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Abstract. Using the Consensus Economics dataset with individual expert forecasts from G7 countries we investigate determinants of disagreement (cross-sectional dispersion of forecasts) about six key economic indicators. Disagreement about real variables (GDP, consumption, investment and unemployment) has a distinct dynamic from disagreement about nominal variables (inflation and interest rate). Disagreement about real variables intensifies strongly during recessions, including the current one (by about 40 percent in terms of the interquartile range). Disagreement about nominal variables rises with their level, has fallen after 1998 or so (by 30 percent), and is considerably lower under independent central banks (by 35 percent). Cross-sectional dispersion for both groups increases with uncertainty about the underlying actual indicators, though to a lesser extent for nominal series. Country-by-country regressions for inflation and interest rates reveal that both the level of disagreement and its sensitivity to macroeconomic variables tend to be larger in Italy, Japan and the United Kingdom, where central banks became independent only around the mid-1990s. These findings suggest that more credible monetary policy can substantially contribute to anchoring of expectations about nominal variables; its effects on disagreement about real variables are moderate.

Keywords: disagreement, survey expectations, monetary policy, forecasting

JEL Classification: E31, E32, E37, E52, C53

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1. Introduction

Macroeconomic models often impose homogeneity. Agents have the same preferences, beliefs, information sets, are hit with the same shocks or process information in the same way. Such assumptions are convenient because they make models simple and tractable while keeping them useful for aggregate policy analysis. However, evidence from micro data and casual observations show that people differ from each other, and economists have recently put much effort into constructing and studying models that can account for some of the differences.[1]

Expectations are known to be a crucial determinant of economic dynamics.[2] Although existing micro data sets make it possible to measure and test many aspects of heterogeneity (e.g., differences in income, portfolios, demographics, shocks or labor force status), they typically contain little information about expectations. In addition, even when such information exists, the length and frequency of the series do not allow to adequately investigate how the cross-sectional distribution of expectations varies over time, business cycle and with economic policy. Consequently, there has been little work on joint analysis of individual survey expectations across countries and variables.

We investigate determinants of disagreement (cross-sectional dispersion of forecasts) about six key economic indicators in G7 countries roughly over the past twenty years. Using a unique data set with individual expert forecasts from Consensus Economics we provide a set of statistics that capture the key features of dynamics of disagreement and are consistently calculated across countries and variables. The data set has been used quite extensively (see references below) but most work investigates the central tendency—consensus—not the cross-sectional distribution of forecasts. Although it is often challenging in large data sets like ours, which covers six variables in seven countries, to find consistent results, to summarize them and interpret, a number of results emerge quite clearly from our analysis.

We find that disagreement about real variables (GDP, consumption, investment and unemployment) has a distinct dynamic from disagreement about nominal variables (inflation and interest rate). Disagreement about real variables intensifies strongly during recessions (by about 40 percent in terms of the interquartile range). Disagreement about nominal variables rises with their level, has fallen after 1998 or so (by 30 percent), and is considerably lower under independent central banks (by 35 percent). For both groups cross-sectional dispersion increases with uncertainty about the underlying actual indicators, though to a lesser extent for nominal series, and disagreement is more strongly cross-correlated among variables within the groups than between them.

[1] For example, models in which some households are more impatient than others (or are subject to liquidity constraints) are useful in studying the monetary policy transmission mechanism (Iacoviello, 2005). Models with heterogeneous beliefs/expectations are becoming popular in asset pricing literature (see Scheinkman and Xiong, 2003 for a survey). Carroll (1997) and Krusell and Smith (1998) model reaction of agents' consumption–saving behavior to idiosyncratic (and aggregate) income shocks. Morris and Shin (2005b) investigate the value of providing of public information to agents depending on the amount of private information they have.

[2] See Bernanke (2004), Morris and Shin (2005a), Woodford (2005) and many others.

While we provide simple and transparent reduced-form estimates, we believe our statistics also suggest a causal relationship: central bank independence reduces disagreement about nominal variables. Country-by-country regressions for inflation and interest rates reveal that both the level of disagreement and its sensitivity to macroeconomic variables tend to be larger in Italy, Japan and the United Kingdom, where central banks became independent only around the mid-1990s. These findings suggest that more credible monetary policy can substantially contribute to anchoring of expectations about nominal variables. In contrast, its effects on disagreement about real variables are moderate.

We believe our results could be of interest to both policy-makers and researchers. The large literature on monetary theory and policy agrees that anchored inflation expectations are of utter importance for safeguarding of price stability. Much work (including Cogley and Sargent, 2001; Stock and Watson, 2002 and Stock and Watson, 2005) has documented that the inflation and GDP processes in G7 countries moderated in the late 1980s and their volatility has been falling further most of the time until recently.[3] Our data set confirms the existing findings that the consensus (mean) expectations have also stabilized for most countries and variables. However, for expectations to be perfectly anchored it is necessary (though not sufficient) that also their cross-sectional dispersion—disagreement—disappears. Our results document across several countries and variables the extent to which this has been the case and suggest how economic shocks and monetary policy setting contributed to the reduction of disagreement we often find in the 2000s. Researchers could use the stylized facts we report to calibrate, test and improve models with heterogeneous beliefs, learning or information processing constraints, which have recently become quite widespread.[4]

Our work builds on two strands of literature on survey expectations. The first and larger area analyzes the central tendency in expectations about inflation, GDP, interest rates and exchange rates.[5] The second, more recent and more closely related body of work investigates heterogeneity in expectations, often

[3]More precisely, the work typically finds that the variance of the permanent component of inflation and GDP was declining before 2006 or so. In addition, evidence below documents that the average variance of the permanent component of the six series we investigate was typically higher in the 1990s than in the 2000s.

[4]For example, Erceg and Levin (2003) use the consensus inflation expectations from the US Survey of Professional Forecasters to calibrate the signal-to-noise ratio, which determines how households and firms disentangle persistent shifts in inflation target from transitory disturbances in the monetary policy rule. The ratio is the key determinant of the persistence of actual inflation and output. Mankiw, Reis, and Wolfers (2003) compare how the sticky information model matches cross-sectional dispersion of inflation forecasts in various US surveys. Bloom, Floetotto, and Jaimovich (2009) document that uncertainty about economic activity is strongly counter-cyclical and build a dynamic stochastic general equilibrium model with heterogeneous firms, non-convex adjustment costs and changing variance of productivity shocks. In such model a rise in uncertainty leads to a fall in output.

[5]For example, Branch (2004) estimates a model of boundedly rational agents on inflation expectations from the Survey of Consumer Attitudes and Behavior of the University of Michigan. Ang, Bekaert, and Wei (2007) find that survey expectations provide better inflation forecasts than macro variables or asset markets. Bernanke and Boivin (2003) and Faust and Wright (2007) compare the Greenbook inflation and GDP forecasts (produced by the US Federal Reserve) to predictions generated by reduced-form econometric models. Kim and Orphanides (2005), Piazzesi and Schneider (2008) and others use interest rate expectations from the US Survey of Professional Forecasters to improve on the existing yield curve models.

using micro data. The key inspiration for our work is a recent important paper of Mankiw et al. (2003), which analyzes central tendency and dispersion of inflation expectations using several US survey data sets, and tests some theories of disagreement. Separate work of Souleles (2004) uses the Michigan Survey of Consumer Attitudes and Behavior to examine the ability of various groups of population to forecast consumption expenditure. Blanchflower and Kelly (2008) study determinants of inflation expectations in the Bank of England's Inflation Attitudes Survey and the European Commission's consumer survey. Patton and Timmermann (2008b) use a simple reduced-form state-space model to explain the cross-sectional dispersion of US GDP growth and inflation forecasts and argue that forecasters' heterogeneity in prior beliefs is more important than heterogeneity in information sets. Lahiri and Sheng (2009) show, using a decomposition of forecasts errors into common and idiosyncratic shocks, that aggregate forecast uncertainty can be expressed as a combination of disagreement among the forecasters and the perceived variability of future aggregate shocks. Carroll (2003) bridges the two strands of literature by proposing and testing a model of average inflation and unemployment expectations of households interact with those of experts. But joint analysis of individual survey expectations across countries and variables is so far under-researched.

The estimates below capture dynamic correlations, conditional on the explanatory variables included in the regressions. Besides being potentially subject to standard econometric issues, such as mis-specification or omitted-variable bias, our estimates can to some extent be affected by endogeneity and, as a result, caution is required to draw strong conclusions about the causal nature of the estimated relationships. We have undertaken a large number of robustness checks (some of which are in the online appendix). We believe the results reported in this paper are reasonably stable although it is of course likely that future work on the topic will provide new, more refined insights.

2. The Data

2.1. **The Data Set.** We use a leading cross-country survey data set compiled by Consensus Economics, http://www.consensuseconomics.com/, a London-based economic survey organization.[6] Each month, starting in October 1989,

Much work, like us, uses the Consensus Economics data set, although often just the central tendency rather than the whole cross-section of observations. For example, Engel and Rogers (2008) and Devereux, Smith, and Yetman (2009) use expectations of consumption, inflation and exchange rates to test models of international risk sharing. Engel, Mark, and West (2008) feed inflation forecasts into the present-value model of the exchange rate in order to evaluate its forecasting performance. Levin, Natalucci, and Piger (2004) investigate the degree to which inflation expectations are anchored in industrial countries. Patton and Timmermann (2008a) study how uncertainty about macroeconomic variables is resolved using forecasts of US inflation and GDP growth.

Separate large literature exists on extracting inflation expectations from prices of indexed bonds. For example Gürkaynak, Levin, and Swanson (2006), Ehrmann, Fratzscher, Gürkaynak, and Swanson (2007) and Beechey, Johannsen, and Levin (2008) use high-frequency financial data to provide evidence complementary to ours on anchoring of long-run inflation expectations in the euro area, Sweden, the UK and the US.

[6]Several other data sets of economic forecasts of experts exist both in the US (Survey of Professional Forecasters and the Livingston Survey) and in Europe (European Central Bank's Survey of Professional Forecasters and Bank of England's Survey of External Forecasters).

Consensus Economics polls experts from public and private economic institutions, mostly investment banks and economic research institutes, about their predictions about the most common macroeconomic indicators. Neither central banks nor governments participate in the survey. Our sample ranges between October 1989 and October 2006 and consists of 205 monthly observations.

While the survey is now conducted in more than twenty countries, the largest sample in terms of length and cross-sectional dimension (number of respondents) is available for G7 countries.[7] Essentially the same survey is conducted in all G7 countries using the same procedure: forecasters fill out the survey form mostly electronically in the first two weeks of each month and the data are published around the middle of the month. In addition, country-specific expertise is guaranteed as most panelists are located in the country they are analyzing. Consequently, the data set is comparable both across countries and across panelists, and collects some of the best economic forecasts.

The data set covers all principal macroeconomic indicators. We focus on the following six: consumer-price inflation, nominal three-month interest rate, GDP growth, consumption growth, investment growth and unemployment rate.[8] Although the survey contains information on other variables (most importantly, industrial/manufacturing production, producer prices, wages, current account and budget balance), their coverage in terms of time period, countries and number of respondents is less complete. These additional indicators are also arguably less important and often less closely followed by forecasters than those we focus on.

Before the analysis we cleaned and transformed the data as follows. The starting point are the expectations series as given in the reports of Consensus Economics. We are able to keep track of the series of each forecaster and attempt to follow them as their institutions merged with others, were taken over or renamed (see the the online appendix). We checked the individual expectations, which substantially differ from others (e.g., three inflation expectations in Japan in February and March 2002) and made sure they correctly reflect the figures in the reports.[9] For each respondent some observations—typically about 10 percent—were linearly interpolated when a single observation was missing (and both adjacent monthly observations were available) within a year or when two observations were missing at the beginning or at the end of the year.

2.2. **Fixed Event and Fixed Horizon Forecasts.** Except for interest rates, the respondents give their expectations over the current and the next calendar

These surveys typically cover only a single country or economic region (euro area), a subset of variables (most prominently inflation), or a shorter time period than the Consensus Economics survey.

[7]Although the survey currently covers all major industrial countries and many emerging economies, data from some relatively large European countries (such as Spain, the Netherlands or Sweden) have only been available since December 1994. Expectations about the euro area variables only go back to December 2002 (and are subject to composition effects as new countries joined the monetary union).

[8]We have also investigated expectations about industrial production but only report these results, which are broadly consistent with those for GDP in the online appendix.

[9]It is possible that these outliers could have been due to typing errors by respondents. However, our measure of disagreement—the cross-sectional interquartile range—is robust to the presence of a limited number of outliers.

year; the survey data thus provides series of *fixed event* forecasts.[10] However, we believe *fixed horizon* (e.g., one-year-ahead) forecasts are preferable for the analysis of disagreement because forecasting horizon of fixed event forecasts varies from month to month and consequently their uncertainty and cross-sectional dispersion is strongly seasonal. In addition, we use fixed horizon forecasts because we want to provide comparable results to much of the literature, including Mankiw et al., 2003.

We approximate fixed horizon forecasts as a weighted average of fixed event forecasts as follows. Denote $F^{\text{fe}}_{y0,m,y1}(x)$ the fixed event forecast of variable x for year $y1 = y0+1$ made in month m of previous year, $y0$, and $F^{\text{fh}}_{y0,m,12}(x)$ the fixed horizon, twelve-month-ahead forecast made at the same time. For example, the November 2008 forecast for year 2009 is $F^{\text{fe}}_{2008,11,2009}(x)$. We approximate the fixed horizon forecast for the next twelve months as an average of the forecasts for the current and next calendar year weighted by their share in forecasting horizon:

$$F^{\text{fh}}_{y0,m,12}(x) = \frac{12-m+1}{12} F^{\text{fe}}_{y0,m,y0}(x) + \frac{m-1}{12} F^{\text{fe}}_{y0,m,y0+1}(x). \tag{1}$$

For example, the November 2008 forecast of inflation rate between November 2008 and November 2009 is approximated by the sum of $F^{\text{fe}}_{2008,11,2008}(\pi)$ and $F^{\text{fe}}_{2008,11,2009}(\pi)$ weighted by $\frac{2}{12}$ and $\frac{10}{12}$ respectively.

We use this procedure for the five variables with the exception of interest rate, which is reported as the fixed-horizon forecast of interest rate between now and three months from now.

Because the disagreement series is used only as the dependent variable, the approximation/measurement error in series $F^{\text{fh}}_{y0,m,12}(x)$ from (1) does not affect the consistency of the regression estimates obtained below as long as the error is not correlated with regressors. Such correlation should be relatively low also given the high, monthly frequency of the data.

It is ultimately an empirical question how well our approximation performs. Using fixed event and fixed horizon forecasts in the US Survey of Professional Forecasters, Dovern and Fritsche (2008) find that approach (1) captures well cross-sectional dispersion of predictions. Correlation between cross-sectional dispersion in (1) and the true dispersion of fixed horizon forecasts is roughly 0.8–0.9 when measured with standard deviation and 0.6–0.9 for the interquartile range (IQR). The remaining nine methods Dovern and Fritsche investigate, including several specifications with unobserved components and seasonal adjustment, typically correlate with the true dispersion at 0.5–0.9 for standard deviation and 0.2–0.8 for the interquartile range.

As the final issue, we need to decide about our preferred measure of cross-sectional dispersion of forecasts. Throughout the paper we use the width of the interquartile range, the difference between the third and first quartile of observations. We do so to be consistent with the previous work (Mankiw et al., 2003) and because the IQR is also likely to be more robust to outliers than standard deviation. The results for disagreement measured with standard deviation are

[10] Once every quarter the survey includes additional questions for selected variables (CPI inflation, GDP, consumption) on the fixed horizon predictions for roughly the following two years. However, these questions are not useful for the analysis of disagreement because only the *consensus (mean) forecasts* are published.

consistent with those presented below, which is not surprising given the relatively high correlation (0.7–0.8) between the two measures shown in Table 15 in the Appendix.[11]

2.3. **Descriptive Statistics.** Before we analyze disagreement among forecasters in more detail, let's have a closer look at the data. Figures 1–6 compare the expected and actual variables. The actual series are shifted backward by twelve months so that the vertical difference between them and expectations is the expectation error. (For example, for November 2003, the dots denote expectations of one-year ahead inflation rate and the actual series is inflation between November 2003 and November 2004.) The shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method, which mirrors the NBER procedure).

Three findings appear for all six expectation series. First, expectations are more stable than the actual series as the actual series contain substantial unpredictable and volatile component.

Second, expectations are sensitive to current conditions: expected one-year ahead rates are quite strongly correlated with the currently observed rates. This is perhaps not surprising in case of inflation, interest rate and unemployment, which are generally known to be quite persistent (so that the last observation is a good predictor of the future one(s)). However, the sensitivity to current conditions is also apparent—although to a lesser extent—for variables like GDP growth, which are only modestly serially correlated.

Third, expectations are sluggish in that they typically overestimate the developments when the underlying variable is falling. This finding is apparent for example during the disinflations of the early 1990s when inflation expectations errors were on average positive. The result is clearer for more persistent variables—inflation, interest rates and unemployment—than for those subject to large transitory fluctuations (GDP, consumption and investment).

Table 1 summarizes the key descriptive statistics about expectations and actual series. Average number of forecasters, displayed in the first line of each panel, typically ranges between 15 and 35 and shows little systematic variation over time: while in Canada, Japan and the US it is approximately constant, it rises somewhat in France, Germany and Italy and falls in the UK after 2000 or so. The number of respondents does not correlate with the phase of the business cycle, and varies little across variables (in a given country). Observations for each forecaster are available for about half of the time on average.

The second line in each panel shows the mean expectation error averaged across forecasters and time periods. The individual forecasts are not statistically significantly biased partly because the standard deviation of expectation errors is quite large. (The bias of consensus, or mean, forecasts is significant for a few variables in some countries.) Average expectation errors are typically positive, which may reflect forecasters' optimism or sluggishness (where the trend in the

[11]For a normal distribution standard deviation (stdev) is proportional to the interquartile range, stdev $= 1.349 \times$ IQR (because the 75th percentile of the standard normal distribution is 0.6745). This scaling on average roughly holds in our data, e.g. for inflation in Canada average IQR $= 0.34$ and stdev$\times 1.349 = 0.26 \times 1.349 = 0.35$. The Shapiro–Wilk test does not reject normality in cross-section about 85–90 percent of time (somewhat below what is implied by its nominal size of 0.05).

underlying variable is falling most of the time, such as in the case of inflation and interest rates).[12] There are few systematic differences across countries (for example, while the US respondents do well in the case of interest rate, they are the worst in the case of consumption).[13]

Lines three, four and five give the average mean squared errors of forecasts, average level of the underlying variable and its variance respectively (taken over the sample period October 1989–October 2006). The level and the variance of economic variables can plausibly be positively correlated—see Ball and Cecchetti (1990) and Ball (1992)[14] on empirical and theoretical investigation for inflation—and both can positively correlate with the MSEs (and also disagreement). However, the evidence in Table 1, based on variables averaged over the sample and summarized in the top panels of Figure 7, implies if anything a negative correlation between the MSE and the level of the underlying variable.[15] In contrast, imprecision of expectations tends to increase with the variance of the underlying variable, as one would expect. While Figure 7 is subject to many criticisms—such as that the relationship is only bivariate and based on time-averaged statistics—we believe it is an interesting starting point for a more careful regression analysis of disagreement below.[16]

3. Drivers of Disagreement

The previous section summarized some key properties of individual expectations. In contrast, this section focuses on the *disagreement* among forecasters—defined as cross-sectional dispersion and measured with the cross-sectional interquartile range—its evolution over time and its relationship to the business cycle and monetary policy.

