. However, if the expected drop in income materialises, an even larger adjustment in consumption becomes necessary. This mechanism should weaken international consumption smoothing.

To test this unexplored connection, we use measures of economic sentiment to provide a sense of the expected direction of future aggregate income changes. Because economic sentiment is such a nebulous concept, we decompose it into two parts: confidence and uncertainty. These are proxied using consumer sentiment surveys and the output growth errors of professional forecasters. We then test the importance of the

[32]We also conducted some tests using model specifications with a more detailed lag structure. These show that uncertainty can still affect international consumption smoothing following less persistent (*i.e.* quarterly) output fluctuations. In particular, a model specification with four lags is highly significant. Future work could examine this aspect in more detail. Our main focus is on annual data to allow for a comparison with the literature.

strength of these sentiment measures *prior* to the realisation of an output fluctuation on a country's *subsequent* degree of consumption smoothing, using a panel of 20 advanced economies.

We find that international consumption smoothing is weaker when an output fluctuation materialises following periods of weak economic sentiment. Using a test of the asymmetric response of consumption to positive and negative output fluctuations following periods of weak consumer sentiment, we find evidence that this effect is due to loss-averse behaviour: countries where weak economic sentiment implies that income is *expected* to decline, *initially* smooth their consumption to a greater degree. However, *if* the expected drop in income materialises, an even larger adjustment in consumption becomes *necessary*. The effect is largely on impact and is not very persistent.

Our results on the relevance of economic sentiments are robust to the inclusion of alternative determinants of international consumption smoothing, such as trade and financial openness, long-term interest rates and financial crisis periods. We also demonstrate that economic sentiments have an effect on international consumption smoothing after explicitly controlling for the state of the business cycle, global output fluctuations and the persistence of idiosyncratic output fluctuations. Overall, to the extent that greater international consumption smoothing boosts the correlation of cross-border business cycles, loss-averse behaviour implies a desynchronisation following periods of weak economic sentiment.

Our findings on the relevance of loss aversion have important implications for the design of public institutions and private initiatives whose task is to help improve the degree of risk sharing and international consumption smoothing. Mendoza (2010) notes that suboptimally low levels of precautionary savings can lead to sudden stops that require large adjustments in consumption. Aizenman (1998) shows that loss averse behaviour can lead to much larger stabilisation funds than those designed on the basis of agents maximising the conventional expected utility. Future work could consider whether this finding, which considers the (domestic) stabilisation funds of commodity producers, extends to an international dimension. It would also be interesting to con-

sider the special case of a monetary union, where nominal interest and exchange rates react to area-wide rather than country-specific developments.

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Tables

TABLE 1. Data

Variable	Source	Frequency
Gross domestic product	OECD Annual National Accounts OECD Quarterly National Accounts	Annual Quarterly
Private consumption	OECD Annual National Accounts OECD Quarterly National Accounts	Annual Quarterly
Population (national concept)	OECD Annual National Accounts OECD Quarterly National Accounts	Annual Quarterly
Consumer price index	OECD Key Short-Term Economic Indicators	Monthly
GDP deflator	OECD Annual National Accounts OECD Quarterly National Accounts	Annual Quarterly
Private consumption deflator	OECD Annual National Accounts OECD Quarterly National Accounts	Annual Quarterly
Exports of good and services	OECD Annual National Accounts OECD Quarterly National Accounts	Annual Quarterly
Imports of good and services	OECD Annual National Accounts OECD Quarterly National Accounts	Annual Quarterly
Gross Disposable Income	OECD Annual National Accounts	Annual
Long term interest rates	OECD Main Economic Indicators	Monthly
Consumers Opinion: Consumer confidence	OECD Business Tendency and Consumer Opinion Surveys (MEI)	Monthly
Consumers Opinion: Future tendency	OECD Business Tendency and Consumer Opinion Surveys (MEI)	Monthly
Current year forecast error	IMF World Economic Outlook and authors' calculations Consensus forecasts and authors' calculations	Semi-Annual Monthly
Year-ahead forecast error	IMF World Economic Outlook and authors' calculations Consensus forecasts (for quarterly) and authors' calculations	Semi-Annual Monthly
Stock market returns volatility	Bloomberg; authors' calculations	Daily
Financial liberalisation	Chinn and Ito (2008)	Annual
Trade openness	Authors' calculations based on OECD's data	Annual

Notes: All variables in the regressions are transformed into real per-capita terms, expressed in logarithms where possible. We convert nominal variables into real terms using the relevant deflators (see Section 4 for details). For quarterly data, we use population (domestic concept) to complete the panel data in case of unavailable data.

TABLE 2. Summary Statistics

	Obs.	Mean	S.D.	Min	p25	p50	p75	Max
Consumers Confidence	725	-0.013	0.996	-2.831	-0.708	0.062	0.691	2.657
Future tendency	513	-0.000	0.992	-3.120	-0.631	0.113	0.682	2.774
Current year forecast error	503	0.001	0.020	-0.071	-0.007	0.002	0.010	0.252
Market volatility	514	0.010	0.004	0.004	0.007	0.009	0.013	0.028
$\Delta \log c_{i,t}$	725	0.015	0.024	-0.112	0.003	0.016	0.029	0.092
$\Delta \log c_{i,t}^{OECD}$	725	0.013	0.015	-0.015	0.004	0.014	0.018	0.056
$\Delta \log y_{i,t}$	725	0.016	0.030	-0.119	0.001	0.017	0.032	0.295
$\Delta \log y_{i,t}^{OECD}$	725	0.011	0.020	-0.046	0.001	0.012	0.024	0.055

Notes: This table reports the summary statistics of the main variables used in our empirical analysis. Our set of advanced economies includes 20 OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. $\Delta \log c_{i,t}$ represents country-specific real consumption growth per capita, $\Delta \log y_{i,t}$ is the country-specific real GDP growth per capita. $\Delta \log c_{i,t}^{OECD}$ and $\Delta \log y_{i,t}^{OECD}$ indicate the aggregate OECD20 real consumption growth per capita and OECD20 real GDP growth. Our maximum sample runs from 1971 to 2015. See Section 4 for details on the construction of all our variables. Obs.: Observations; S.D.: Standard Deviation; Min: Minimum. p25: 25^{th} precentile; p50: Median; p75: 75^{th} precentile; and Max: Maximum.