3.1. **A First Look at Disagreement.**

Line six in each panel of Table 1 summarizes the average disagreement by country and variable. Full-sample time-average of disagreement about inflation is relatively low for France, Germany and Italy. Cross-sectional dispersion of interest rates is quite high in Canada and the US, relatively low in France and Germany, and extremely low in Japan, the last finding being driven by effectively zero interest rates for much of the time since 2000. Forecasters in France, Germany and Italy agree to a large extent on GDP growth, compared to their counterparts in the UK, Canada and in particular Japan (where the dynamics are again dominated by the recession part of the sample). While the series for consumption growth is smoother than

[12]Bias of inflation forecasts tends to be quite high and positive before 1999 and negative afterwards.

[13]Detailed investigation of bias and efficiency of forecasts is beyond the scope of this paper. Large literature exists on this topic, mostly testing GDP, inflation and unemployment forecasts, including work that uses our data set, e.g. Harvey, Leybourne, and Newbold (2001), Isiklar, Lahiri, and Loungani (2006), Batchelor (2007), and Ager, Kappler, and Osterloh (2009).

[14]Ball (1992) proposes a model in which the level of inflation and its uncertainty are positively correlated because when inflation is high, policy-makers face a dilemma: they would like to disinflate but fear the resulting recession.

[15]Note that investment, being an outlier due to large MSEs, is excluded from the Figure to be able to assess if the positive relationship between the MSE and variance holds even without it.

[16]Because the focus of this paper is on disagreement, we will not investigate the determinants of MSEs below.

that for GDP growth, disagreement about consumption tends to be somewhat higher, driven perhaps by less attention that some forecasters pay to the consumption series. However, the two disagreement series correlate quite strongly, which one could expect given the large share of consumption in GDP (see also Figures 10–11 below for time perspective). Disagreement about investment is substantially larger than for other series because of its high volatility. Unemployment on the other hand is smooth (and predictable), which translates into little disagreement.[17]

Figures 8–13 illustrate the evolution of disagreement over time by country and variable. Perhaps unsurprisingly given the monthly frequency of our sample, disagreement is subject to much transitory but quite persistent variation. However, two findings arise in several countries and series. First, disagreement tends to rise during recessions. Second, there is a downward time trend in disagreement.

Disagreement about inflation in Figure 8 is roughly constant in France and Germany but falls steadily after 1992 or so in Italy, as the country was expected to join the euro area, in Japan and in the UK. The series is quite strongly anti-cyclical (in terms of the difference between its average in recessions and booms) in Canada, Italy, Japan, the UK and the US.

As shown in Figure 9, disagreement about interest rate tends to trend downward in all countries except for the US and its dynamics is strongly anti-cyclical (except for Japan where there was little disagreement when the interest rates lied close to zero).

Disagreement about GDP growth in Figure 10 is again anti-cyclical, except for France; in the remaining countries it is typically 30–50% higher in recessions than in booms. Disagreement about the remaining real variables (consumption, investment and unemployment) broadly tracks that of GDP.

One can think of at least two structural breaks in our sample: the introduction of the euro in January 1999 and the German re-unification in October 1990. The expectations of the first event seem to have affected disagreement about inflation in Italy, which started to fall following the breakdown of the European Exchange Rate Mechanism in September 1992. Disagreement in the remaining two euro area members, France and Germany, has been roughly constant perhaps because the inflation rate in these two countries has been low and stable. Figures 8–13 show, the structural break due to the German re-unification in October 1990 temporarily elevated disagreement about real variables (GDP, consumption, investment and unemployment), but not about inflation and interest rate. To a large extent unrelated to these two events, there has been much dynamics in disagreement of various series, in particular the clear downward trend in the UK and cyclical dynamics in most countries. We investigate these developments in more detail below using simple regression analysis.

3.2. **Disagreement over Time.** To provide quantitative insights Tables 2–7 use the fixed effects panel estimator (in which coefficients other than the constant are restricted to be the same in all countries[18]) to assess general trends common

[17]The somewhat higher mean for Germany is driven by the uncertainty about labor market statistics during the re-unification.

[18]The constant term β_0 in the Tables is normalized to give the average of country-specific intercepts.

in all countries. We discuss the results for the three most important indicators—inflation, interest rates and GDP—in more detail and summarize the remaining variables (consumption, investment and unemployment) only briefly.

The top panel (Panel A) of each of Tables 2–7 investigates how disagreement ("disagr") varies over time and during recessions using two versions of regression:

$$\text{disagr}_t = \beta_0 + \beta_1 \times \text{rec}_t + \beta_2 \times \text{post-1998}_t + u_t,$$

where "rec" denotes the recession dummy and "post-1998" is the dummy for the second part of the sample.

Disagreement about inflation is analyzed in Table 2. Row 1 reports that the cross-sectional interquartile range averaged across countries and time is about 0.3, which suggests that half of the forecasters typically lie within 0.15 percentage points of the consensus. Row 2 shows that disagreement rises by about 15 percent during recessions, a fact that can be due to the increase in general macroeconomic uncertainty, and that disagreement is much lower—by 25%—in the second part of the sample, after 1998.

Qualitatively similar findings obtain for disagreement about interest rates and GDP growth and are reported in Tables 3 and 4 respectively. For both variables, disagreement rises during recessions and falls after 1998. While the effects for interest rates are quantitatively similar to those for inflation, the increase in disagreement about GDP during recessions is almost twice as large—41 percent (and the fall after 1998 is less pronounced). This seems reasonable as macroeconomic uncertainty during a recession is skewed toward GDP (and less evident for interest rates and, in particular, inflation). The finding is also closely in line with the evidence in Bloom et al. (2009), who construct a synthetic index of aggregate uncertainty based on measures of cross-firm and cross-industry dispersion, time variation of aggregate data and forecaster disagreement (about GDP growth and unemployment rate); the index of Bloom et al. indicates that uncertainty increases by 42.5 percent during recessions. Results for consumption growth, investment growth and unemployment rate in Tables 5, 6 and 7 respectively are again qualitatively consistent with the rest.

Qualitatively, the estimates (together with those of Tables 2–3) suggest that the recession differential in disagreement—the difference between average disagreement in a recession and a boom—is generally larger for real variables (GDP, consumption, investment and unemployment) than for the two nominal variables. In contrast, the fall in disagreement after 1998 tends to be smaller for real variables than for nominal ones.

Two important broad factors behind the variation in disagreement can be the shocks to economic variables and economic policy. Larger shocks boost the volatility of the underlying actual variables and make them less predictable. As a result, forecasters are more likely to disagree about future outcomes (because they may use different models, priors, subjective probabilities or data). More credible economic policies can make economic indicators easier to forecast. An obvious example is the introduction of an explicit numerical inflation target, which can contribute to better anchoring of inflation expectations. Similarly, independent central banks are often perceived as better safeguards to price stability

(and can indirectly also contribute to the stabilization of output). We investigate these two factors—economic shocks and policies—in a simple reduced-form setup below but before doing so we first have to measure them.

3.3. **An Intermezzo on Macroeconomic Volatility.** To capture the shocks that hit the underlying actual variable x_t we employ the following unobserved component stochastic volatility (UCSV) model of Stock and Watson (2007), which is a simple, canonical device to decompose a series into the permanent and the transitory part with time-varying volatility.[19] Intuitively, the dynamics of x_t are driven by a permanent component τ_t with white noise innovations ε_t and a transitory component η_t:

$$x_t = \tau_t + \eta_t, \tag{2}$$
$$\tau_t = \tau_{t-1} + \varepsilon_t. \tag{3}$$

Both η_t and ε_t are independently normally distributed and have time-varying (random-walk) variances $\sigma^2_{\eta,t}$ and $\sigma^2_{\varepsilon,t}$ respectively ($\eta_t \sim \mathcal{N}(0, \sigma^2_{\eta,t})$, $\varepsilon_t \sim \mathcal{N}(0, \sigma^2_{\varepsilon,t})$):

$$\log \sigma^2_{\eta,t} = \log \sigma^2_{\eta,t-1} + \nu_{\eta,t}, \tag{4}$$
$$\log \sigma^2_{\varepsilon,t} = \log \sigma^2_{\varepsilon,t-1} + \nu_{\varepsilon,t}. \tag{5}$$

Innovations to variances $\nu_t = (\nu_{\eta,t}, \nu_{\varepsilon,t})^\top$ are iid $\mathcal{N}(0, \gamma I_2)$ and γ is a scalar parameter which controls the smoothness of the estimated volatilities $\sigma^2_{\cdot,t}$. We estimate the model with the Gibbs sampling.[20] We use the UCSV model as a flexible device to capture how the volatility of shocks varies over time. In the regressions below we investigate how disagreement correlates with the variance $\sigma^2_{\varepsilon,t}$ because permanent uncertainty driven by shocks ε_t is much more important for the formation of expectations (over the next twelve months) than transitory uncertainty due to η_t, which subsides immediately.[21]

Figures 14–19 summarize the dynamics of the variance of permanent shocks $\sigma^2_{\varepsilon,t}$. Full-sample averages of $\sigma^2_{\varepsilon,t}$ across countries and variables tend to positively co-move with those of disagreement. For example, both shocks to investment and disagreement about it are substantially higher than for other variables. Permanent shocks to inflation have be quite modest for France, Germany and Italy, and permanent shocks to consumption have generally been larger than those to GDP.

[19] The same specification is used in Wright (2008) to model inflation; Stock and Watson (2002) and Stock and Watson (2005) propose variants of this model for GDP, consumption, investment, employment and many other variables. Similar, more sophisticated models are analyzed in Harvey and Trimbur (2003), Creal, Koopman, and Zivot (2008), Giordani and Kohn (2008) and elsewhere.

[20] The online appendix shows the diagnostics we used to assess the quality and convergence of the MCMC approximation.

[21] As a robustness exercise we have also proxied uncertainty about the underlying variable x_t simply with its one-year squared difference $\Delta_{12} x_t^2 = (x_t - x_{t-12})^2$. An advantage of that measure is that it is independent of the parametric model used to back out $\sigma^2_{\varepsilon,t}$. For the specification (2)–(5), $\Delta x_t = \varepsilon_t + \eta_t - \eta_{t-1}$ and $\mathbf{E}(\Delta x_t^2) = \sigma^2_{\varepsilon,t} + 2\sigma^2_{\eta,t}$. Estimation results for this alternative measure of uncertainty ($\Delta_{12} x_t^2$) are broadly consistent with the baseline shown below in sections 3.4 and 3.5. One difference is that disagreement about inflation correlates more strongly with $\Delta_{12} INFL_t^2$ than with $\sigma^2_{INFL,\varepsilon,t}$. This is not surprising because both measures of uncertainty co-move quite closely, with correlation of more than 0.4. (Estimation results and comparison plots of $\Delta_{12} x_t^2$ and $\sigma^2_{x,\varepsilon,t}$ are shown in the online appendix.)

Variance of permanent shocks is also positively related to the path of disagreement over time. Forecasters disagree more when the economy is hit with larger permanent shocks, in particular in recessions but to a lesser extent also before 1999 (compared to the post-1998 period). The key message to take away from the comparison of Figures 8–13 and 14–19 is that both economic shocks and disagreement are more substantial during recessions and tended to be more muted in the second part of our sample. In addition, the anti-cyclicality of disagreement and shocks is somewhat more pronounced for real variables than for inflation.

3.4. **Disagreement and Macro Variables.** The middle panel (Panel B) of Tables 2–7 investigates how disagreement correlates with the level of the underlying actual variables, uncertainty about these variables proxied with the variance of permanent shocks, output gap[22] and the squared change in the policy interest rate (Δpolicy rate$_t^2$)—a proxy of the variation in monetary policy:

$$\text{disagr}_t = \beta_0 + \beta_2 \times x_t + \beta_3 \times \sigma^2_{x,t} + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t,$$

where x_t denotes the level of the underlying variable and $\sigma^2_{x,t}$ is a short-hand notation for the variance $\sigma^2_{x,\varepsilon,t}$ of permanent shocks to x_t (as given in equation (5)).

Disagreement about inflation rate increases with its level: one percentage point increase in inflation raises the cross-sectional interquartile range by 0.026, or about 10 percent (with respect to the mean 0.299). The direct effect of inflation uncertainty (the term $\sigma^2_{INFL,t}$), while correctly signed, is statistically insignificant. The coefficient on output gap is negative, which is in line with the previous evidence that disagreement increases during recessions. Finally, disagreement about inflation rises when monetary policy rates change, which again tends to coincide with recessions. (But the positive coefficient on interest rates is significant even when output gap is included.) In addition, including interest rates among explanatory variables substantially increases the explanatory power of the regression.

Disagreement about interest rates shown in Table 3 rises with the level, uncertainty and squared change of rates. These findings are in line with the fact reported in panel A that disagreement about interest rates fell after 1998, as both the level and variation in rates is much lower in the second part of the sample (see also Figure 2). In addition, disagreement also tends to move inversely to the output gap. While the coefficients in these regressions are comparable to those for inflation and GDP growth, their explanatory power is considerably higher, and the uncertainty term is significant.

Table 4 analyzes drivers of disagreement about GDP growth. In contrast to inflation and interest rates but in line with the evidence of panel A, disagreement about GDP growth moves inversely with its level: disagreement rises in periods of weak economic growth. Arguably, the effects of GDP growth on disagreement are non-linear: disagreement can be expected to rise during periods of heightened uncertainty, which likely occur during recessions, but also when economic growth accelerates considerably. (However, the latter periods are virtually absent in our

[22]The output gap used here is the ex post estimate taken from OECD's Economic Outlook. The series is quarterly, interpolated constant within each quarter, and starts in 1991:Q1.

sample as GDP growth only rarely exceeds 5 percent.) In fact, the coefficient on shocks to GDP $\sigma^2_{GDP,t}$ is estimated to be positive, high and overwhelmingly significant. As for disagreement about inflation and interest rates, variation in interest rates analyzed in model 4 also improves the performance of the regression (measured with adjusted R^2).

Given the large share of consumption expenditure on output, it is not surprising that the findings for consumption in Table 5 mirror quite closely those for GDP. The results are qualitatively similar for investment and unemployment rate although the explanatory power of investment regressions is smaller (as disagreement about investment tends to move more, much of which is unrelated to the explanatory macro variables).

The results in panel B are also broadly agree with the bivariate illustration of the relationship between time-averaged disagreement and the level/variance of the underlying variable in the bottom panels of Figure 7. While the first correlation is close to zero (for reasons outlined above), the one for variance, which proxies better for underlying uncertainty, is positive and quite strong.

Our findings in this and the previous section are in line with Mankiw et al. (2003) and Döpke and Fritsche (2006). Mankiw et al. (2003) report that in the US disagreement about inflation increases with its level and absolute value of its change, in particular when the change is sharp, and though it shows anticyclical pattern after 1975 or so for consumers, its dependence on the phase of the business cycle is less clear for experts. Döpke and Fritsche (2006) find that dispersion of inflation and growth expectations in Germany is high before and during recessions and correlates positively with macroeconomic uncertainty.

3.5. **Disagreement and Central Bank Independence.** It might be a priori expected that better macroeconomic policy alleviates economic uncertainty and disagreement. Without going into much detail about measuring the quality of economic institutions, panel C of Tables 2–7 provides a simple illustration of how much better and more credible monetary policy affects disagreement about various variables. In particular, we attempt to capture credibility of monetary policy using an indicator of central bank independence as defined in Table 8.[23]

We estimate two versions of the following regression

$$\begin{aligned} \text{disagr}_t &= \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times x_t + \beta_3 \times \sigma^2_{x,t} + \\ &+ \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t. \end{aligned}$$

Although the dummy for central bank independence (CB Independence$_t$) is negative for all variables, it is larger and highly statistically significant for only for inflation, interest rate and unemployment. Quantitatively, the reduction in disagreement related to central bank independence is largest for the two nominal

[23]We intentionally use a simple indicator, which transparently tracks central bank independence throughout our sample. The indicator is broadly in line with a measure of political autonomy of central banks recently calculated by Arnone, Laurens, Segalotto, and Sommer (2007), who use the methodology proposed by Grilli, Masciandaro, and Tabellini (1991) and Cukierman (1992). Their approach defines political autonomy as the ability of central banks to select the final objectives of monetary policy and measures it using a combination of eight criteria related to how the governor and the board of directors are appointed, the relations with government and the nature of the laws relevant for central banks.

variables, interest rates and inflation, 38% and 36% respectively; for real variables it ranges between 5% and 20%. In addition, while the explanatory power of these regressions is substantially larger than those with recession dummies oonly (and for inflation even marginally larger than those with recession and post-1998 dummies of model 2) for nominal variables, this result reverses for real variables (where adjusted R^2s of model 4 are low).

Model 6 attempts to separate the effects of central bank independence and other factors (by including macroeconomic control variables of Panel B jointly). The estimates imply that the monetary policy indicator remains overwhelmingly significant for nominal variables but not for real indicators. For most variables, the point estimate of β_1 changes only modestly (relative to model 5). At the same time other parameters turn out to be broadly comparable in size to estimates of β_3 of Panel B.

These findings suggest that (i) higher central bank independence coincides with a substantial decline in disagreement and (ii) the effect is particularly pronounced for nominal variables.[24] While the first result, the quantification of effects of central bank independence on disagreement, is to our knowledge new, it is related to the large literature on economic effects of central bank independence (Rogoff, 1985; Alesina and Summers, 1993; Alesina and Gatti, 1995 and many others). Most empirical work in that field agrees that central bank independence promotes price stability although its effects on real economic performance are hard to detect reliably, which is broadly in line with our second finding.

The second result can also be explained with the introduction of clear mandates in terms of price stability (including inflation targeting) in some countries in our sample and more generally with the adoption of more predictable monetary policy and increased and improved communication of central bankers with other economic agents. The effect of these developments is stronger for nominal variables, which are directly affected by explicit inflation targets or communication about possible future paths of policy rates. On the other hand, disagreement about real variables, whose future dynamics central bank typically communicate less extensively, is less sensitive to the institutional setting of monetary policy.

The explanatory power of our regressions is quite low; adjusted R^2 often ranges between 0.1 and 0.2. This is perhaps not surprising because Figures 1–6 show that disagreement is subject to much transitory variation, which cannot easily be captured with the explanatory variables and simple models we use. The disagreement series we construct is subject to much measurement and sampling uncertainty: questions that aim to capture expectations about economic variables can be challenging to answer even for professional forecasters; we use monthly data, which are generally known to be noisy; we attempt to extract cross-sectional variation from a sample of about 20–30 experts. However, we believe the data still do provide interesting information because many of the coefficients we estimate are overwhelmingly significant and reasonable in size.

[24]Related work of Crowe and Meade (2008) finds that higher central bank transparency is associated with more accurate private sector inflation forecasts.

4. Disagreement Across Countries

While panel analysis is useful in summarizing the general trends in determinants of disagreement, averaging wipes out information about cross-country heterogeneity. The analysis of this section attempts to capture and interpret such heterogeneity.

4.1. **Country-by-Country Regression Analysis.** Tables 9–14 summarize the cross-country differences in the drivers of disagreement by estimating models 2 and 4 (of Tables 2–7) separately country by country.[25]

The results are broadly consistent with the panel analysis of the previous section. While most coefficients are signed in line with our priors, some of them are insignificant because of their smaller size and because of their larger standard errors caused in part by fewer observations (roughly 200 compared to roughly 7×200 for panel estimates).

The top panel of Table 9 divides countries into two groups depending on how much disagreement about inflation varies over time. In Canada, France, Germany and the United States this variable is rather insensitive to the phase of the business cycle and constant over the two time periods (pre-1999 and post-1998): while the coefficients β_1 and β_2 are sometimes significant (and almost always have the correct sign), the explanatory power of the regressions in these countries is rather low—about 0.1 or less in terms of adjusted R^2—because the coefficients tend to be smaller than in the remaining countries. In contrast, in Italy, Japan and the United Kingdom the two variables explain up to 40 percent of the variation in disagreement about inflation (in adjusted R^2 terms). Findings consistent with the top panel are shown in the bottom panel: disagreement in Italy, Japan and the UK is much more sensitive to macro variables (inflation level and its variation, output gap and variation in policy interest rates), with adjusted R^2 of as much as 0.5, than in the rest of the sample, where coefficients are often insignificant or small.

Analogous regressions for short-run interest rates shown in Table 10 are broadly consistent with those for inflation, even though the difference in sensitivity of disagreement for the two country groups is less pronounced: adjusted R^2s for Italy, Japan and the United Kingdom range around 0.4–0.5 (in both panels); those for other countries average to about 0.25. This finding seems reasonable, as the existence of and independent central bank and/or explicit numeric inflation target can help stabilize inflation expectations and reduce disagreement about inflation. In contrast, such targets are not announced for interest rates (or other variables).

The level and sensitivity of disagreement about inflation and interest rates relate quite closely to the fraction of the sample with an independent central

[25] To remind, model 2 has the form:

$$\text{disagr}_t = \beta_0 + \beta_1 \times \text{rec}_t + \beta_2 \times \text{post-1998}_t + u_t,$$

and model 4:

$$\text{disagr}_t = \beta_0 + \beta_2 \times x_t + \beta_3 \times \sigma^2_{x,t} + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t.$$

Detailed results for all models are available in the the online appendix. We don note investigate regressions of Panel C of of Tables 2–7 as monetary policy institutions vary little within each country.

bank, shown in the right-most column of Table 8: Canada, France, Germany and the United States have had an independent monetary authority for large majority of the sample, while Japan and the UK for about half of the time.

Properties of disagreement about real variables in continental Europe differ from Anglo–Saxon countries. Top panels of Tables 11–14 suggest that disagreement about GDP, consumption, investment and to some extent also unemployment tends to be less counter-cyclical in France, Germany and Italy. For example, cross-sectional dispersion in GDP forecasts increases in recessions by roughly 30 percent in the three countries while it is 73 percent higher in the US. This finding corresponds closely to the well-known result that macroeconomic volatility is lower in the euro area than in the US (see Doyle and Faust, 2005 and Giannone and Reichlin, 2005 for evidence on GDP and consumption).

Other than that the results for real variables variables—GDP, consumption, investment and unemployment rate, shown in Tables 11, 12, 13 and 14 respectively—exhibit little systematic variation across countries. The finding that the link between monetary policy institutions and sensitivity of disagreement about real variables is not particularly pronounced could be explained by the fact that the key (and typically sole) goal for monetary goal for monetary policy is safeguarding of price stability. In contrast, central banks usually affect output stability only indirectly.

4.2. **Cross-Variable and Cross-Country Links between Disagreement.** We have also investigated the cross-country and cross-variable links in disagreement. We only summarize them briefly as not enough clear-cut results appear to justify a more detailed exposition.[26] First, for a given variable, disagreement is typically moderately positively correlated across countries: the correlation are around 0.2 (at monthly frequency). (Correlations increase to around 0.3–0.4 once the data are aggregated to quarterly frequency by averaging.) Cross-country correlations tend to be higher for more persistent variables: interest rate and unemployment.

Cross-variable correlations (within a given country) are in the same ballpark as the cross-country ones and suggest that disagreement about inflation and GDP growth is relatively strongly correlated with other variables. Disagreement is more synchronized in the UK and the US. Multivariate analysis of conditional correlations—regressions of disagreement about one variable on disagreement about the remaining variables—suggest that disagreement tends to co-move for real variables, especially GDP, consumption and unemployment, and for nominal variables, inflation and interest rate. Links between real and nominal variables are less important (conditional on correlations between variables from the same group). We found little systematic pattern between countries in cross-country conditional multivariate regressions (i.e., regressions of disagreement in one country on disagreement in others for a given variable).

5. Turbulent Expectations 2008–2009

This section investigates in detail the dynamics of the cross-sectional distribution of expectations during the ongoing financial turbulence. To describe these

[26] Cross-variable and cross-country correlations in disagreement are given in Tables 16 and 17 in the Appendix.

dynamics we extend our data set until March 2009 and augment it with data for the euro area.

Figure 20 illustrates the effects of the turmoil on disagreement about inflation and GDP growth.[27] Although the recession in continental Europe and Japan has according to CEPR's business cycle dating committee and ECRI officially started[28] in the late 2007 or early 2008, substantial increase in disagreement occurred only in the late 2008, following the fall of the investment bank Lehman Brothers in September, the considerable intensification of uncertainty on global financial markets and the worsening of the macroeconomic outlook. By contrast, disagreement about inflation and GDP in the US—the epicenter of the turbulence—gradually started to increase much earlier, right after the crisis broke in the summer 2007. Disagreement in the UK, whose financial sector is large and closely linked with the US, evolved as an intermediate case between the US and continental Europe, starting to increase in the summer 2008. While before the turmoil the level of disagreement was roughly the same in all countries, the impact of the crisis on disagreement about GDP in Japan and disagreement about inflation in the UK and the US was significantly larger, reflecting sharper and larger revisions of forecasts of these variables in the late 2008 and early 2009.[29]

Figures 21 and 22 display the cross-sectional distribution of GDP and inflation expectations (estimated using kernel density). The pre-crisis (June 2007) distribution of expectations is very peaked reflecting the widespread agreement among forecasters. Before September 2008 expectations became more dispersed as the underlying variables moved and uncertainty was increasing. Comparison of peaks of the distributions across regions suggests that expectations in the euro area are more centered than in the UK and the US: For example, the probability weight on the mode of the euro area distribution of GDP (around 1) has typically exceeded those in the UK and the US (around 0.7). (This observation remains broadly valid also for individual large euro area member countries shown in Figure 22.) The more spread-out distributions in the UK and US coincide with more vigorous and volatile dynamics of the underlying variables and consensus expectations, in particular in the case of inflation (which has remained more stable in the euro area and its large members).[30] Finally, the figures suggest that disagreement in most countries peaked in the early 2009 and decreased somewhat in March 2009.

[27]Shaded areas again mark recessions as determined by ECRI and, for the euro area, by CEPR's business cycle dating committee.

[28]We refer to the dates identified by CEPR's business cycle dating committee for the euro area, by NBER's business cycle dating committee for the US, and by ECRI for other regions.

[29]For example, one-year ahead consensus expectations of GDP growth in Japan plummeted from 1.3 percent in August 2008 to −4.7 percent in March 2009. Consensus expectations of inflation in the UK and the US, peaked in August 2008 at 3.8 and 3.6 percent respectively before declining to 0.6 in the UK and −0.5 percent in the US in March 2009. (By comparison, inflation expectations in the euro area increased from roughly 2 percent before the crisis to 3 percent in July 2008 and fell to 0.7 percent in March 2009.)

[30]This is not the case in Germany, where the expected GDP growth was being revised quite substantially downward (compared to other euro area members and the US), reflecting in part the country's dependence on exports, and where disagreement intensified in the early 2009.

6. Conclusion

Our estimates document a dichotomy between disagreement about real variables (GDP, consumption, investment and unemployment), which is more strongly affected by real factors, and disagreement about nominal variables (inflation and interest rate), which reacts to the institutional setting of monetary policy (in particular central bank independence). Disagreement about real variables intensifies strongly during recessions. Disagreement about nominal variables is considerably lower under independent central banks. Cross-sectional dispersion for both groups increases with uncertainty about the underlying indicators. Country-by-country regressions for inflation and interest rates reveal that both the level of disagreement and its sensitivity to macroeconomic variables tend to be larger in Italy, Japan and the United Kingdom, where central banks became independent only around the mid-1990s.

Our findings suggest that more credible monetary policy can substantially contribute to the anchoring of expectations about nominal variables; its effects on disagreement about real variables are moderate. While our analysis uses data on expectations of professional forecasters, qualitatively similar results may obtain also for other economists (in industry, government and academia) and households. This could be the case if our data are taken as a proxy for expectations of the rest of population, or if news spread epidemiologically from experts to other agents (as proposed by Carroll, 2003).

To our knowledge, the results in this paper provide one of the first joint analyses of individual survey expectations across countries and variables. The strength of some signals we use to investigate disagreement has been relatively weak: following the Great Moderation, economic shocks in our sample (1989–2006) have been quite modest. Further insights about expectations and disagreement will be gained once the data points covering the recent global turbulence accumulate.

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TABLE 1. Summary Statistics, All Countries, Full Sample

Statistic	Canada	France	Germany	Italy	Japan	UK	US
INFL							
Average # Forecasters	16.40	18.07	28.02	14.53	18.27	32.84	28.16
Average Expectation Error†	0.21	0.15	−0.01	0.04	0.14	0.28	0.05
Average MSE	1.87	0.43	0.81	0.75	0.66	1.19	0.92
Average Level of INFL	2.31	1.89	2.19	3.49	0.59	3.20	2.94
Variance of INFL	2.05	0.59	1.73	2.62	1.76	3.96	1.08
Average Disagreement	0.34	0.21	0.24	0.26	0.33	0.38	0.33
R3M							
Average # Forecasters	16.36	17.98	25.61	11.99	19.09	31.05	26.77
Average Expectation Error†	0.55	0.03	0.25	0.20	0.48	0.57	0.35
Average MSE	2.71	1.39	0.93	2.53	1.00	1.60	2.14
Average Level of R3M	5.35	5.20	4.72	6.76	1.78	6.75	4.55
Variance of R3M	7.76	8.64	5.97	16.29	6.37	9.08	3.77
Average Disagreement	0.76	0.50	0.46	0.58	0.27	0.71	0.56
GDP							
Average # Forecasters	16.41	18.18	27.65	14.56	18.39	33.03	28.19
Average Expectation Error†	−0.02	0.45	0.17	0.59	0.38	−0.26	−0.25
Average MSE	3.52	2.06	3.10	2.82	3.63	1.90	2.59
Average Level of GDP	2.65	1.85	1.85	1.37	1.46	2.33	2.89
Variance of GDP	3.98	1.49	3.38	1.90	3.34	2.02	2.03
Average Disagreement	0.46	0.30	0.34	0.26	0.69	0.43	0.38
CONS							
Average # Forecasters	16.40	18.16	27.90	14.51	18.37	32.65	28.00
Average Expectation Error†	−0.23	0.16	−0.06	0.40	0.18	−0.26	−0.54
Average MSE	2.23	1.66	2.38	3.90	2.19	2.46	1.86
Average Level of CONS	2.68	2.03	1.71	1.43	1.71	2.59	3.23
Variance of CONS	2.39	1.54	2.77	2.91	2.55	2.71	1.46
Average Disagreement	0.47	0.31	0.40	0.34	0.65	0.55	0.38
INV							
Average # Forecasters	16.29	17.81	27.64	14.53	17.98	31.99	27.86
Average Expectation Error†	2.43	1.38	2.61	1.35	1.74	−0.57	1.31
Average MSE	46.67	20.90	32.41	22.20	42.06	16.89	23.66
Average Level of INV	3.66	2.26	1.67	1.81	−0.19	2.89	4.13
Variance of INV	35.83	15.07	19.73	22.32	13.84	23.31	20.11
Average Disagreement	2.60	1.17	1.56	1.01	2.42	1.66	1.93
UN							
Average # Forecasters	16.41	18.07	27.65	13.99	17.98	32.32	28.12
Average Expectation Error†	−0.02	0.43	0.05	0.79	−0.01	0.63	0.07
Average MSE	0.81	0.89	1.09	0.97	0.18	1.21	0.42
Average Level of UN	8.54	9.98	9.58	9.95	3.75	5.34	5.50
Variance of UN	2.50	1.30	2.79	2.06	1.28	5.88	0.93
Average Disagreement	0.29	0.24	0.41	0.33	0.25	0.31	0.22

Notes: Averages taken across forecasters and time periods. † : {*,**,***}=Statistical significance at {10,5,1} percent.

TABLE 2. Disagreement and Business Cycle—Panel Results, INFL

Model	β_0	β_1	β_2	β_3	β_4	β_5	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagr}_t = \beta_0 + \beta_1 \times \text{rec}_t + \beta_2 \times \text{post-1998}_t + u_t$							
1.	0.299^{***}						-0.004
	(0.003)						
2.	0.327^{***}	0.050^{***}	-0.082^{***}				0.129
	(0.005)	(0.017)	(0.014)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times INFL_t + \beta_3 \times \sigma^2_{INFL,t} + \beta_4 \times \text{output gap}_t + + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
3.	0.237^{***}		0.026^{***}				0.076
	(0.006)		(0.005)				
4.	0.223^{***}		0.019^{***}	0.227	-0.017^{***}	0.057^{**}	0.093
	(0.008)		(0.006)	(0.155)	(0.006)	(0.023)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times INFL_t + \beta_3 \times \sigma^2_{INFL,t} + + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
5.	0.420^{***}	-0.152^{***}					0.169
	(0.006)	(0.025)					
6.	0.381^{***}	-0.150^{***}	0.004	0.235^{*}	-0.020^{***}	0.033^{*}	0.230
	(0.013)	(0.031)	(0.007)	(0.138)	(0.005)	(0.020)	

Notes: Fixed effects estimators, HAC standard errors, Bartlett kernel, bandwidth = 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts. "post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008). $\sigma^2_{INFL,t}$ denotes variance of the permanent component of INFL. "CB Independence$_t$" denotes a 0–1 indicator of independent monetary policy defined in table 8.

TABLE 3. Disagreement and Business Cycle—Panel Results, R3M

Model	β_0	β_1	β_2	β_3	β_4	β_5	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagr}_t = \beta_0 + \beta_1 \times \text{rec}_t + \beta_2 \times \text{post-1998}_t + u_t$							
1.	0.549^{***}						-0.004
	(0.007)						
2.	0.624^{***}	0.124^{***}	-0.214^{***}				0.232
	(0.009)	(0.036)	(0.026)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times R3M_t + \beta_3 \times \sigma^2_{R3M,t} + \beta_4 \times \text{output gap}_t + + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
3.	0.319^{***}		0.046^{***}				0.276
	(0.011)		(0.005)				
4.	0.363^{***}		0.027^{***}	0.421^{**}	-0.015	0.041^{*}	0.229
	(0.013)		(0.008)	(0.187)	(0.010)	(0.023)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times R3M_t + \beta_3 \times \sigma^2_{R3M,t} + + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
5.	0.783^{***}	-0.294^{***}					0.165
	(0.011)	(0.035)					
6.	0.554^{***}	-0.174^{***}	0.019^{**}	0.286	-0.021^{**}	0.034	0.272
	(0.025)	(0.046)	(0.009)	(0.180)	(0.009)	(0.023)	

Notes: Fixed effects estimators, HAC standard errors, Bartlett kernel, bandwidth = 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts. "post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008). $\sigma^2_{R3M,t}$ denotes variance of the permanent component of R3M. "CB Independence$_t$" denotes a 0–1 indicator of independent monetary policy defined in table 8.

TABLE 4. Disagreement and Business Cycle—Panel Results, GDP

Model	β_0	β_1	β_2	β_3	β_4	β_5	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagr}_t = \beta_0 + \beta_1 \times \text{rec}_t + \beta_2 \times \text{post-1998}_t + u_t$							
1.	0.410^{***}						-0.004
	(0.004)						
2.	0.394^{***}	0.160^{***}	-0.032^{*}				0.134
	(0.006)	(0.027)	(0.018)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times GDP_t + \beta_3 \times \sigma^2_{GDP,t} + \beta_4 \times \text{output gap}_t +$ $+ \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
3.	0.482^{***}		-0.035^{***}				0.107
	(0.007)		(0.006)				
4.	0.379^{***}		-0.025^{***}	0.686^{***}	-0.001	0.048	0.136
	(0.013)		(0.007)	(0.180)	(0.007)	(0.035)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times GDP_t + \beta_3 \times \sigma^2_{GDP,t} +$ $+ \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
5.	0.458^{***}	-0.061^{*}					0.010
	(0.007)	(0.034)					
6.	0.424^{***}	-0.060^{*}	-0.023^{***}	0.677^{***}	-0.004	0.038	0.149
	(0.017)	(0.031)	(0.006)	(0.178)	(0.007)	(0.033)	

Notes: Fixed effects estimators, HAC standard errors, Bartlett kernel, bandwidth = 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts. "post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008). $\sigma^2_{GDP,t}$ denotes variance of the permanent component of GDP. "CB Independence$_t$" denotes a 0–1 indicator of independent monetary policy defined in table 8.