TABLE 3. Economic sentiments and consumption smoothing

	(1)	(2)	(3)	(4)
Output	0.61***	0.42***	0.27***	0.10*
	(0.02)	(0.04)	(0.05)	(0.06)
Output $\times$ $\theta^C_{i,t-1}$		0.28***		0.38***
		(0.06)		(0.08)
$\theta^C_{i,t-1}$		-0.01***		-0.02***
		(0.00)		(0.00)
Output $\times$ $\theta^U_{i,t-1}$			0.40***	0.32***
			(0.08)	(0.08)
$\theta^U_{i,t-1}$			-0.01***	-0.00**
			(0.00)	(0.00)
Observations	725	687	480	463
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Notes: This table shows the results of panel regressions using annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. Output refers to $\Delta \log y_{i,t}$. Larger estimated coefficients represent less consumption smoothing. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment, proxied by our measures of consumer confidence ($\theta^C_{i,t}$) and uncertainty ($\theta^U_{i,t}$), varies between 0 and 1. See Section 4 for details on the construction of our economic sentiment measures.

TABLE 4. Asymmetries: Confidence

	(1)	(2)	(3)
$pos_{i,t}$	0.51***	0.43***	0.51***
	(0.03)	(0.06)	(0.03)
$neg_{i,t}$	0.74***	0.70***	0.28***
	(0.04)	(0.04)	(0.11)
$\theta^C_{i,t-1} \times pos_{i,t}$		0.18*	
		(0.09)	
$\theta^C_{i,t-1}$		-0.01***	-0.01***
		(0.00)	(0.00)
$\theta^C_{i,t-1} \times neg_{i,t}$			0.64***
			(0.14)
Observations	687	687	687
Country FE	YES	YES	YES
Year FE	YES	YES	YES
Test - H_0:	$\beta_1^{pos} = \beta_2^{neg}$	$\beta_1^{pos} + \beta_3^{pos} = \beta_2^{neg}$	$\beta_2^{neg} + \beta_3^{neg} = \beta_1^{pos}$
F-stat	15.60	1.44	35.41

Notes: This table shows the results of panel regressions using annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. Output refers to $\Delta \log y_{i,t}$. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment is proxied by our measure of consumer confidence $\theta^C_{i,t}$ and varies between 0 and 1. See Section 4 for details on the construction of this economic sentiment measure. We analyse the asymmetric effects of consumption smoothing in response to positive and negative output fluctuations. See Section 3 for details on the construction of the positive and negative output fluctuation series.

TABLE 5. Asymmetries: Uncertainty

	(1)	(2)	(3)
$pos_{i,t}$	0.32***	0.16***	0.32***
	(0.04)	(0.06)	(0.03)
$neg_{i,t}$	0.83***	0.81***	0.52***
	(0.04)	(0.04)	(0.11)
$\theta^U_{i,t-1} \times pos_{i,t}$		0.33***	
		(0.11)	
$\theta^U_{i,t-1}$		-0.01***	0.00
		(0.00)	(0.00)
$\theta^U_{i,t-1} \times neg_{i,t}$			0.47***
			(0.14)
Observations	480	480	480
Country FE	YES	YES	YES
Year FE	YES	YES	YES
Test - H_0:	$\beta_1^{pos} = \beta_2^{neg}$	$\beta_1^{pos} + \beta_3^{pos} = \beta_2^{neg}$	$\beta_2^{neg} + \beta_3^{neg} = \beta_1^{pos}$
F-stat	68.44	12.99	84.77

Notes: This table shows the results of panel regressions using annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. Output refers to $\Delta \log y_{i,t}$. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment is proxied by our measure of uncertainty $\theta^U_{i,t}$ and varies between 0 and 1. See Section 4 for details on the construction of this economic sentiment measure. We analyse the asymmetric effects of consumption smoothing in response to positive and negative output fluctuations. See Section 3 for details on the construction of the positive and negative output fluctuation series.

TABLE 6. Confounding factors: Confidence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Output	0.60***	0.42***	0.41***	0.47***	0.27***	0.63***	0.33***
	(0.02)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
Output $\times$ $\theta^C_{i,t-1}$		0.28***	0.24***	0.27***	0.14**	0.17***	0.29***
		(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.07)
$\theta^C_{i,t-1}$		-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Output $\times$ D_{crisis}			0.12***				
			(0.04)				
D_{crisis}			-0.00**				
			(0.00)				
Output $\times$ Financial Openness				-0.02			
				(0.02)			
Financial Openness				0.00			
				(0.00)			
Output $\times$ LIR					0.03***		
					(0.01)		
Long term interest rates (LIR)					-0.00***		
					(0.00)		
Output $\times$ Trade Openness						-0.00***	
						(0.00)	
Trade Openness						-0.00***	
						(0.00)	
Output$\times$ F($z_{i,t-1}$)							0.16**
							(0.08)
F($z_{i,t-1}$)							0.00
							(0.00)
Observations	687	687	687	687	626	687	609
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES

Notes: This table shows the results of panel regressions using annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. Output refers to $\Delta \log y_{i,t}$. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment is proxied by our measure of consumer confidence $\theta^C_{i,t}$ and varies between 0 and 1. See Section 4 for details on the construction of this economic sentiment measure. F($z_{i,t-1}$) represents an indicator of the state of the business cycle, broadly based on the approach of Auerbach and Gorodnichenko (2012). See Section 5.2 for details on the construction of the business cycle state indicator.