TABLE 5. Disagreement and Business Cycle—Panel Results, CONS

Model	β_0	β_1	β_2	β_3	β_4	β_5	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagr}_t = \beta_0 + \beta_1 \times \text{rec}_t + \beta_2 \times \text{post-1998}_t + u_t$							
1.	0.445^{***}						-0.004
	(0.004)						
2.	0.419^{***}	0.161^{***}	-0.012				0.128
	(0.006)	(0.024)	(0.015)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times CONS_t + \beta_3 \times \sigma^2_{CONS,t} + \beta_4 \times \text{output gap}_t +$ $+ \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
3.	0.512^{***}		-0.031^{***}				0.073
	(0.007)		(0.007)				
4.	0.452^{***}		-0.023^{***}	0.262^{***}	-0.002	0.044^{*}	0.088
	(0.011)		(0.008)	(0.077)	(0.007)	(0.024)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times CONS_t + \beta_3 \times \sigma^2_{CONS,t} +$ $+ \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
5.	0.469^{***}	-0.031					-0.001
	(0.007)	(0.030)					
6.	0.458^{***}	-0.007	-0.023^{***}	0.256^{***}	-0.002	0.043^{*}	0.088
	(0.017)	(0.031)	(0.008)	(0.082)	(0.007)	(0.024)	

Notes: Fixed effects estimators, HAC standard errors, Bartlett kernel, bandwidth = 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts. "post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008). $\sigma^2_{CONS,t}$ denotes variance of the permanent component of CONS. "CB Independence$_t$" denotes a 0–1 indicator of independent monetary policy defined in table 8.

TABLE 6. Disagreement and Business Cycle—Panel Results, INV

Model	β_0	β_1	β_2	β_3	β_4	β_5	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagr}_t = \beta_0 + \beta_1 \times \text{rec}_t + \beta_2 \times \text{post-1998}_t + u_t$							
1.	1.764^{***}						-0.004
	(0.017)						
2.	1.702^{***}	0.329^{***}	-0.002				0.029
	(0.025)	(0.103)	(0.071)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times INV_t + \beta_3 \times \sigma^2_{INV,t} + \beta_4 \times \text{output gap}_t + + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
3.	1.784^{***}		-0.025^{***}				0.027
	(0.019)		(0.008)				
4.	1.582^{***}		-0.016^{*}	0.177^{***}	0.006	0.066	0.046
	(0.037)		(0.009)	(0.066)	(0.028)	(0.117)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times INV_t + \beta_3 \times \sigma^2_{INV,t} + + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t$							
5.	1.833^{***}	-0.086					-0.003
	(0.019)	(0.107)					
6.	1.597^{***}	-0.020	-0.016^{*}	0.178^{***}	0.006	0.062	0.045
	(0.057)	(0.096)	(0.010)	(0.068)	(0.029)	(0.118)	

Notes: Fixed effects estimators, HAC standard errors, Bartlett kernel, bandwidth = 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts. "post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008). $\sigma^2_{INV,t}$ denotes variance of the permanent component of INV. "CB Independence$_t$" denotes a 0–1 indicator of independent monetary policy defined in table 8.

TABLE 7. Disagreement and Business Cycle—Panel Results, UN

Model	β_0	β_1	β_2	β_3	β_4	β_5	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagr}_t = \beta_0 + \beta_1 \times \text{rec}_t + \beta_2 \times \text{post-1998}_t + u_t$							
1.	0.293^{***}						-0.004
	(0.005)						
2.	0.297^{***}	0.156^{***}	-0.074^{***}				0.169
	(0.006)	(0.041)	(0.018)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times UN_t + \beta_3 \times \sigma^2_{UN,t} + \beta_4 \times \text{output gap}_t + + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
3.	0.302^{***}		-0.001				-0.005
	(0.023)		(0.013)				
4.	0.432^{***}		-0.034^{*}	7.857^{***}	-0.009	-0.017	0.162
	(0.027)		(0.020)	(1.927)	(0.008)	(0.014)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times UN_t + \beta_3 \times \sigma^2_{UN,t} + + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
5.	0.344^{***}	-0.064^{**}					0.011
	(0.023)	(0.029)					
6.	0.506^{***}	-0.050	-0.037^{*}	7.284^{***}	-0.015^{*}	-0.023^{*}	0.168
	(0.036)	(0.032)	(0.020)	(1.874)	(0.009)	(0.014)	

Notes: Fixed effects estimators, HAC standard errors, Bartlett kernel, bandwidth = 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts. "post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008). $\sigma^2_{UN,t}$ denotes variance of the permanent component of UN. "CB Independence$_t$" denotes a 0–1 indicator of independent monetary policy defined in table 8.

TABLE 8. Central Bank Independence in G7 Countries, 1989–2006

Country	Monetary Policy Setting	Dummy Variable	Fraction of Sample with Independent CB
Canada	De facto independent central bank;*	1 full sample	1
France†	Independent central bank since August 4, 1993	0 before August 1993, 1 otherwise	$\frac{159}{205} = 0.78$
Germany†	Independent central bank since August 1, 1957	1 full sample	1
Italy†	Independent central bank effectively since January 1, 1994‡	0 before January 1994, 1 otherwise	$\frac{154}{205} = 0.75$
Japan	Independent central bank since June 18, 1997	0 before July 1997, 1 otherwise	$\frac{112}{205} = 0.55$
UK	Independent central bank since June 1, 1998; inflation targeting since October 1992	0 before June 1998, 1 otherwise	$\frac{101}{205} = 0.49$
US	Independent central bank since December 23, 1913	1 full sample	1

Notes: *: Bank of Canada was technically independent *until* 1967 and has been *de jure* dependent on the Minister of Finance since then. (Inflation targeting since February 1991.) †: Refers to the period before the country joined the euro area. ‡: Formally since February 7, 1992, however, granting of independence was effectively not completed until 1994.

Sources: Web pages of the respective central banks.

TABLE 9. Disagreement Over Time and Business Cycle—Country-by-Country Results, INFL

Country	β_0	β_1	β_2	β_3	β_4	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagreement}_t = \beta_0 + \beta_1 \times \text{recession}_t + \beta_2 \times \text{post-1998}_t + u_t$						
CN	0.353^{***}	0.073^{***}	-0.054^{*}			0.112
	(0.020)	(0.026)	(0.029)			
FR	0.212^{***}	0.007	-0.006			-0.007
	(0.012)	(0.021)	(0.015)			
GE	0.224^{***}	0.005	0.041^{*}			0.056
	(0.013)	(0.022)	(0.022)			
IT	0.310^{***}	0.096^{*}	-0.137^{***}			0.349
	(0.022)	(0.055)	(0.025)			
JP	0.376^{***}	0.055^{*}	-0.145^{***}			0.321
	(0.024)	(0.031)	(0.028)			
UK	0.503^{***}	-0.005	-0.268^{***}			0.414
	(0.062)	(0.081)	(0.063)			
US	0.324^{***}	0.105^{**}	-0.005			0.088
	(0.012)	(0.052)	(0.024)			
Panel B: Disagreement and Macro Variables $\text{disagreement}_t = \beta_0 + \beta_1 \times INFL_t + \beta_2 \times \sigma^2_{INFL,t} +$ $+ \beta_3 \times \text{output gap}_t + \beta_4 \times \Delta\text{policy rate}^2_t + u_t$						
CN	0.302^{***}	0.029^{***}	-0.308	-0.004	0.069^{***}	0.176
	(0.045)	(0.010)	(0.241)	(0.011)	(0.017)	
FR	0.203^{***}	-0.013	0.678	-0.004	0.000	-0.000
	(0.027)	(0.011)	(0.641)	(0.010)	(0.024)	
GE	0.252^{***}	-0.006	-0.014	-0.012	0.022	0.042
	(0.022)	(0.012)	(0.481)	(0.008)	(0.073)	
IT	0.076^{***}	0.040^{***}	1.107	-0.016^{*}	0.081^{***}	0.363
	(0.027)	(0.010)	(1.003)	(0.009)	(0.019)	
JP	0.163^{***}	-0.007	2.019^{***}	0.004	0.007	0.218
	(0.036)	(0.017)	(0.445)	(0.008)	(0.009)	
UK	0.314^{***}	-0.007	0.373	-0.137^{***}	0.233^{***}	0.527
	(0.057)	(0.026)	(0.669)	(0.027)	(0.072)	
US	0.280^{***}	0.001	0.296^{**}	-0.022^{***}	0.120^{**}	0.112
	(0.043)	(0.015)	(0.120)	(0.007)	(0.061)	

Notes: Country-by-country regressions, Newey–West standard errors, 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts."post-1998_t" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession_t" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. $\sigma^2_{INFL,t}$ denotes variance of the permanent component of INFL. "output gap_t" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008).

TABLE 10. Disagreement Over Time and Business Cycle—Country-by-Country Results, R3M

Country	β_0	β_1	β_2	β_3	β_4	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagreement}_t = \beta_0 + \beta_1 \times \text{recession}_t + \beta_2 \times \text{post-1998}_t + u_t$						
CN	0.885^{***}	0.190	-0.328^{***}			0.295
	(0.084)	(0.187)	(0.093)			
FR	0.514^{***}	0.231^{**}	-0.101^{**}			0.221
	(0.033)	(0.111)	(0.042)			
GE	0.477^{***}	0.110^{**}	-0.126^{**}			0.191
	(0.054)	(0.049)	(0.049)			
IT	0.720^{***}	0.149^{*}	-0.341^{***}			0.405
	(0.050)	(0.080)	(0.052)			
JP	0.417^{***}	-0.052	-0.267^{***}			0.513
	(0.026)	(0.041)	(0.050)			
UK	0.827^{***}	0.208^{**}	-0.299^{***}			0.399
	(0.074)	(0.086)	(0.078)			
US	0.549^{***}	0.124^{***}	0.008			0.031
	(0.035)	(0.044)	(0.056)			
Panel B: Disagreement and Macro Variables $\text{disagreement}_t = \beta_0 + \beta_1 \times R3M_t + \beta_2 \times \sigma^2_{R3M,t} +$ $+ \beta_3 \times \text{output gap}_t + \beta_4 \times \Delta\text{policy rate}^2_t + u_t$						
CN	0.543^{***}	0.026	-0.263	-0.053^{**}	0.075^{**}	0.213
	(0.079)	(0.021)	(0.574)	(0.026)	(0.036)	
FR	0.444^{***}	-0.018^{*}	1.695^{***}	0.007	0.030	0.460
	(0.037)	(0.010)	(0.393)	(0.016)	(0.090)	
GE	0.232^{***}	0.041^{***}	0.886	-0.032^{***}	-0.046	0.248
	(0.053)	(0.015)	(1.297)	(0.011)	(0.198)	
IT	0.251^{***}	0.045^{**}	0.053	-0.045^{***}	0.008	0.435
	(0.057)	(0.018)	(0.281)	(0.012)	(0.067)	
JP	0.243^{***}	-0.021	1.798	0.071^{***}	0.020	0.580
	(0.025)	(0.015)	(2.289)	(0.011)	(0.012)	
UK	0.634^{***}	-0.020	3.187^{***}	-0.109^{***}	-0.102	0.463
	(0.105)	(0.022)	(1.100)	(0.037)	(0.086)	
US	0.625^{***}	-0.024	0.441	-0.007	0.112	0.058
	(0.072)	(0.015)	(0.972)	(0.019)	(0.095)	

Notes: Country-by-country regressions, Newey–West standard errors, 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts."post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. $\sigma^2_{R3M,t}$ denotes variance of the permanent component of R3M. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008).

TABLE 11. Disagreement Over Time and Business Cycle—Country-by-Country Results, GDP

Country	β_0	β_1	β_2	β_3	β_4	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagreement}_t = \beta_0 + \beta_1 \times \text{recession}_t + \beta_2 \times \text{post-1998}_t + u_t$						
CN	0.492^{***}	0.170^{***}	-0.114^{**}			0.240
	(0.025)	(0.045)	(0.049)			
FR	0.283^{***}	0.027	0.036			0.037
	(0.011)	(0.039)	(0.024)			
GE	0.340^{***}	0.114^{***}	-0.086^{***}			0.214
	(0.023)	(0.040)	(0.033)			
IT	0.241^{***}	0.120^{***}	0.025			0.076
	(0.024)	(0.044)	(0.027)			
JP	0.589^{***}	0.207^{***}	0.029			0.141
	(0.053)	(0.080)	(0.083)			
UK	0.477^{***}	0.189^{***}	-0.138^{***}			0.387
	(0.036)	(0.055)	(0.040)			
US	0.348^{***}	0.255^{***}	0.015			0.211
	(0.026)	(0.061)	(0.031)			
Panel B: Disagreement and Macro Variables $\text{disagreement}_t = \beta_0 + \beta_1 \times GDP_t + \beta_2 \times \sigma^2_{GDP,t} +$ $+ \beta_3 \times \text{output gap}_t + \beta_4 \times \Delta\text{policy rate}^2_t + u_t$						
CN	0.233^{***}	0.003	1.684^{***}	-0.022^{**}	0.011	0.321
	(0.083)	(0.013)	(0.526)	(0.011)	(0.021)	
FR	0.406^{***}	-0.032^{*}	-0.588	0.038^{***}	0.102^{**}	0.112
	(0.073)	(0.017)	(0.630)	(0.012)	(0.052)	
GE	0.256^{***}	-0.022^{**}	0.814^{***}	-0.017	0.074	0.227
	(0.032)	(0.010)	(0.240)	(0.014)	(0.118)	
IT	0.318^{***}	-0.029^{**}	-0.091	0.010	0.022	0.084
	(0.038)	(0.012)	(0.351)	(0.011)	(0.030)	
JP	0.717^{***}	-0.032	0.116	-0.001	0.030	0.028
	(0.166)	(0.032)	(0.644)	(0.019)	(0.052)	
UK	0.316^{***}	-0.012	2.648^{***}	-0.026	0.109	0.478
	(0.047)	(0.010)	(0.668)	(0.020)	(0.075)	
US	0.439^{***}	-0.042^{***}	0.598	0.027^{**}	0.451^{***}	0.429
	(0.061)	(0.011)	(0.372)	(0.011)	(0.106)	

Notes: Country-by-country regressions, Newey–West standard errors, 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts."post-1998_t" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession_t" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. $\sigma^2_{GDP,t}$ denotes variance of the permanent component of GDP. "output gap_t" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008).

TABLE 12. Disagreement Over Time and Business Cycle—Country-by-Country Results, CONS

Country	β_0	β_1	β_2	β_3	β_4	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagreement}_t = \beta_0 + \beta_1 \times \text{recession}_t + \beta_2 \times \text{post-1998}_t + u_t$						
CN	0.478^{***}	0.231^{***}	-0.071^{*}			0.208
	(0.031)	(0.080)	(0.040)			
FR	0.285^{***}	0.046	0.031			0.038
	(0.010)	(0.033)	(0.021)			
GE	0.377^{***}	0.088^{**}	-0.013			0.079
	(0.031)	(0.035)	(0.033)			
IT	0.321^{***}	0.198^{***}	0.006			0.166
	(0.017)	(0.066)	(0.027)			
JP	0.561^{***}	0.206^{***}	0.016			0.170
	(0.033)	(0.053)	(0.054)			
UK	0.548^{***}	0.176^{***}	-0.043			0.146
	(0.039)	(0.052)	(0.050)			
US	0.364^{***}	0.213^{***}	0.003			0.182
	(0.026)	(0.059)	(0.029)			
Panel B: Disagreement and Macro Variables $\text{disagreement}_t = \beta_0 + \beta_1 \times CONS_t + \beta_2 \times \sigma^2_{CONS,t} +$ $+ \beta_3 \times \text{output gap}_t + \beta_4 \times \Delta\text{policy rate}^2_t + u_t$						
CN	0.350^{***}	-0.014	1.129^{***}	0.007	0.037	0.324
	(0.076)	(0.021)	(0.286)	(0.012)	(0.043)	
FR	0.355^{***}	-0.006	-0.318^{***}	-0.020^{**}	0.013	0.052
	(0.027)	(0.007)	(0.120)	(0.009)	(0.041)	
GE	0.350^{***}	-0.024^{**}	0.408^{***}	-0.018^{*}	-0.064	0.150
	(0.029)	(0.010)	(0.102)	(0.011)	(0.093)	
IT	0.310^{***}	-0.023^{**}	0.375^{**}	0.027^{**}	0.002	0.196
	(0.022)	(0.009)	(0.161)	(0.013)	(0.027)	
JP	0.764^{***}	-0.020	-0.332	0.012	0.039	0.004
	(0.133)	(0.028)	(0.413)	(0.033)	(0.033)	
UK	0.506^{***}	-0.023	0.848	0.018	0.183^{***}	0.212
	(0.106)	(0.014)	(0.636)	(0.025)	(0.070)	
US	0.294^{***}	-0.008	1.851^{***}	0.019^{**}	0.251^{***}	0.293
	(0.057)	(0.012)	(0.313)	(0.008)	(0.089)	

Notes: Country-by-country regressions, Newey–West standard errors, 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts. "post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. $\sigma^2_{CONS,t}$ denotes variance of the permanent component of CONS. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008).