TABLE 7. Confounding factors: Uncertainty

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Output	0.48***	0.27***	0.21***	0.30**	0.19***	0.47***	0.16***
	(0.03)	(0.05)	(0.05)	(0.13)	(0.05)	(0.06)	(0.06)
Output $\times$ $\theta^U_{i,t-1}$		0.40***	0.30***	0.40***	0.21***	0.41***	0.44***
		(0.08)	(0.07)	(0.08)	(0.08)	(0.07)	(0.08)
$\theta^U_{i,t-1}$		-0.01***	-0.01***	-0.01***	-0.00	-0.01***	-0.01***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Output $\times$ D_{crisis}			0.34***				
			(0.04)				
D_{crisis}			-0.00***				
			(0.00)				
Output $\times$ Financial Openness				-0.01			
				(0.05)			
Financial Openness				-0.00			
				(0.00)			
Output $\times$ LIR					0.03***		
					(0.01)		
Long term interest rates (LIR)					-0.00***		
					(0.00)		
Output $\times$ Trade Openness						-0.00***	
						(0.00)	
Trade Openness						-0.00*	
						(0.00)	
Output$\times$ F($z_{i,t-1}$)							0.24***
							(0.08)
F($z_{i,t-1}$)							-0.00
							(0.00)
Observations	480	480	480	480	472	480	480
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES

Notes: This table shows the results of panel regressions using annual data, with consumption (Δ log $c_{i,t}$) as the dependent variable. Output refers to Δ log $y_{i,t}$. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment is proxied by our measure of uncertainty $\theta^U_{i,t}$ and varies between 0 and 1. See Section 4 for details on the construction of this economic sentiment measure. F($z_{i,t-1}$) represents an indicator of the state of the business cycle, broadly based on the approach of Auerbach and Gorodnichenko (2012). See Section 5.2 for details on the construction of the business cycle state indicator.

TABLE 8. Linear panel model with interactive fixed effects

	(1) Benchmark	(2) Confidence	(3) Uncertainty
Output	0.68***	0.52***	0.41***
	(0.03)	(0.06)	(0.08)
$\theta_{i,t-1} \times$ Output		0.23**	0.36***
		(0.09)	(0.11)
$\theta_{i,t-1}$		-0.01***	-0.01***
		(0.00)	(0.00)
Observations	894	686	480

Notes: This table shows the results of a linear panel model with the (unknown) factors as interactive fixed effects using annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. Output refers to $\Delta \log y_{i,t}$. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment $\theta_{i,t}$ varies between 0 and 1. See Section 4 for details on the construction of our economic sentiment measures.

TABLE 9. Economic sentiments and consumption smoothing: Channels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Ex ante				*Ex post*				Consumption			
Output	0.03**	0.08***	0.04	0.07	0.31***	0.46***	0.56***	0.73***	0.60***	0.42***	0.27***	0.10*
	(0.01)	(0.03)	(0.04)	(0.04)	(0.03)	(0.05)	(0.06)	(0.07)	(0.02)	(0.04)	(0.05)	(0.06)
$\theta^C_{i,t-1} \times$ Output		-0.09**		-0.06		-0.23***		-0.43***		0.28***		0.38***
		(0.04)		(0.05)		(0.07)		(0.09)		(0.06)		(0.08)
$\theta^C_{i,t-1}$		0.00		-0.00		0.01***		0.02***		-0.01***		-0.02***
		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
$\theta^U_{i,t-1} \times$ Output			0.01	0.02			-0.27***	-0.20**			0.40***	0.32***
			(0.06)	(0.06)			(0.10)	(0.10)			(0.08)	(0.08)
$\theta^U_{i,t-1}$			-0.00	-0.00			0.01**	0.00			-0.01***	-0.00**
			(0.00)	(0.00)			(0.00)	(0.00)			(0.00)	(0.00)
Observations	689	655	461	461	655	655	478	461	687	687	480	463
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: This table shows the results of panel regressions using annual data, with *Ex ante* ($\Delta \log y_{i,t} - \Delta \log inc_{i,t}$), *Ex post* ($\Delta \log inc_{i,t} - \Delta \log c_{i,t}$) and consumption ($\Delta \log c_{i,t}$) as the dependent variables. Output refers to $\Delta \log y_{i,t}$. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment, proxied by our measures of consumer confidence ($\theta^C_{i,t}$) and uncertainty ($\theta^U_{i,t}$), varies between 0 and 1. See Section 4 for details on the construction of our economic sentiment measures.

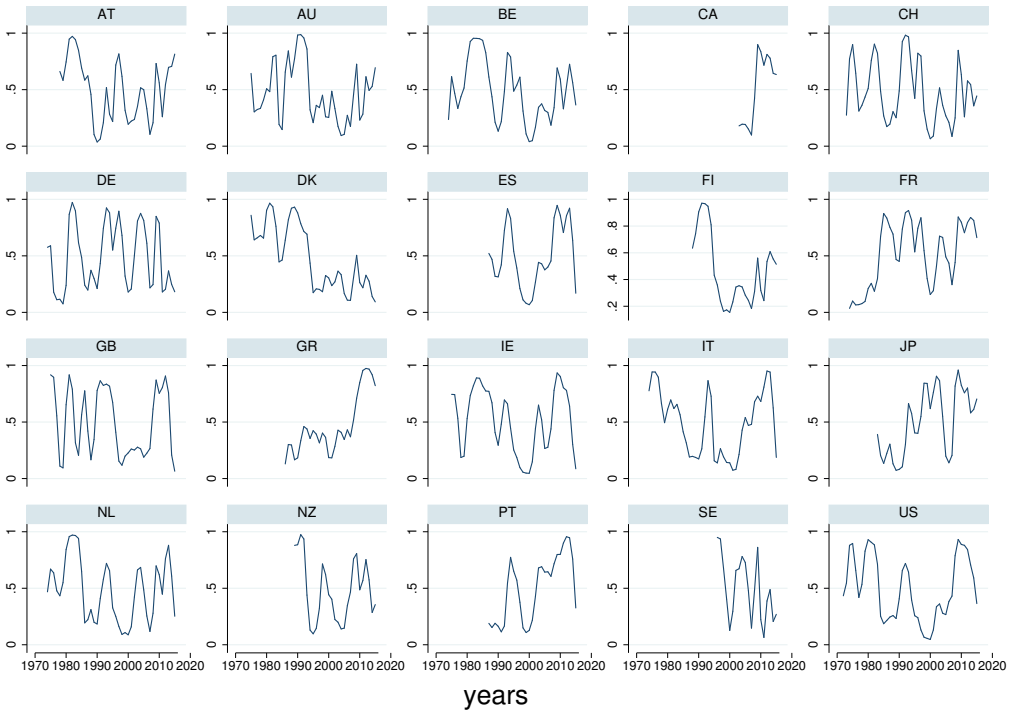
TABLE 10. Economic sentiments and consumption smoothing: Quarterly

	(1)	(2)	(3)	(4)
Output	0.34***	0.16***	0.32***	0.15**
	(0.03)	(0.05)	(0.05)	(0.06)
Output $\times\theta^C_{i,t-1}$		0.38***		0.49***
		(0.07)		(0.09)
$\theta^C_{i,t-1}$		-2.63***		-2.65***
		(0.31)		(0.36)
Output $\times\theta^U_{i,t-1}$			0.06	-0.03
			(0.08)	(0.08)
$\theta^U_{i,t-1}$			-0.58*	-0.00
			(0.34)	(0.32)
Observations	1,866	1,831	1,375	1,367
R-squared	0.42	0.47	0.40	0.48
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Notes: This table shows the results of panel regressions using quarterly data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. Output refers to $\Delta \log y_{i,t}$. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment, proxied by our measures of consumer confidence ($\theta^C_{i,t}$) and uncertainty ($\theta^U_{i,t}$), varies between 0 and 1. See Section 4 for details on the construction of our economic sentiment measures.