TABLE 13. Disagreement Over Time and Business Cycle—Country-by-Country Results, INV

Country	β_0	β_1	β_2	β_3	β_4	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagreement}_t = \beta_0 + \beta_1 \times \text{recession}_t + \beta_2 \times \text{post-1998}_t + u_t$						
CN	2.929^{***}	-0.369^{*}	-0.619^{**}			0.083
	(0.150)	(0.192)	(0.248)			
FR	1.170^{***}	0.001	-0.004			-0.010
	(0.037)	(0.093)	(0.100)			
GE	1.284^{***}	0.293^{**}	0.374^{***}			0.201
	(0.104)	(0.119)	(0.112)			
IT	1.027^{***}	0.224	-0.085			0.024
	(0.117)	(0.142)	(0.183)			
JP	2.141^{***}	0.294	0.346			0.061
	(0.165)	(0.296)	(0.271)			
UK	1.641^{***}	0.727^{***}	-0.147			0.224
	(0.114)	(0.178)	(0.149)			
US	1.845^{***}	1.021^{***}	-0.003			0.217
	(0.097)	(0.117)	(0.138)			
Panel B: Disagreement and Macro Variables $\text{disagreement}_t = \beta_0 + \beta_1 \times INV_t + \beta_2 \times \sigma^2_{INV,t} +$ $+ \beta_3 \times \text{output gap}_t + \beta_4 \times \Delta\text{policy rate}^2_t + u_t$						
CN	1.646^{***}	0.017	0.580^{***}	0.179^{*}	0.125	0.170
	(0.252)	(0.020)	(0.162)	(0.093)	(0.177)	
FR	1.244^{***}	-0.026^{*}	-0.047	0.034	0.050	0.037
	(0.100)	(0.014)	(0.161)	(0.043)	(0.238)	
GE	1.745^{***}	-0.029^{*}	-0.079	0.047	0.032	0.061
	(0.119)	(0.016)	(0.091)	(0.035)	(0.513)	
IT	0.661^{***}	-0.039^{***}	0.362^{***}	0.171^{***}	0.004	0.217
	(0.124)	(0.015)	(0.088)	(0.059)	(0.087)	
JP	2.227^{***}	0.059	0.032	-0.188^{***}	-1.426	0.110
	(0.352)	(0.038)	(0.491)	(0.071)	(0.931)	
UK	1.725^{***}	-0.047^{***}	0.017	0.051	0.309	0.228
	(0.182)	(0.011)	(0.118)	(0.050)	(0.294)	
US	1.825^{***}	-0.030	0.365	-0.001	0.968	0.168
	(0.264)	(0.023)	(0.273)	(0.054)	(0.630)	

Notes: Country-by-country regressions, Newey–West standard errors, 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts."post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. $\sigma^2_{INV,t}$ denotes variance of the permanent component of INV. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008).

TABLE 14. Disagreement Over Time and Business Cycle—Country-by-Country Results, UN

Country	β_0	β_1	β_2	β_3	β_4	$\bar{R}^2$
Panel A: Disagreement over Time $\text{disagreement}_t = \beta_0 + \beta_1 \times \text{recession}_t + \beta_2 \times \text{post-1998}_t + u_t$						
CN	0.330^{***}	0.121^{***}	-0.112^{***}			0.375
	(0.012)	(0.027)	(0.023)			
FR	0.238^{***}	0.035	-0.004			0.011
	(0.015)	(0.036)	(0.019)			
GE	0.410^{***}	0.341^{***}	-0.261^{***}			0.395
	(0.061)	(0.125)	(0.097)			
IT	0.344^{***}	0.166	-0.066			0.100
	(0.038)	(0.159)	(0.044)			
JP	0.208^{***}	0.042	0.051			0.086
	(0.030)	(0.030)	(0.033)			
UK	0.337^{***}	0.187^{***}	-0.113^{***}			0.498
	(0.020)	(0.046)	(0.027)			
US	0.217^{***}	0.098^{**}	-0.013			0.121
	(0.009)	(0.040)	(0.019)			
Panel B: Disagreement and Macro Variables $\text{disagreement}_t = \beta_0 + \beta_1 \times UN_t + \beta_2 \times \sigma^2_{UN,t} +$ $+ \beta_3 \times \text{output gap}_t + \beta_4 \times \Delta\text{policy rate}^2_t + u_t$						
CN	0.240	-0.011	4.563^{***}	-0.004	-0.011	0.323
	(0.152)	(0.023)	(1.698)	(0.011)	(0.011)	
FR	0.555^{***}	-0.038^{**}	7.160^{**}	-0.050^{***}	0.091	0.190
	(0.141)	(0.015)	(3.337)	(0.015)	(0.076)	
GE	2.227^{***}	-0.202^{***}	8.193^{**}	-0.061^{**}	0.450^{*}	0.662
	(0.428)	(0.040)	(3.932)	(0.030)	(0.240)	
IT	0.057	0.017	7.452^{*}	-0.033	-0.093	0.165
	(0.163)	(0.015)	(4.149)	(0.023)	(0.063)	
JP	0.335^{***}	-0.006	-7.022	-0.027^{***}	-0.013^{**}	0.122
	(0.068)	(0.024)	(7.079)	(0.008)	(0.005)	
UK	0.139^{***}	0.016^{**}	6.233^{***}	0.034^{**}	0.066	0.628
	(0.027)	(0.006)	(1.095)	(0.016)	(0.040)	
US	0.306^{***}	-0.030^{**}	5.979^{**}	-0.005	-0.026	0.073
	(0.060)	(0.014)	(2.644)	(0.009)	(0.031)	

Notes: Country-by-country regressions, Newey–West standard errors, 12 lags. The dependent variable is measured as cross-sectional IQR. β_0 denotes the average of country-specific intercepts."post-1998$_t$" denotes a dummy variable which equals 0 before 1999 and 1 after 1998. "recession$_t$" denotes a dummy variable which equals 1 during recession set by the Economic Cycle Research Institute (ECRI) and 0 otherwise. $\sigma^2_{UN,t}$ denotes variance of the permanent component of UN. "output gap$_t$" denotes the ex-post output gap estimated in the OECD Economic Outlook quarterly output gap revisions database (in August 2008).

Appendix—Additional Results

Table 15. Correlation between the Two Disagreement Measures (Cross-Sectional IQR and Standard Deviation)

	Canada	France	Germany	Italy	Japan	UK	US
Inflation	0.75	0.61	0.58	0.82	0.68	0.92	0.70
Interest Rate	0.87	0.78	0.80	0.84	0.88	0.86	0.73
GDP	0.79	0.62	0.78	0.69	0.76	0.66	0.83
Consumption	0.78	0.51	0.69	0.68	0.76	0.72	0.82
Investment	0.72	0.67	0.77	0.80	0.78	0.71	0.75
Unemployment	0.79	0.66	0.93	0.84	0.75	0.85	0.71

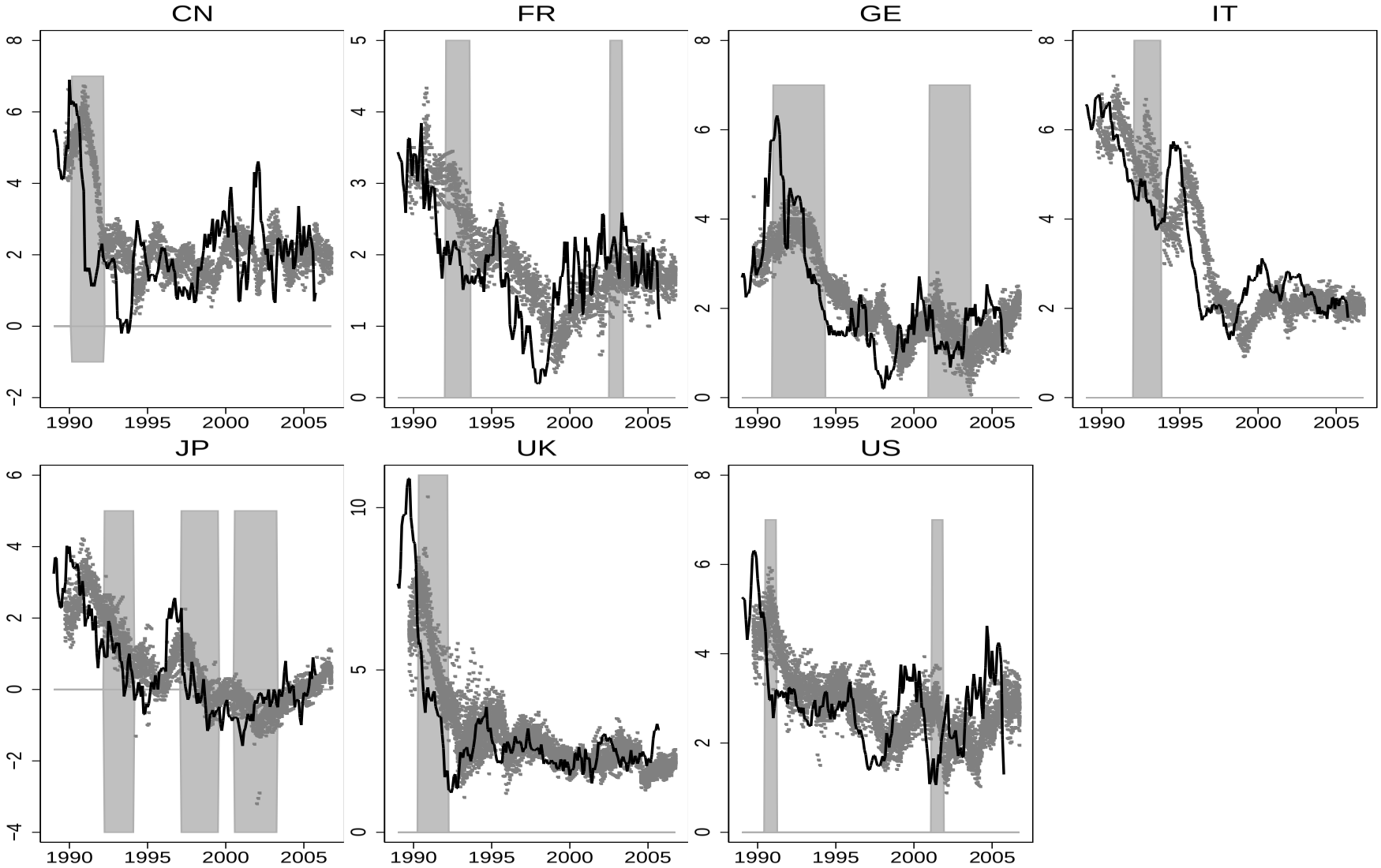
Table 16: Correlation of Disagreement Across Countries (for each Variable), Full Sample, Disagreement Measure: IQR

Variable	Country	Canada	France	Germany	Italy	Japan	UK
INFL	France	0.16					
	Germany	0.01	−0.05				
	Italy	0.28	0.25	−0.18			
	Japan	0.16	0.18	0.03	0.48		
	UK	0.35	0.23	−0.04	0.64	0.56	
	US	0.16	0.24	0.07	0.19	0.09	0.07
GDP	France	0.12					
	Germany	0.25	0.08				
	Italy	0.19	0.21	0.32			
	Japan	0.13	0.15	0.26	0.15		
	UK	0.55	−0.04	0.12	0.15	0.02	
	US	0.37	0.29	0.01	0.26	−0.07	0.31
R3M	France	0.27					
	Germany	0.38	0.38				
	Italy	0.34	0.42	0.41			
	Japan	0.41	0.22	0.28	0.52		
	UK	0.52	0.45	0.47	0.46	0.54	
	US	0.28	0.01	0.25	0.01	−0.05	0.09
CONS	France	0.17					
	Germany	−0.02	0.15				
	Italy	0.14	0.04	0.22			
	Japan	0.05	0.17	0.18	0.37		
	UK	0.32	0.13	0.13	0.06	0.06	
	US	0.40	0.10	0.10	0.16	0.06	0.30
INV	France	0.01					
	Germany	0.00	0.20				
	Italy	0.31	0.30	0.27			
	Japan	0.11	0.10	0.30	0.19		
	UK	0.06	0.03	−0.02	0.03	0.03	
	US	0.14	0.11	0.16	0.29	0.22	0.36
UN	France	0.09					
	Germany	0.39	0.02				
	Italy	0.13	0.33	0.34			
	Japan	−0.13	0.19	−0.23	0.08		
	UK	0.53	−0.01	0.54	0.26	−0.29	
	US	0.36	−0.03	0.07	0.00	−0.01	0.27

Table 17: Correlation of Disagreement Across Variables Within Country, Full Sample, Disagreement Measure: IQR

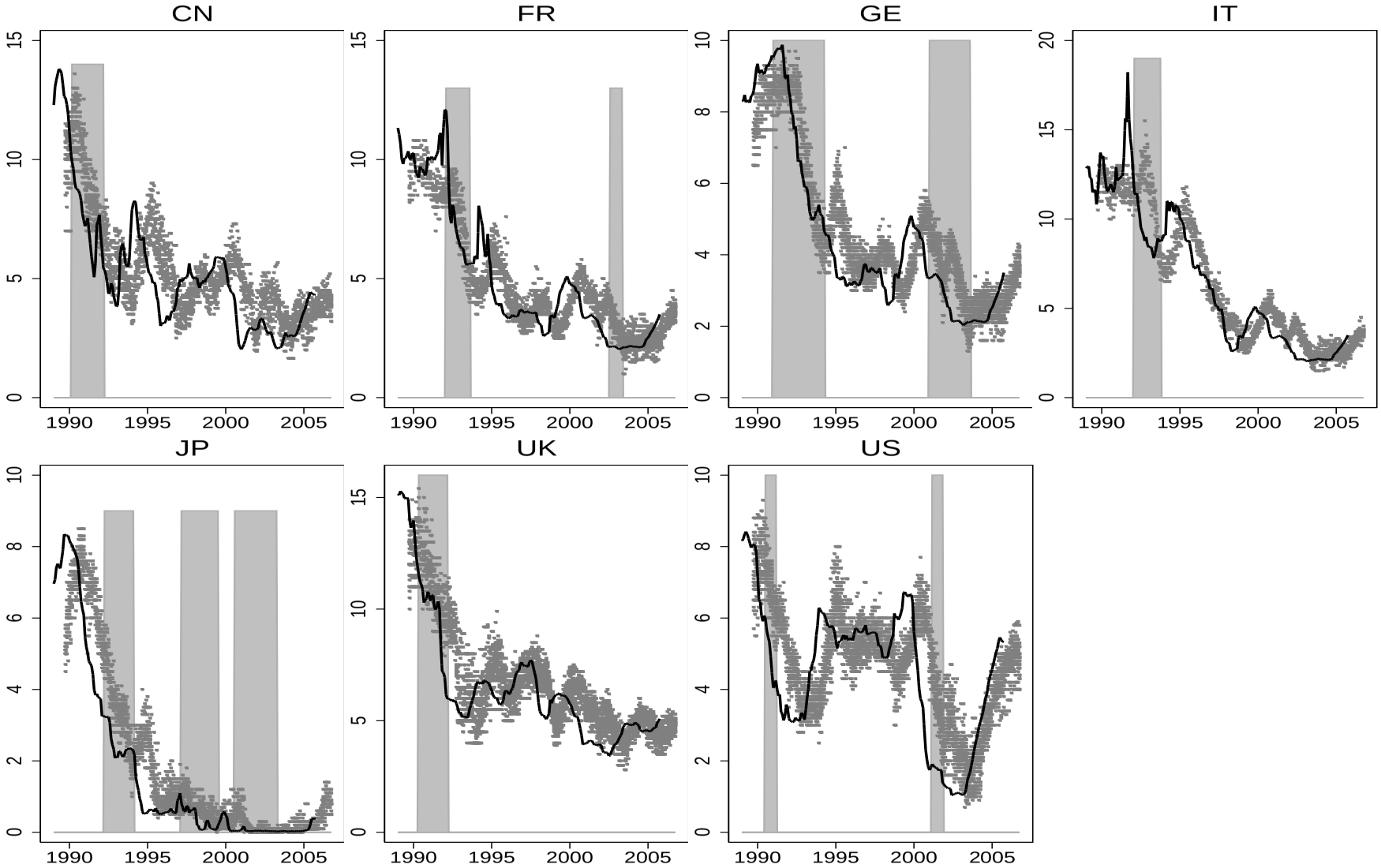
Country	Variable	Inflation	GDP	Int. Rate	Cons	Inv
CN	GDP	0.19				
	Interest Rate	0.22	0.27			
	Consumption	0.22	0.53	0.27		
	Investment	0.11	0.25	0.05	0.15	
	Unemployment	0.31	0.57	0.34	0.48	0.28
FR	GDP	0.16				
	Interest Rate	0.26	0.14			
	Consumption	0.04	0.41	0.12		
	Investment	0.20	0.39	0.19	0.28	
	Unemployment	0.05	0.23	0.27	0.16	0.11
GE	GDP	−0.03				
	Interest Rate	0.09	0.18			
	Consumption	0.14	0.44	0.28		
	Investment	0.07	0.17	0.11	0.32	
	Unemployment	−0.04	0.34	0.22	0.23	−0.08
IT	GDP	0.17				
	Interest Rate	0.56	0.12			
	Consumption	0.25	0.39	0.16		
	Investment	0.29	0.36	0.23	0.32	
	Unemployment	0.31	0.32	0.12	0.32	0.26
JP	GDP	0.26				
	Interest Rate	0.47	0.06			
	Consumption	0.24	0.57	0.08		
	Investment	0.13	0.53	−0.03	0.38	
	Unemployment	0.04	0.50	−0.14	0.39	0.26
UK	GDP	0.49				
	Interest Rate	0.66	0.53			
	Consumption	0.31	0.59	0.33		
	Investment	0.37	0.56	0.41	0.52	
	Unemployment	0.47	0.63	0.61	0.45	0.56
US	GDP	0.41				
	Interest Rate	0.31	0.22			
	Consumption	0.36	0.74	0.05		
	Investment	0.32	0.55	0.11	0.50	
	Unemployment	0.18	0.48	0.12	0.50	0.37

FIGURE 1. Expected and Actual Inflation Rate (Percent)