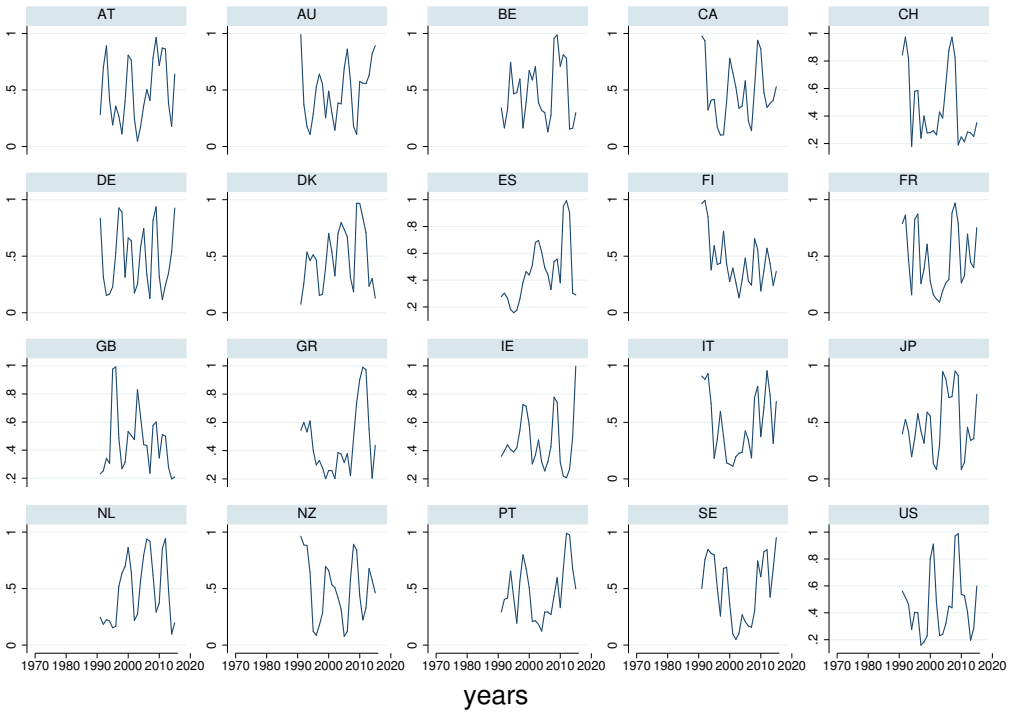
Figures

FIGURE 1. Strength of economic sentiment: Consumer confidence



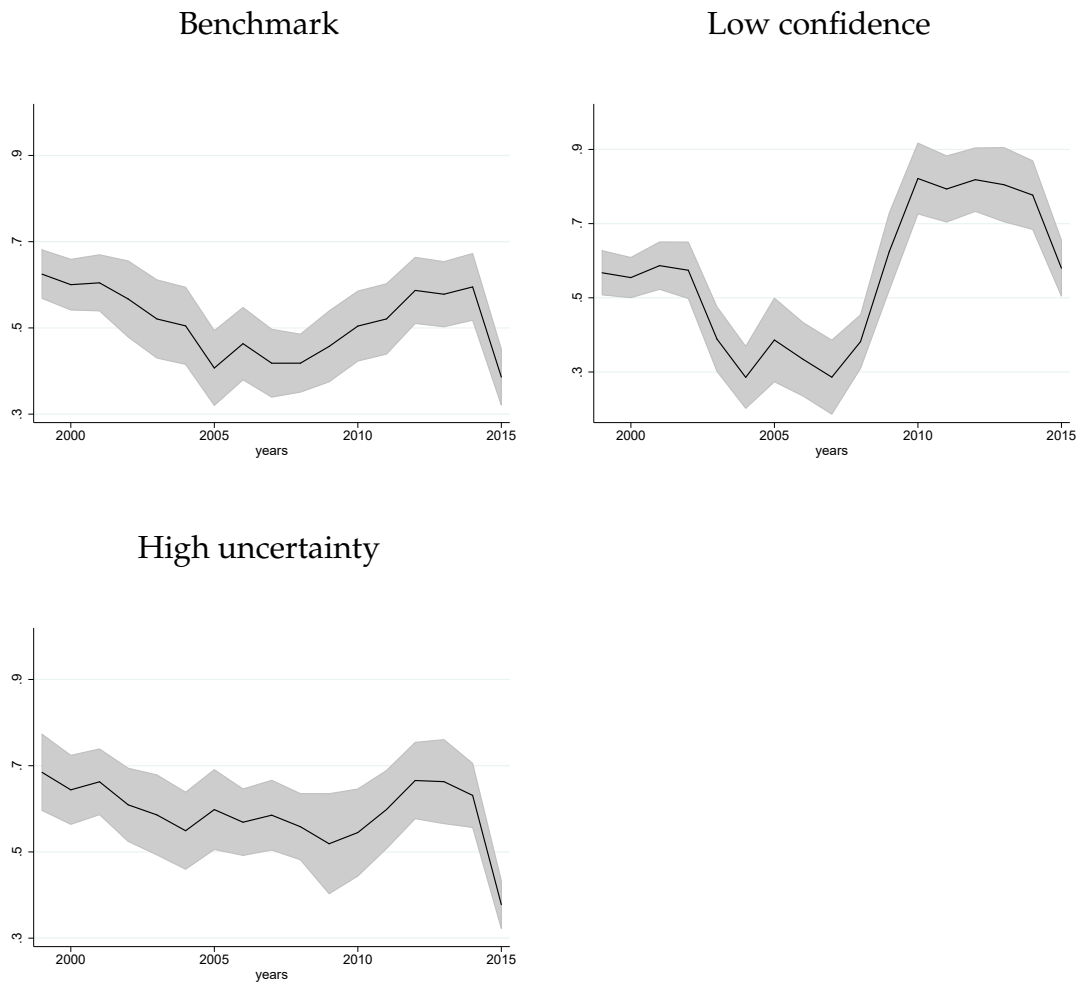
Notes: This figure plots our constructed measure of consumer confidence, $\theta^{C}_{i,t}$. This measure varies between 0 and 1, with higher values indicating lower consumer confidence and therefore weaker economic sentiment. See Section 4 for a detailed discussion of the construction and interpretation of this sentiment measure.

FIGURE 2. Strength of economic sentiment: Uncertainty



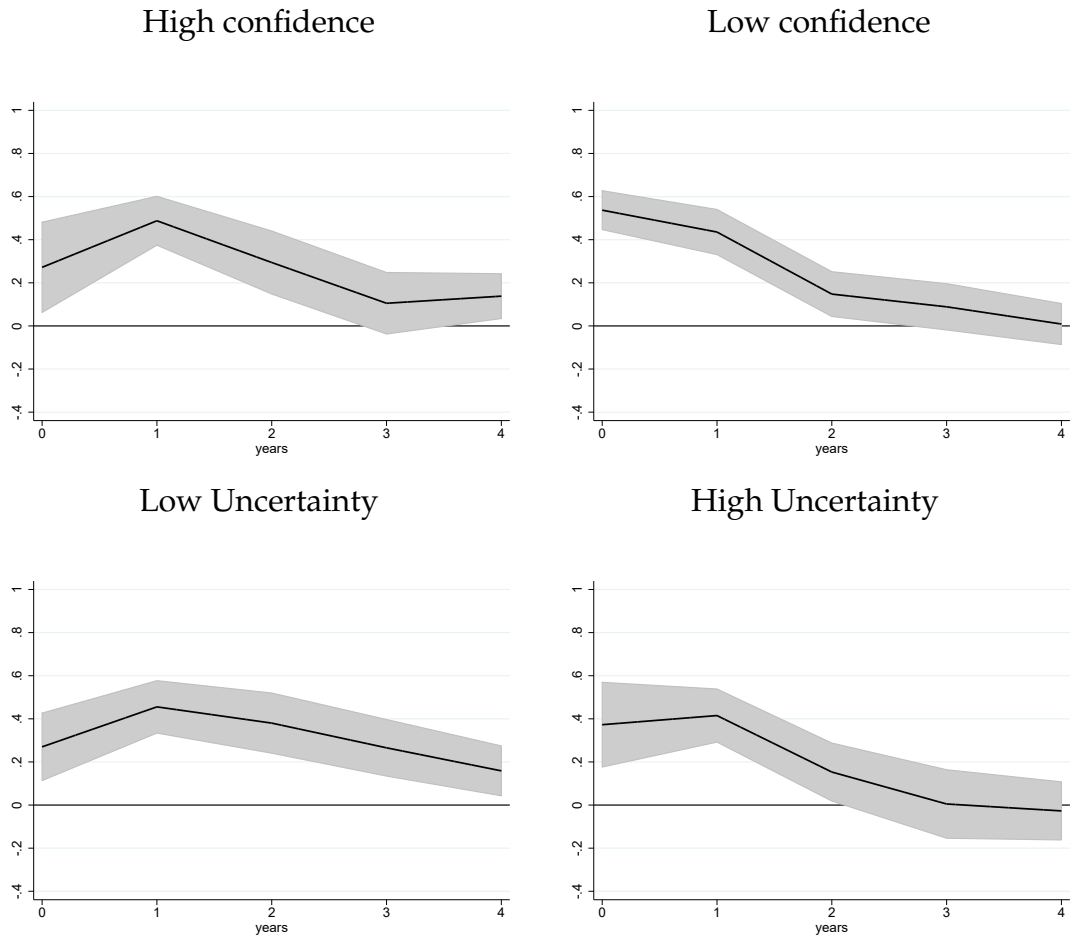
Notes: This figure plots our constructed measure of uncertainty, $\theta^{U}_{i,t}$. This measure varies between 0 and 1, with higher values indicating high uncertainty and therefore weaker economic sentiment. See Section 4 for a detailed discussion of the construction and interpretation of this sentiment measure.

FIGURE 3. Rolling consumption smoothing



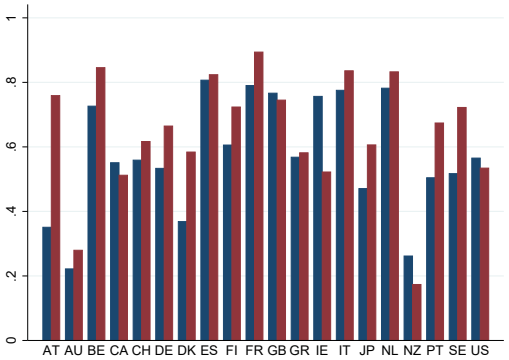
Notes: The solid lines represent the estimated degree of consumption smoothing using 10-year rolling windows, while the shaded areas contain the 95% confidence intervals. Low confidence and high uncertainty corresponds to the 90^{th} percentile of our economic sentiment measures. See Section 4 for details on the construction of our economic sentiment measures.

FIGURE 4. Dynamic consumption smoothing



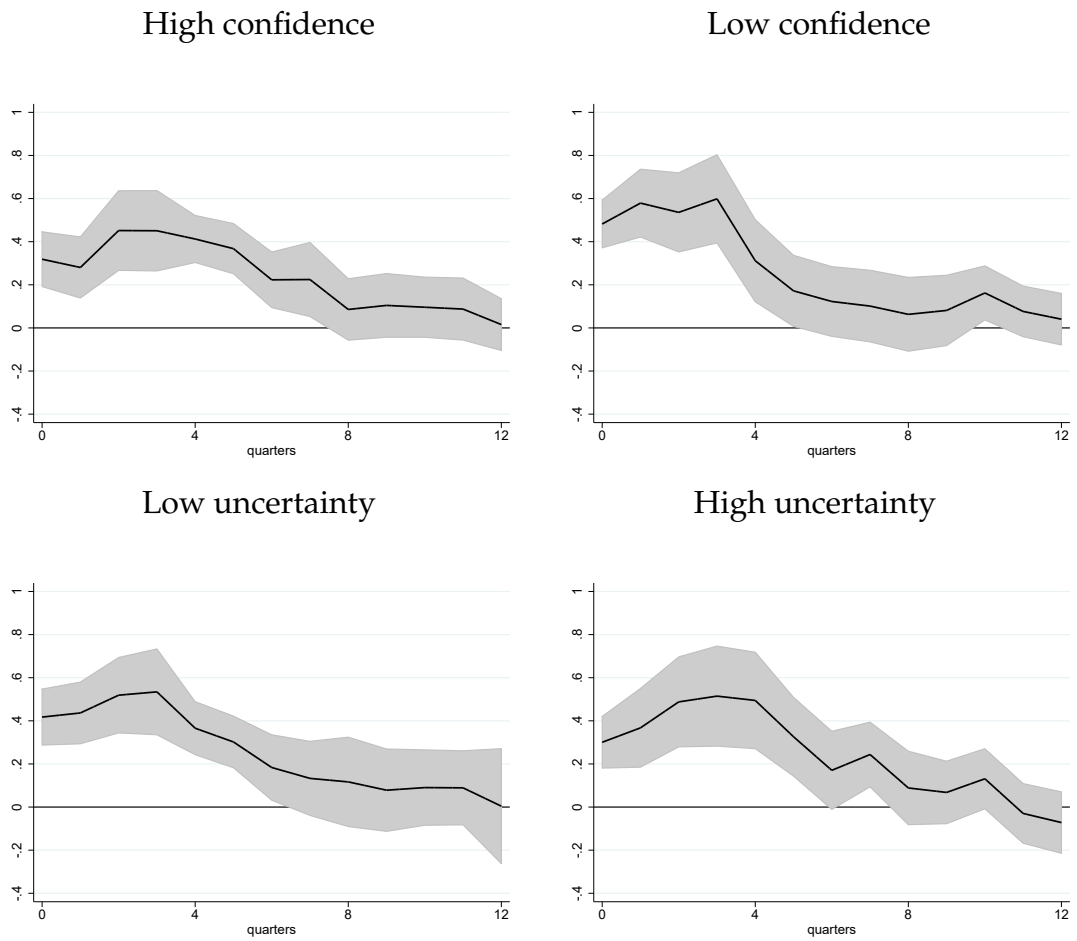
Notes: The solid lines represent the estimated degree of consumption smoothing, while the shaded areas contain the 90% confidence intervals. Low confidence and high uncertainty correspond to the 90^{th} percentiles of our economic sentiment measures, while high confidence and low uncertainty correspond to the 10^{th} percentiles.