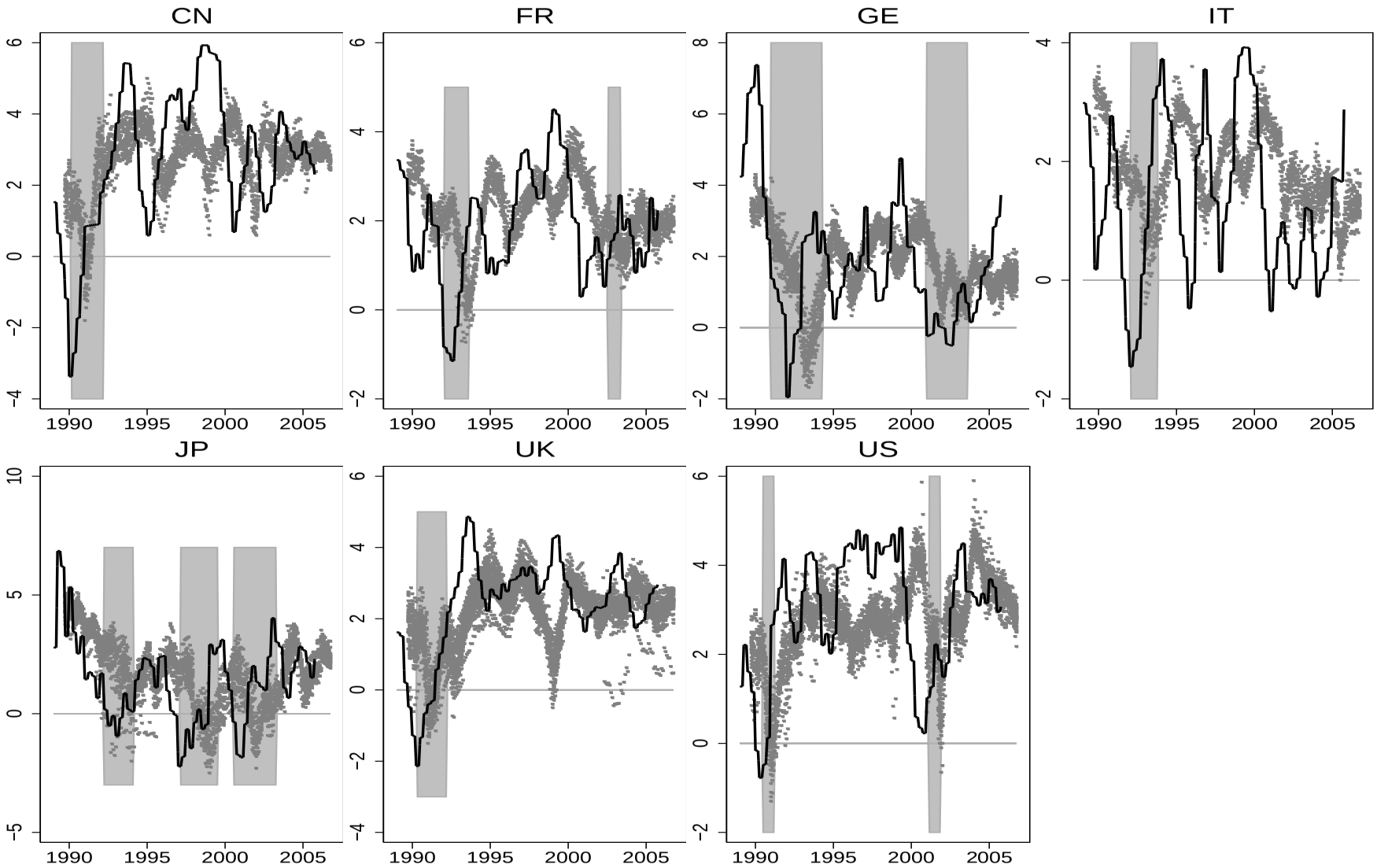
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 2. Expected and Actual Short-term Interest Rates (Percent)



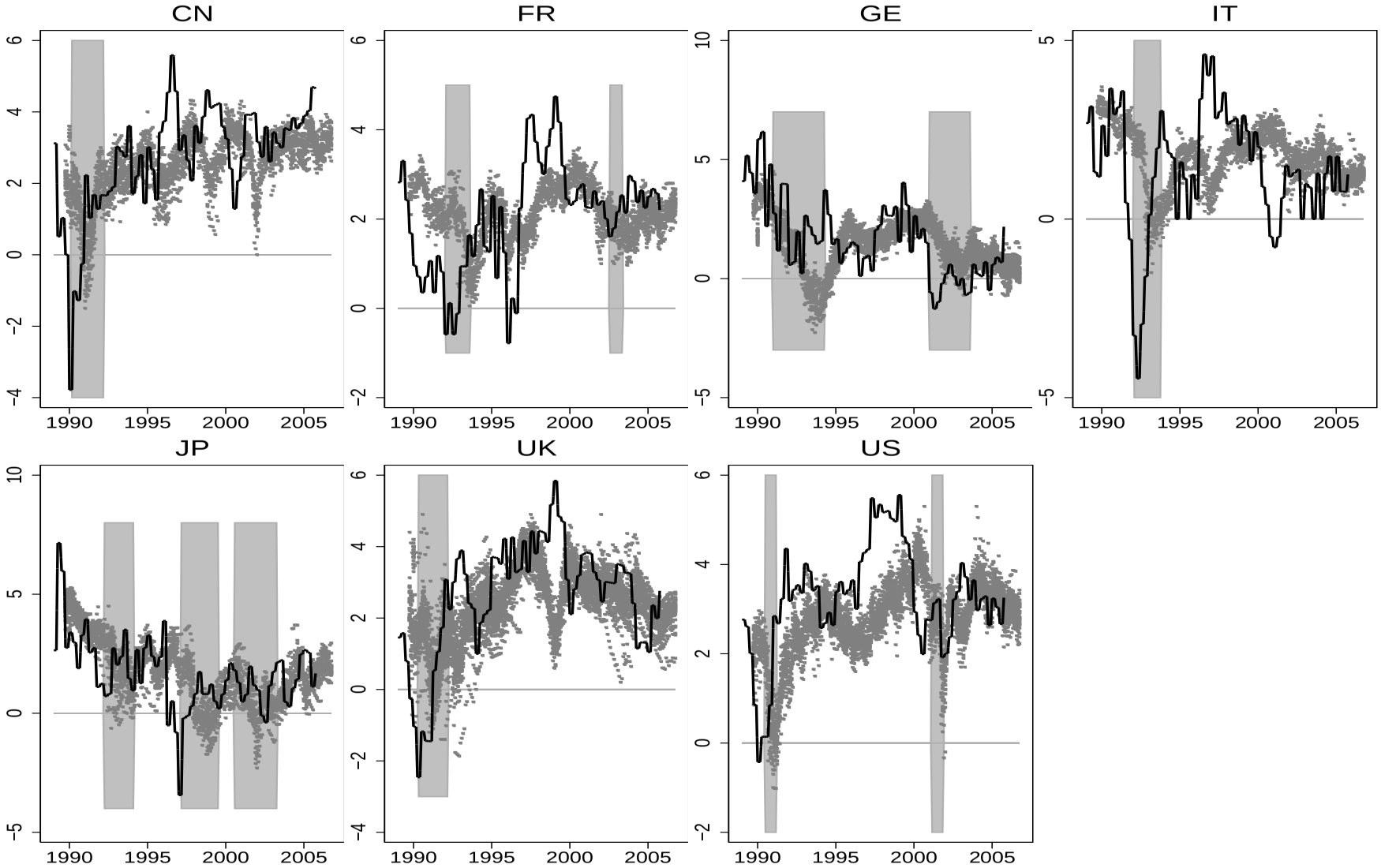
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 3. Expected and Actual GDP Growth (Percent)



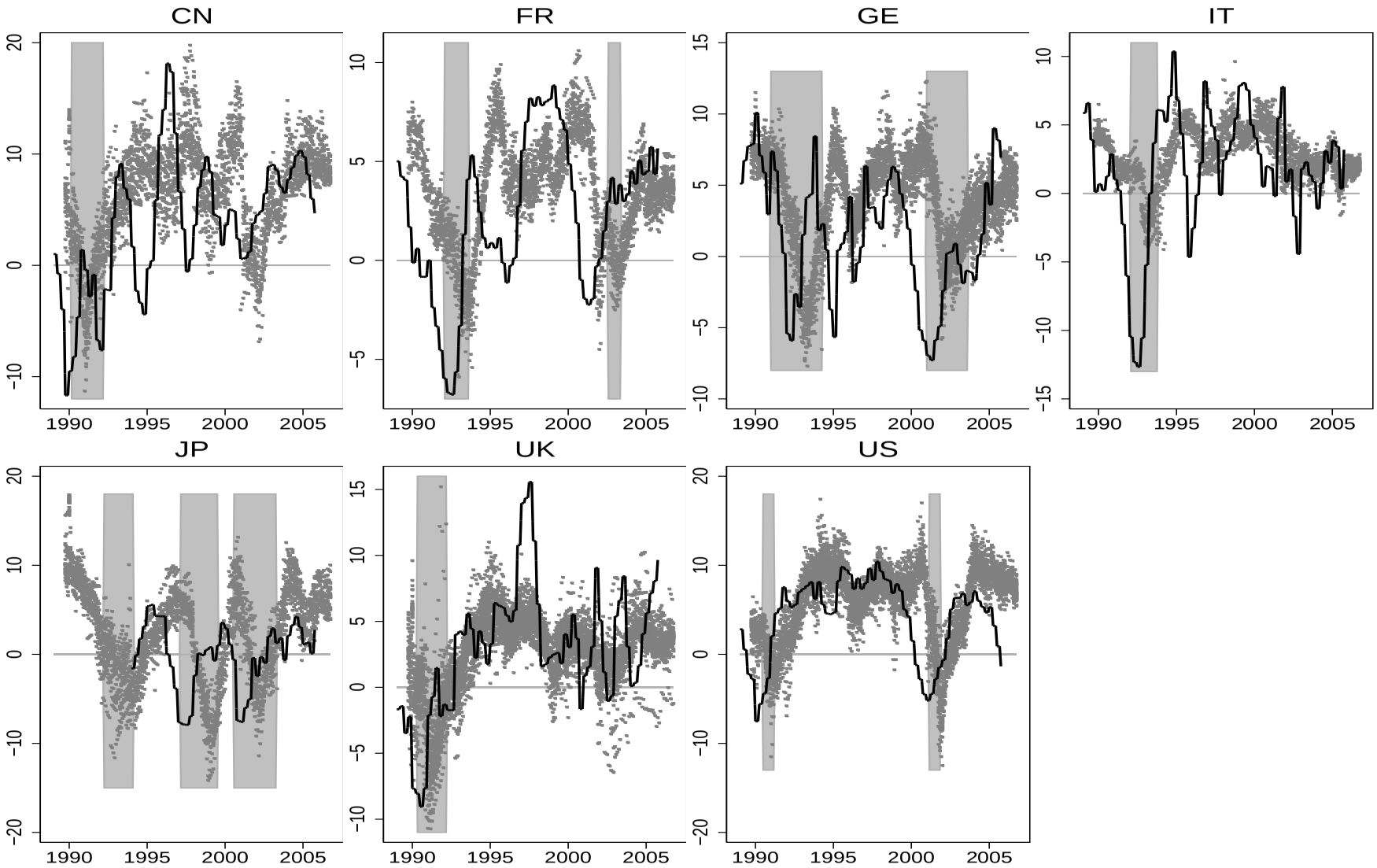
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 4. Expected and Actual Consumption Growth (Percent)



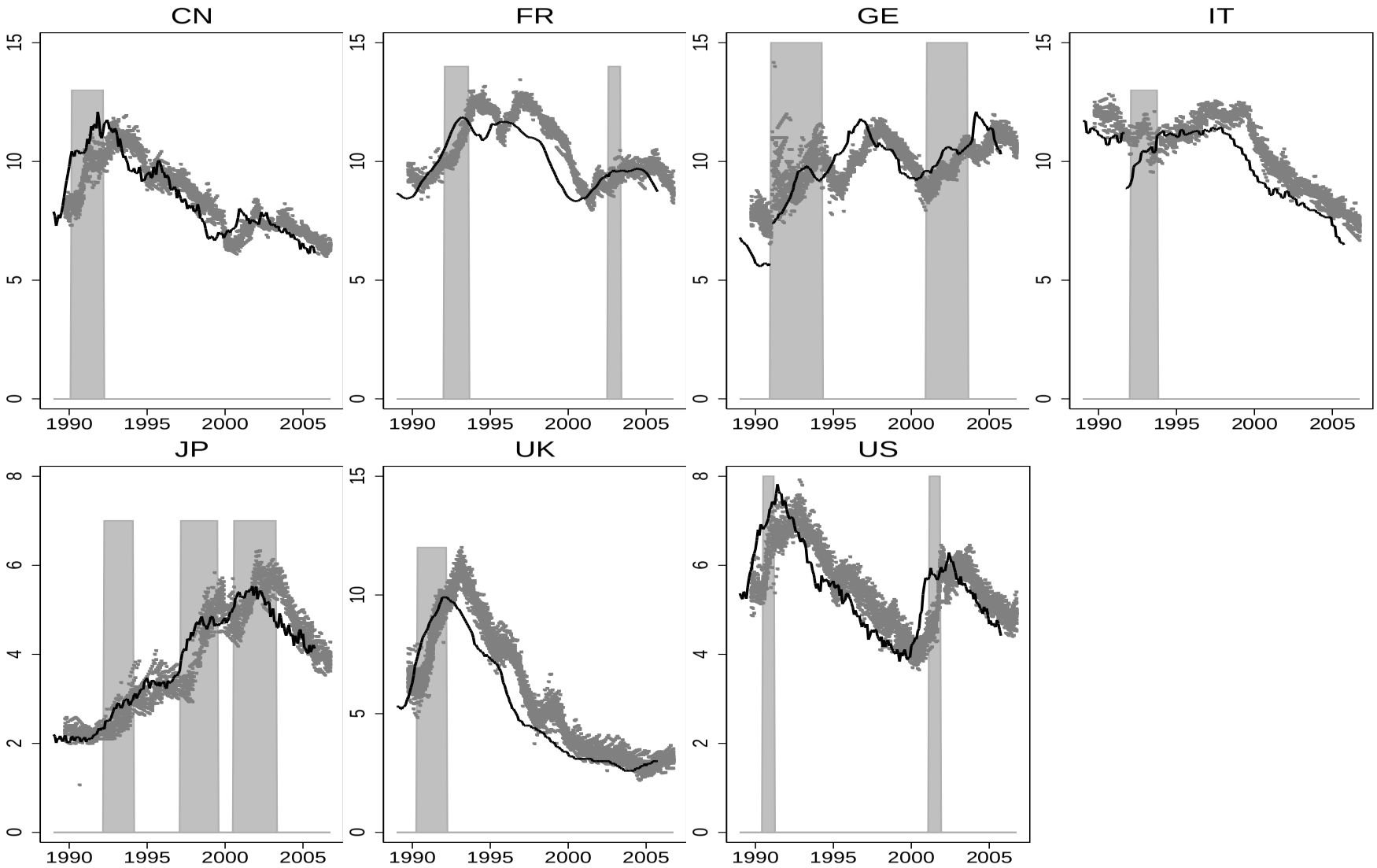
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 5. Expected and Actual Investment Growth (Percent)



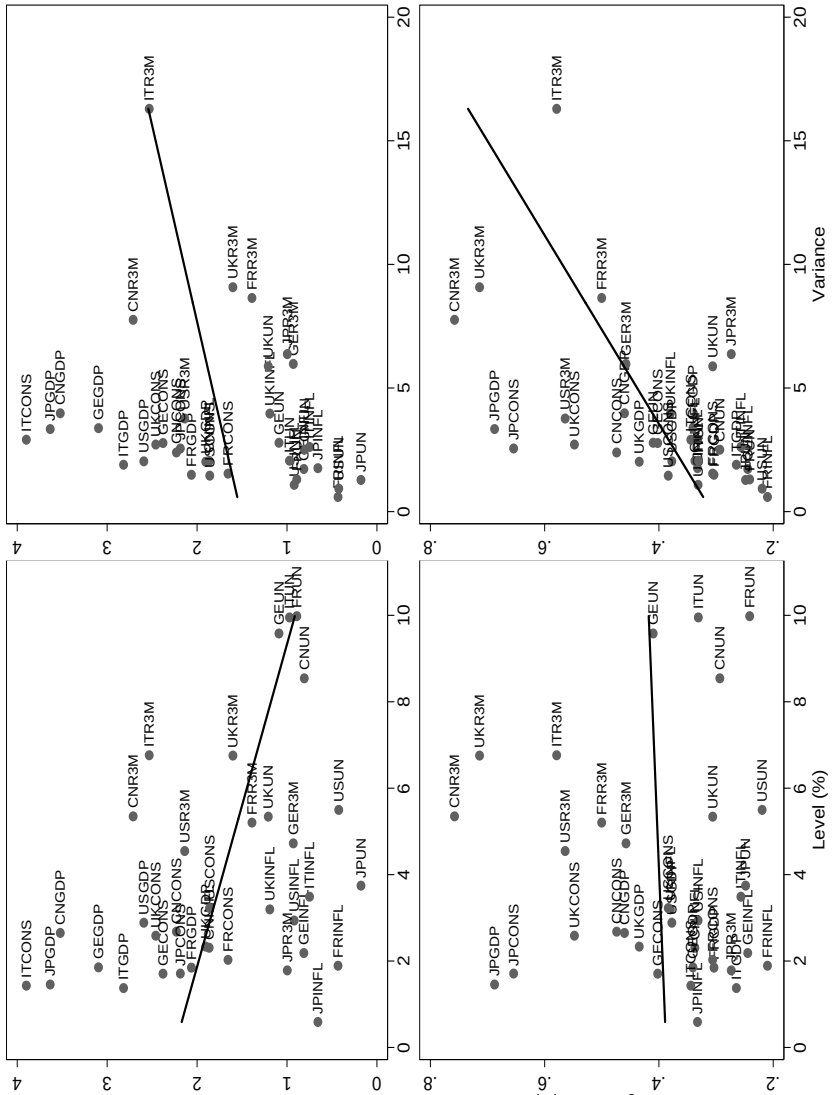
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 6. Expected and Actual Unemployment Rate (Percent)