FIGURE 5. Estimated global factor



Note: The bars represent the percentage of GDP (blue bar) and Consumption (red bar) variance explained by our estimated global factor. See Section 5.4 for a discussion on the extraction of this global factor.

FIGURE 6. Quarterly dynamic consumption smoothing



Notes: The solid lines represent the estimated degree of consumption smoothing, while the shaded areas contain the 90% confidence intervals. Low confidence and high uncertainty correspond to the 90^{th} percentiles of our economic sentiment measures, while high confidence and low uncertainty correspond to the 10^{th} percentiles.

A Alternative estimators

TABLE 11. Alternative estimators: Confidence

	(1) GLS SE	(2) Panel-corrected SE	(3) GMM
Output	0.42***	0.28***	0.29***
	(0.04)	(0.06)	(0.10)
$\theta^C_{i,t-1} \times$ Output	0.28***	0.45***	0.40***
	(0.06)	(0.08)	(0.09)
$\theta^C_{i,t-1}$	-0.01***	-0.02***	-0.01***
	(0.00)	(0.00)	(0.00)
Observations	687	687	666

Notes: This table shows the results of panel regressions with annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. GLS and Panel-corrected SE estimations include country- and time-fixed effects, GMM estimations include time-fixed effects. Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Output refers to $\Delta \log y_{i,t}$. The strength of economic sentiment is proxied by our measure of consumer confidence $\theta^C_{i,t}$ and varies between 0 and 1. See Section 4 for details on the construction of this economic sentiment measure.

TABLE 12. Alternative estimators: Uncertainty

	(1) GLS SE	(2) Panel-corrected SE	(3) GMM
Output	0.27***	0.18***	0.20
	(0.05)	(0.06)	(0.13)
$\theta^U_{i,t-1} \times$ Output	0.40***	0.47***	0.39***
	(0.08)	(0.09)	(0.13)
$\theta^U_{i,t-1}$	-0.01***	-0.01***	-0.01*
	(0.00)	(0.00)	(0.00)
Observations	480	480	460

Notes: This table shows the results of panel regressions with annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. GLS and Panel-corrected SE estimations include country- and time-fixed effects, GMM estimations include time-fixed effects. Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Output refers to $\Delta \log y_{i,t}$. The strength of economic sentiment is proxied by our measure of uncertainty $\theta^U_{i,t}$ and varies between 0 and 1. See Section 4 for details on the construction of this economic sentiment measure.

B Alternative economic sentiment measures

We assess the robustness of our findings to alternative measures of economic sentiment. For our consumer confidence measure, we use the *future tendency* component of the OECD's consumer confidence surveys rather than the contemporaneous component. For our uncertainty measure, we use *stock market volatility* (Bloom, 2014) as an alternative proxy to IMF output growth errors. We retrieve the data from Bloomberg and compute the standard deviation of the stock market return. In this case, Ireland is not included in the sample due to data availability. As before, higher values of these measures indicate higher volatility (*i.e.* weaker economic sentiment). The results are detailed in Tables 13. Our results are qualitatively unaffected by these alternative approaches to constructing our confidence and uncertainty measures.

TABLE 13. Alternative economic sentiment measures

	(1) Benchmark	(2) Confidence	(3) Uncertainty	(4) Future tendency	(5) Market volatility
Output	0.60***	0.43***	0.27***	0.23***	0.51***
	(0.02)	(0.04)	(0.05)	(0.05)	(0.05)
Output $\times\ \theta_{i,t-1}$		0.28***	0.40***	0.53***	0.24***
		(0.06)	(0.08)	(0.07)	(0.08)
$\theta_{i,t-1}$		-0.01***	-0.01***	-0.02***	-0.01*
		(0.00)	(0.00)	(0.00)	(0.00)
Observations	894	688	480	479	508
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Note: This table shows the results of panel regressions with annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Output refers to $\Delta \log y_{i,t}$. The strength of economic sentiment $\theta_{i,t}$) varies between 0 and 1. See Section 4 and Appendix B for details on the construction of our economic sentiment measures.

C European monetary union

Our results show that loss aversion can materially affect the degree of consumption smoothing following an output fluctuation. In particular, weak economic sentiments, that signal the expected direction of future income changes, reduce consumption smoothing and could lead to a desynchronisation of cross-border business cycles. Members of a monetary union do not have direct control over their nominal interest and exchange rates, and therefore have a reduced set of macroeconomic stabilisation tools available to them (Afonso and Furceri, 2008).[33] Therefore, we assess the degree to which economic sentiments affect the degree of consumption smoothing following subsequent output fluctuations in the 11 euro area countries in our sample in isolation. We then test whether this effect is due to loss aversion.

The baseline results for the euro-area subsample are reported in Table 14. The extent of consumption smoothing with and without controlling for prevailing economic sentiments is very similar to that uncovered in the full sample. This is contrary to the notion that these countries' participation in a monetary union should, in principle, lead to a higher degree of business cycle synchronisation (Giannone et al., 2010; De Grauwe and Ji, 2017). One notable difference in the baseline results is that uncertainty is no longer significant when also controlling for consumer confidence. This indicates that the consumer confidence channel may play a larger role in international consumption smoothing than the uncertainty channel (at least according to our measure of uncertainty) in a monetary union.

The results of our asymmetry tests aimed at uncovering the mechanism through which economic sentiments affect the degree of international consumption smoothing are reported in Tables 15 and 16 for confidence and uncertainty respectively. We find strong evidence of loss aversion from our measure of confidence, with the effect larger in the euro area countries than in the full sample. However, while the sign of the coefficient of our uncertainty measure is consistent with loss-averse behaviour, it is

[33]The recent introduction of macroprudential regulation offers a new national policy tool that can help stabilise small open economies in monetary unions (Clancy and Merola, 2017), who have such little weight in area-wide aggregates that nominal interest and exchange rates are effectively exogenous.

statistically insignificant.

The importance of our economic sentiment measures are robust to the inclusion of the same set of confounding factors used in the full sample analysis. The main difference in results is that trade openness and the business cycle are more important factors in international consumption smoothing in the euro area. We also find qualitatively and quantitatively similar results for our analysis of consumption smoothing dynamics, confounding variables, global output fluctuations, the persistence of fluctuations and alternative measures of economic sentiment. To save space, we do not report the results here, but they are available from the authors upon request.

TABLE 14. Euro area economic sentiments and consumption smoothing

	(1)	(2)	(3)	(4)
Output	0.59***	0.32***	0.35***	0.06
	(0.03)	(0.06)	(0.08)	(0.08)
Output $\times$ $\theta^C_{i,t-1}$		0.44***		0.69***
		(0.08)		(0.10)
$\theta^C_{i,t-1}$		-0.02***		-0.02***
		(0.00)		(0.00)
Output $\times$ $\theta^U_{i,t-1}$			0.34***	0.09
			(0.12)	(0.11)
$\theta^U_{i,t-1}$			-0.00	-0.00
			(0.00)	(0.00)
Observations	489	393	264	264
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Notes: This table shows the results of panel regressions using annual data for the euro area countries in our sample, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment, proxied by our measures of consumer confidence ($\theta^C_{i,t}$) and uncertainty ($\theta^U_{i,t}$), varies between 0 and 1. See Section 4 for details on the construction of our economic sentiment measures.

TABLE 15. Euro area Asymmetries: Confidence

	(1)	(2)	(3)
$pos_{i,t}$	0.45***	0.32***	0.45***
	(0.05)	(0.07)	(0.04)
$neg_{i,t}$	0.82***	0.75***	0.15
	(0.06)	(0.06)	(0.14)
$\theta^C_{i,t-1} \times pos_{i,t}$		0.29**	
		(0.12)	
$\theta^C_{i,t-1}$		-0.02***	-0.01**
		(0.00)	(0.00)
$\theta^C_{i,t-1} \times neg_{i,t}$			0.87***
			(0.18)
Observations	393	393	393
Country FE	YES	YES	YES
Year FE	YES	YES	YES

Notes: This table shows the results of panel regressions using annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment is proxied by our measure of consumer confidence $\theta^C_{i,t}$ and varies between 0 and 1. See Section 4 for details on the construction of this economic sentiment measure. We analyse the asymmetric effects of consumption smoothing in response to positive and negative output fluctuations. See Section 3 for details on the construction of the positive and negative output fluctuation series.

TABLE 16. Euro area Asymmetries: Uncertainty

	(1)	(2)	(3)
$pos_{i,t}$	0.30***	0.29***	0.29***
	(0.05)	(0.10)	(0.05)
$neg_{i,t}$	0.90***	0.90***	0.71***
	(0.05)	(0.06)	(0.15)
$\theta^U_{i,t-1} \times pos_{i,t}$		0.02	
		(0.17)	
$\theta^U_{i,t-1}$		0.00	0.00
		(0.00)	(0.00)
$\theta^U_{i,t-1} \times neg_{i,t}$			0.28
			(0.19)
Observations	264	264	264
Country FE	YES	YES	YES
Year FE	YES	YES	YES

Notes: This table shows the results of panel regressions using annual data, with consumption ($\Delta \log c_{i,t}$) as the dependent variable. The HAC-robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The strength of economic sentiment is proxied by our measure of uncertainty $\theta^U_{i,t}$ and varies between 0 and 1. See Section 4 for details on the construction of this economic sentiment measure. We analyse the asymmetric effects of consumption smoothing in response to positive and negative output fluctuations. See Section 3 for details on the construction of the positive and negative output fluctuation series.

European Stability Mechanism

6a Circuit de la Foire Internationale
L-1347 Luxembourg

Tel: +352 260 292 0

www.esm.europa.eu

info@esm.europa.eu