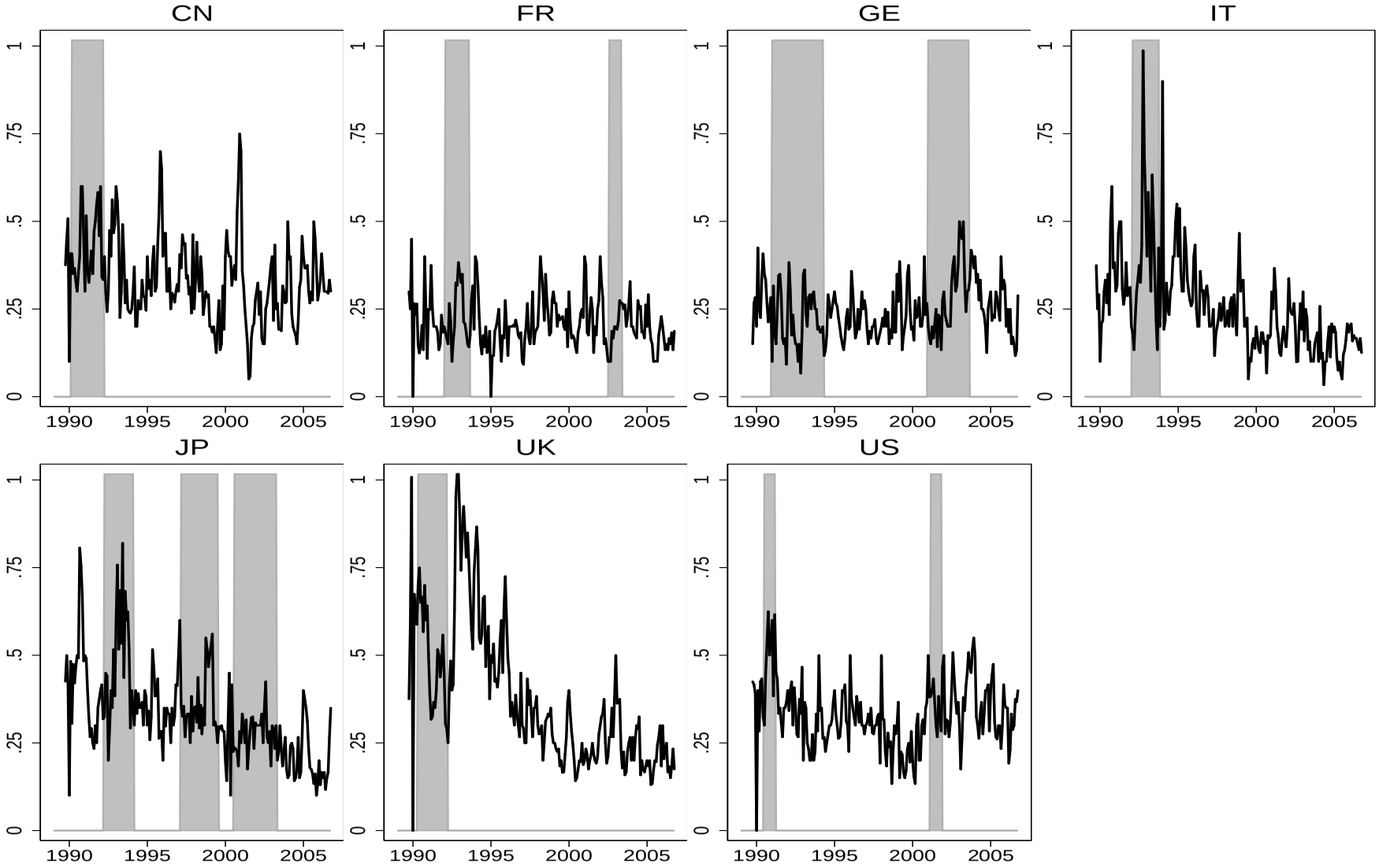
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 7. Disagreement and MSE of Expectations vs. Level and Variance of the Underlying Variable



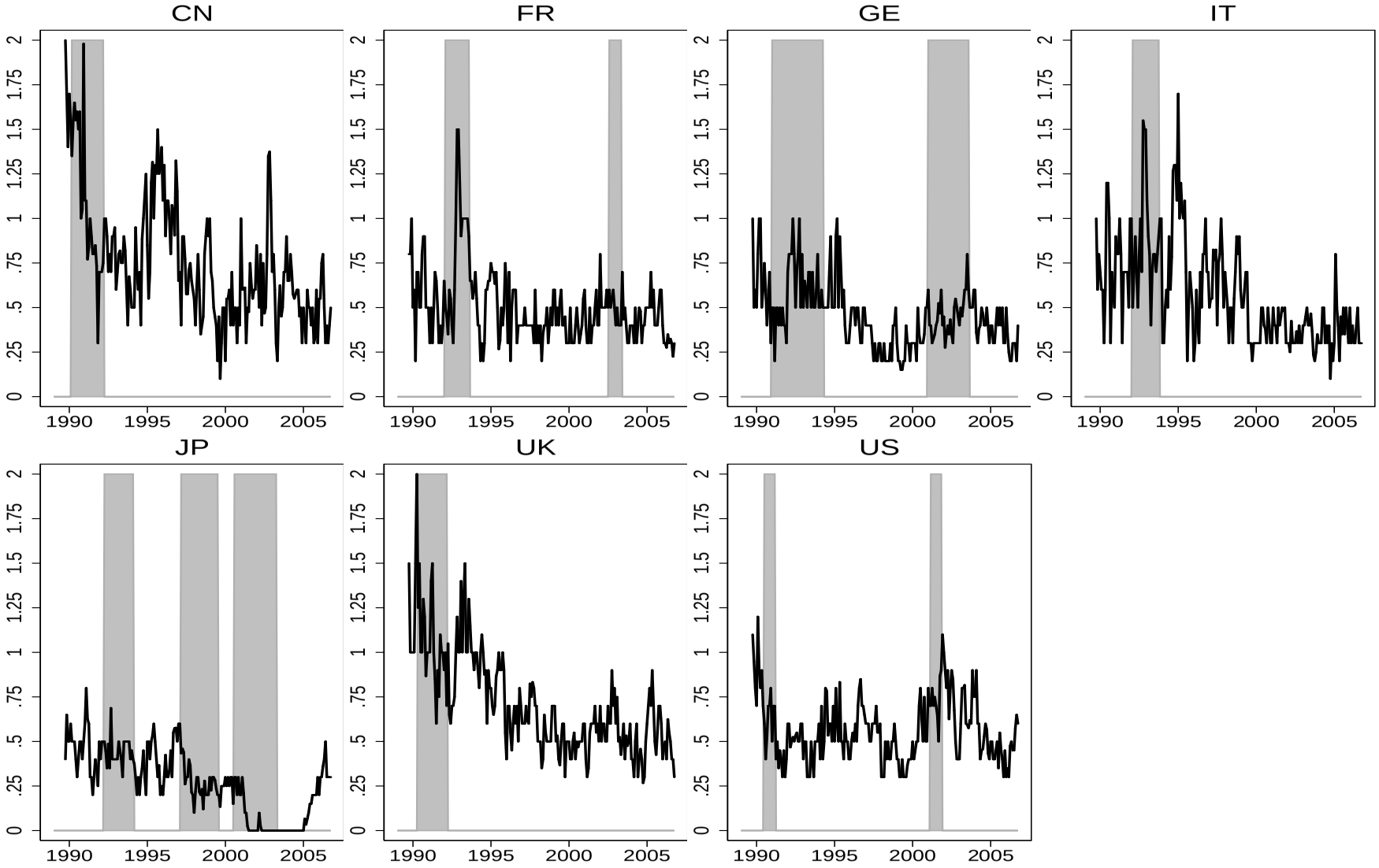
Notes: Disagreement is measured with the cross-sectional interquartile range. Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 8. Disagreement about Inflation Rate (Percent)



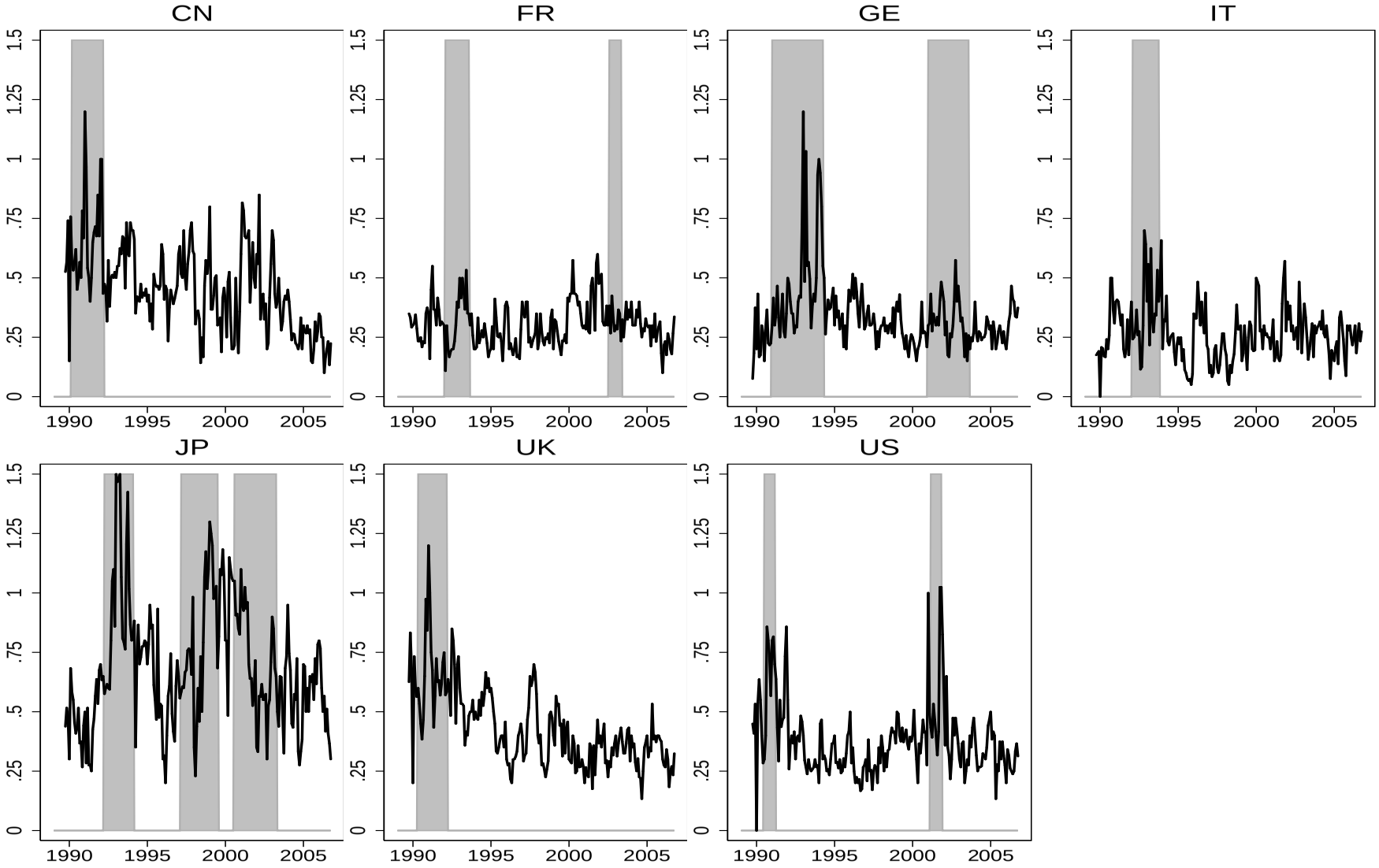
Notes: Disagreement is measured with the cross-sectional interquartile range. Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 9. Disagreement about Short-term Interest Rate (Percent)



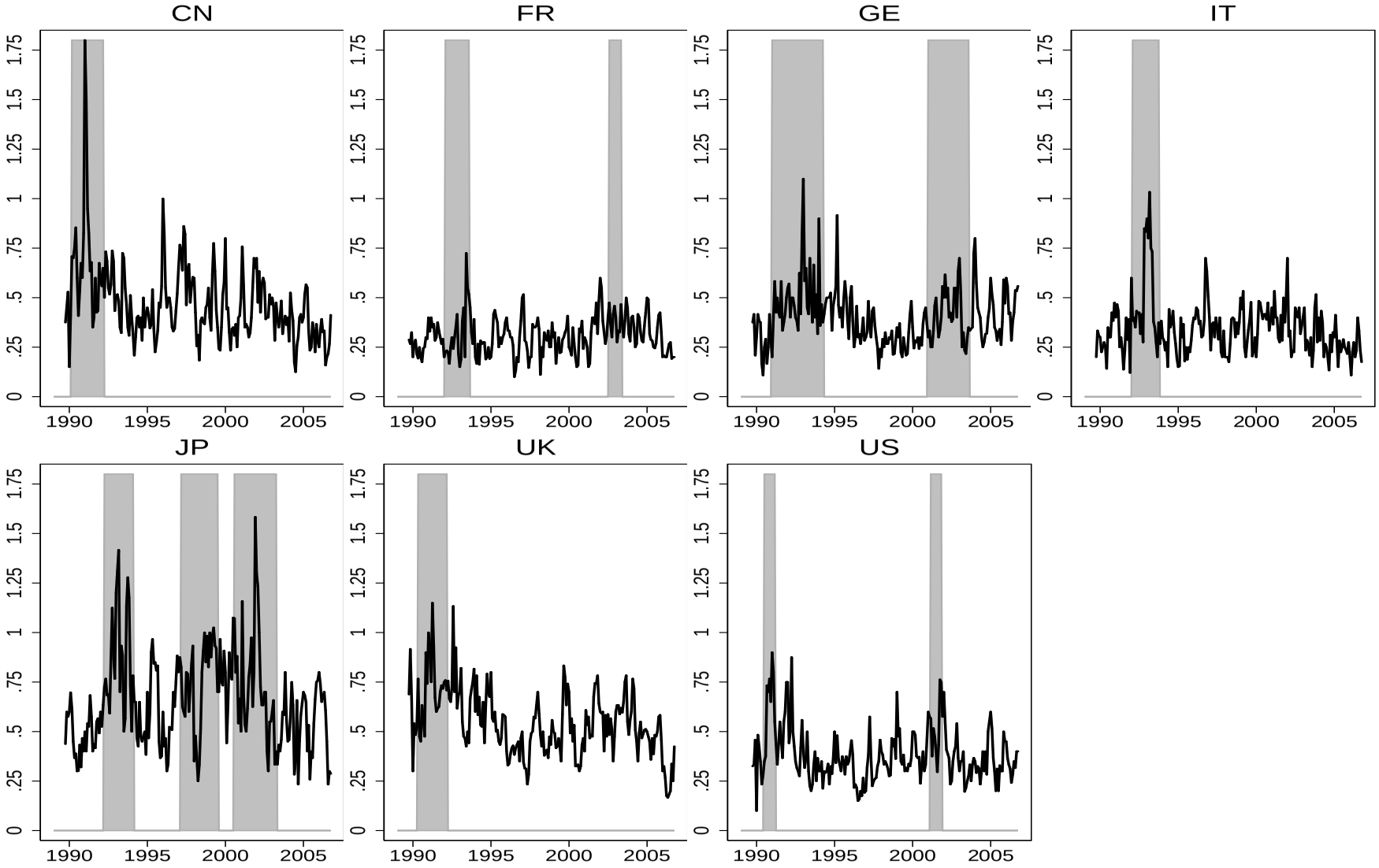
Notes: Disagreement is measured with the cross-sectional interquartile range. Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 10. Disagreement about GDP Growth (Percent)



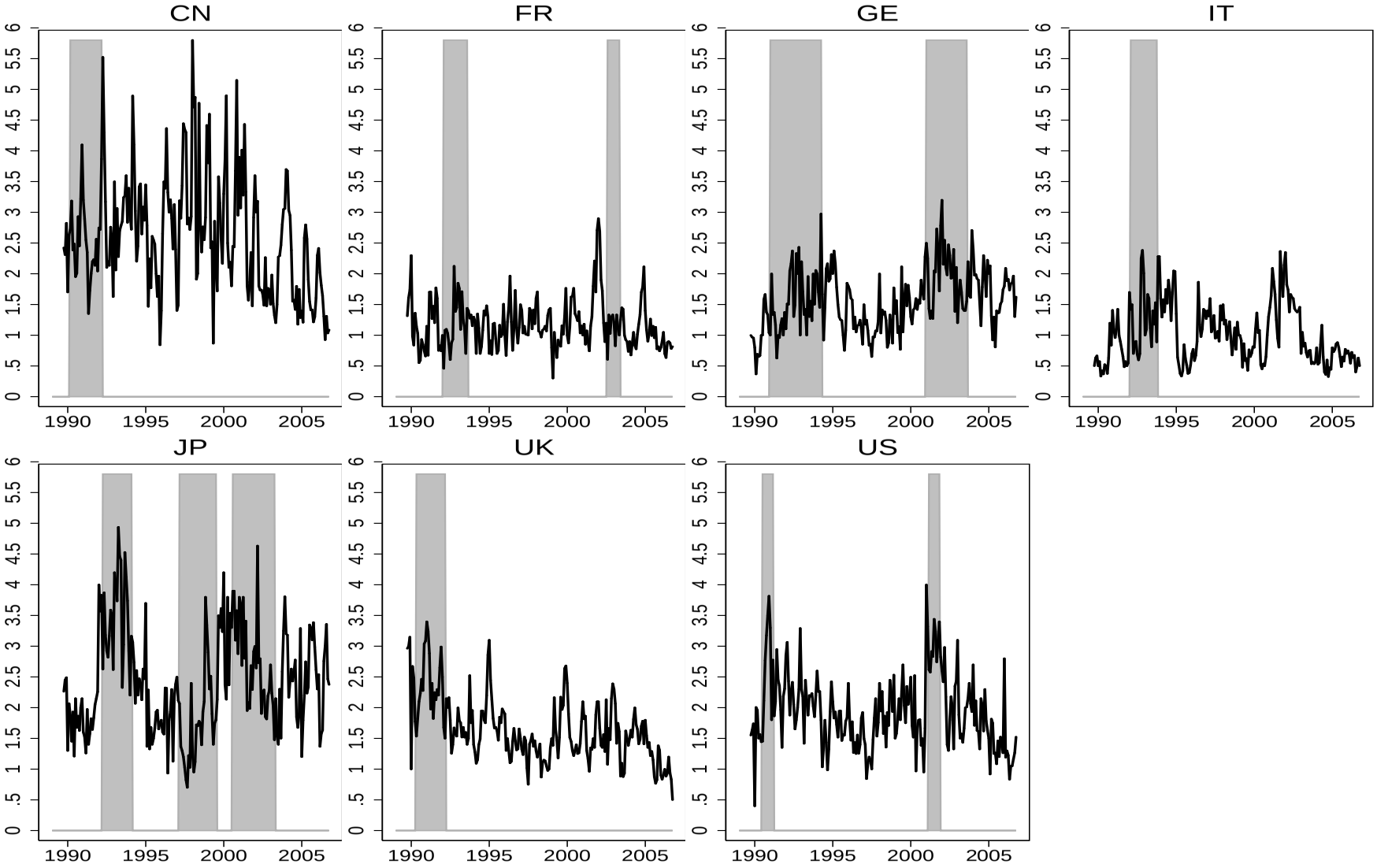
Notes: Disagreement is measured with the cross-sectional interquartile range. Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 11. Disagreement about Consumption Growth (Percent)



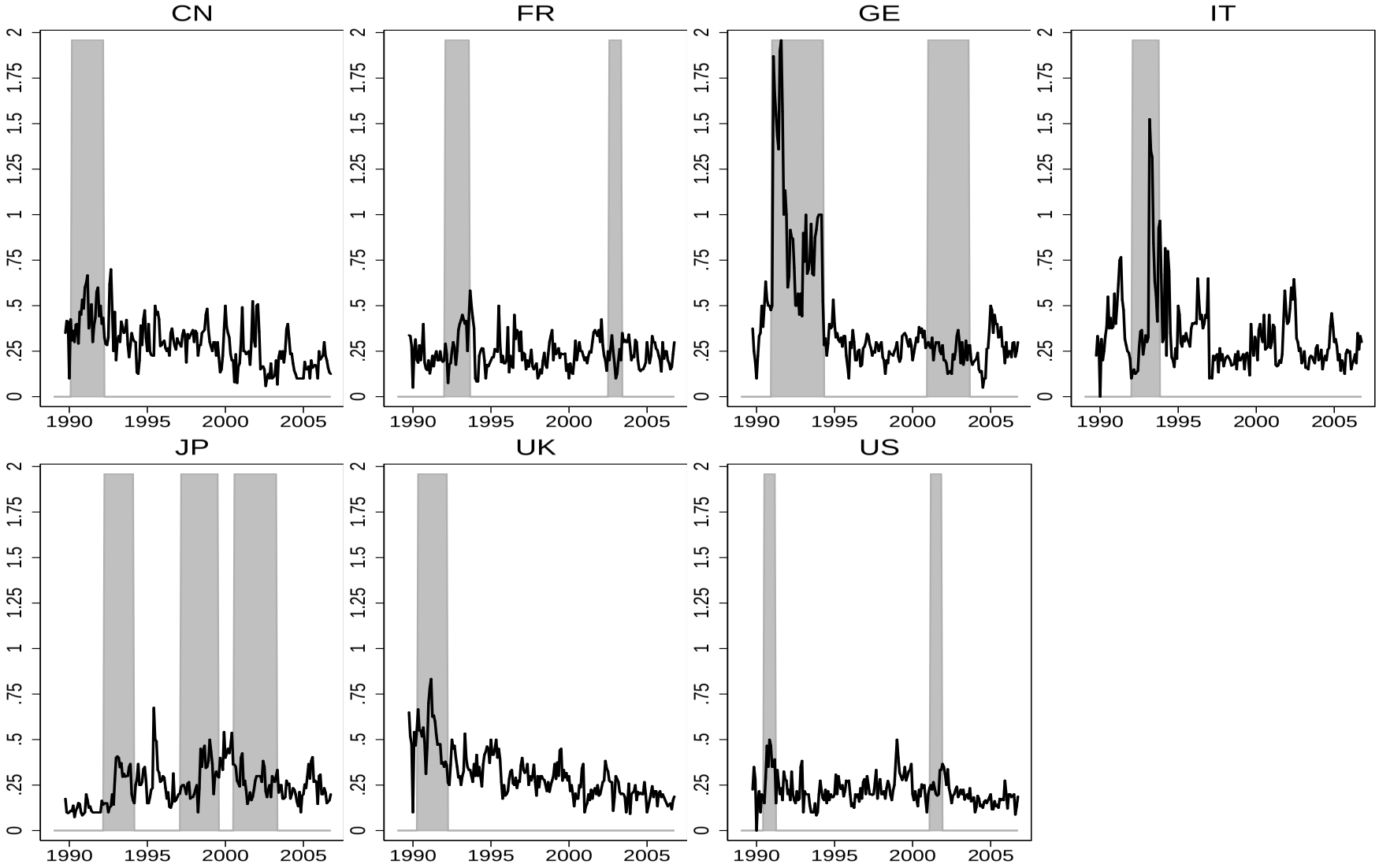
Notes: Disagreement is measured with the cross-sectional interquartile range. Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 12. Disagreement about Investment Growth (Percent)



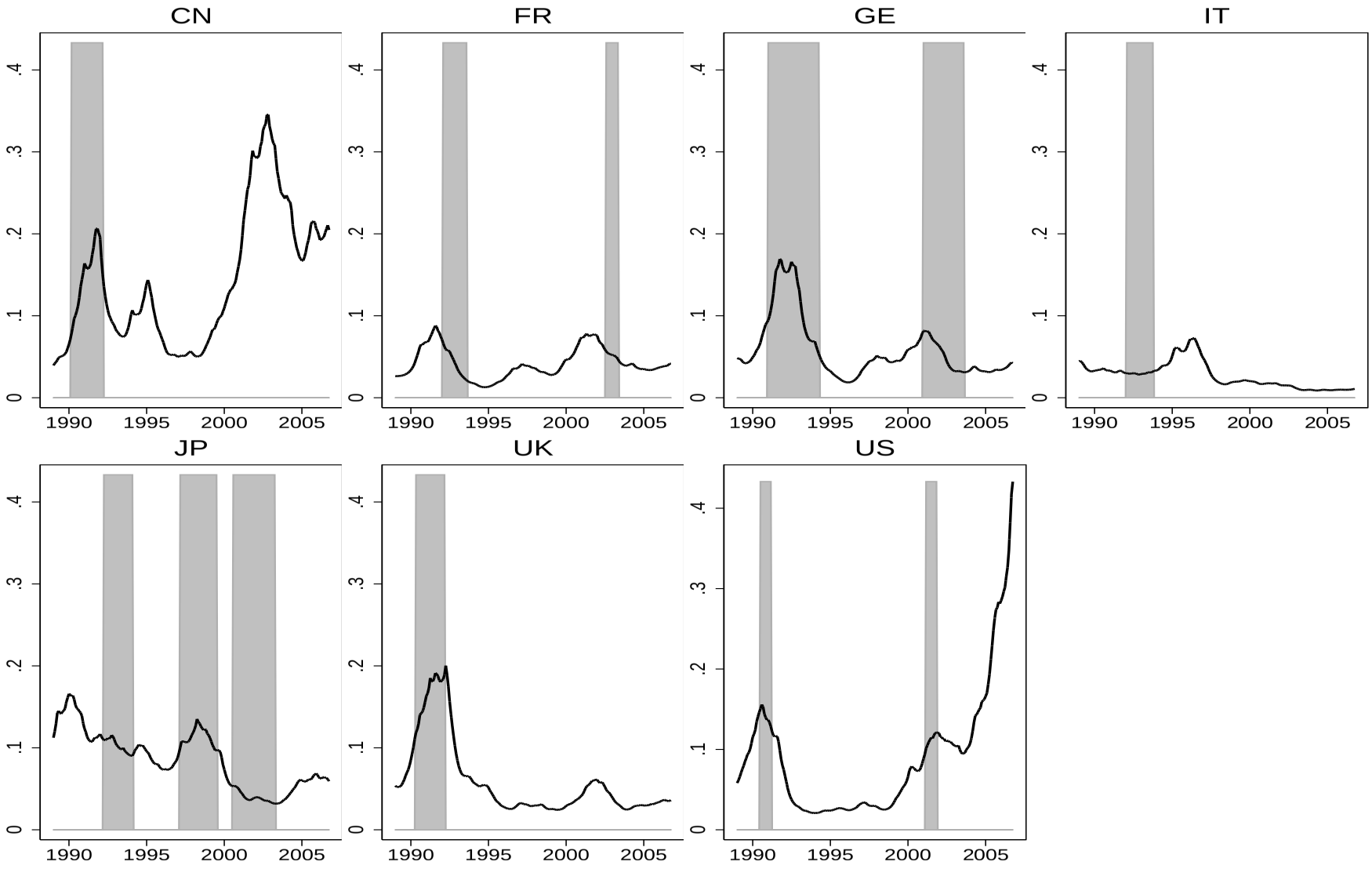
Notes: Disagreement is measured with the cross-sectional interquartile range. Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 13. Disagreement about Unemployment Rate (Percent)



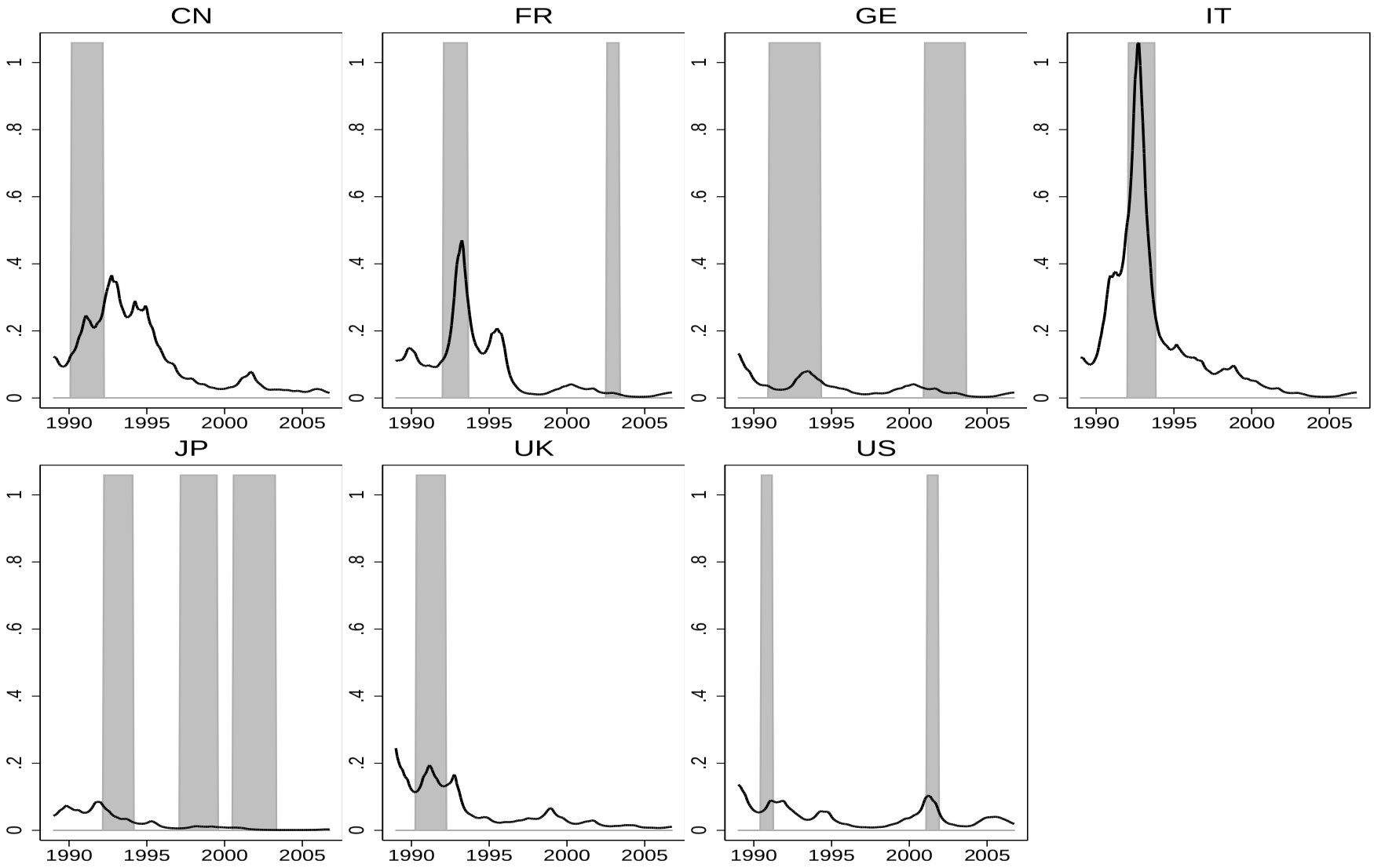
Notes: Disagreement is measured with the cross-sectional interquartile range. Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 14. Variance of Permanent Component $\sigma^2_{\varepsilon,t}$—Inflation



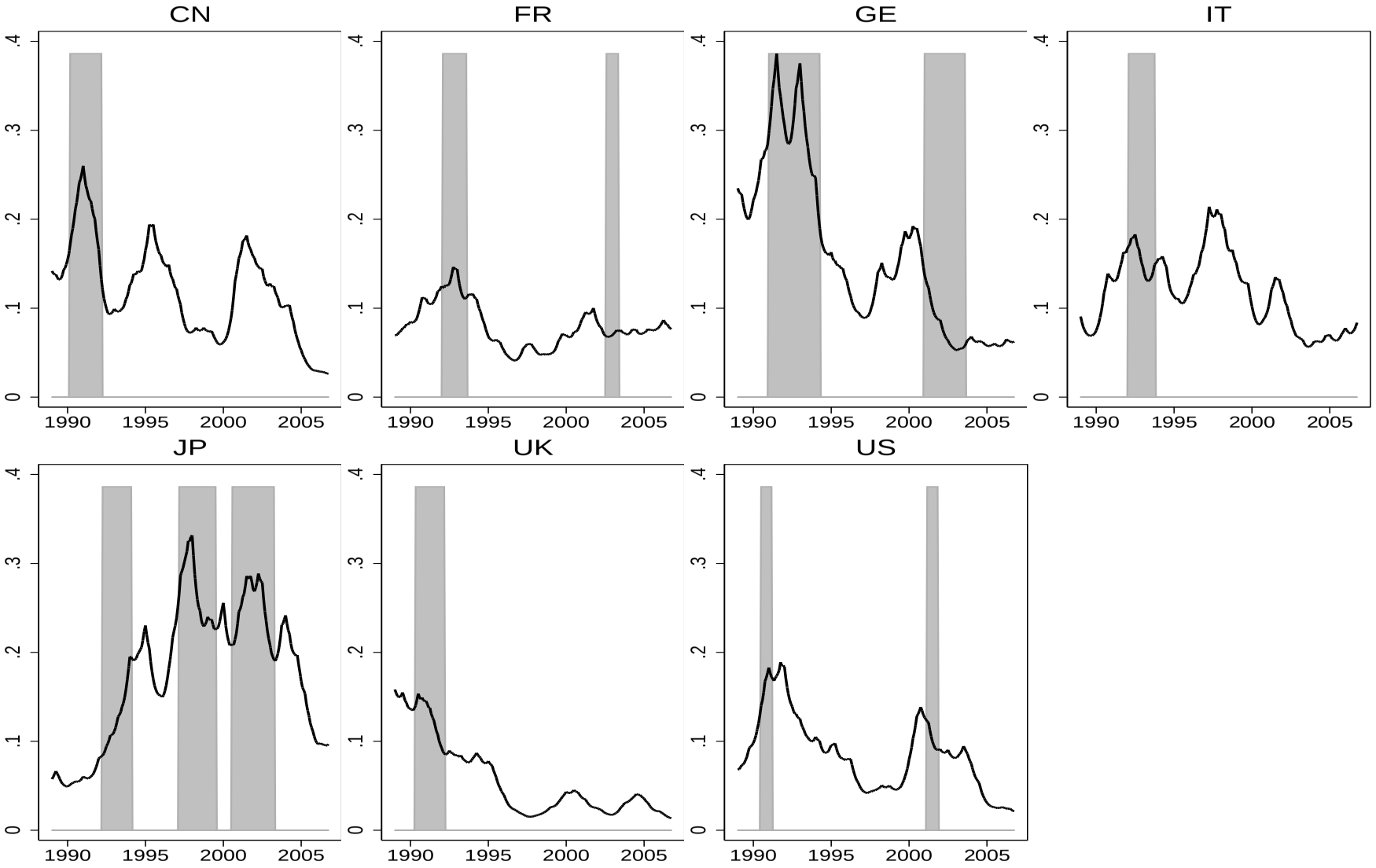
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 15. Variance of Permanent Component $\sigma^2_{\varepsilon,t}$—Interest Rate



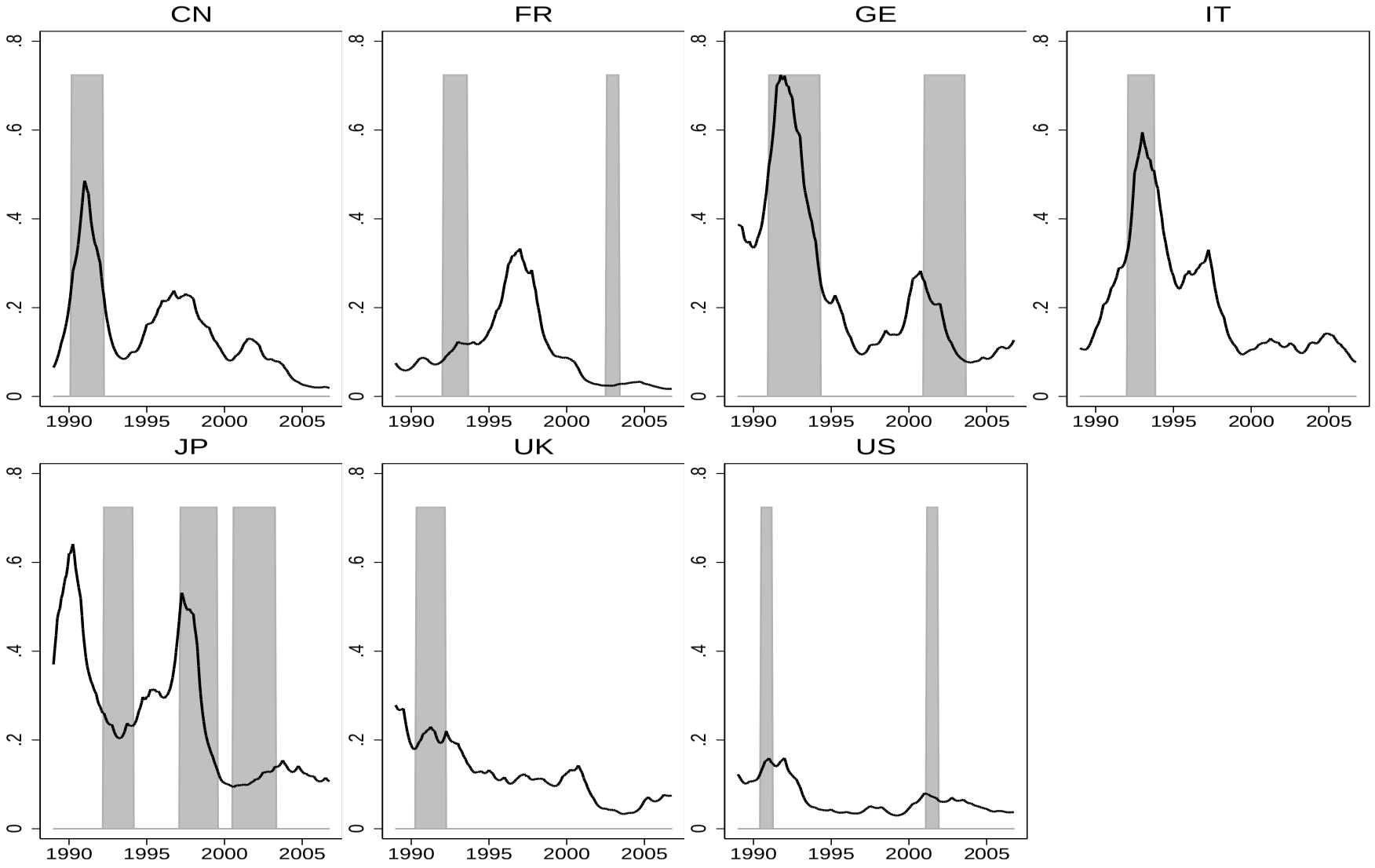
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 16. Variance of Permanent Component $\sigma^2_{\varepsilon,t}$—GDP Growth



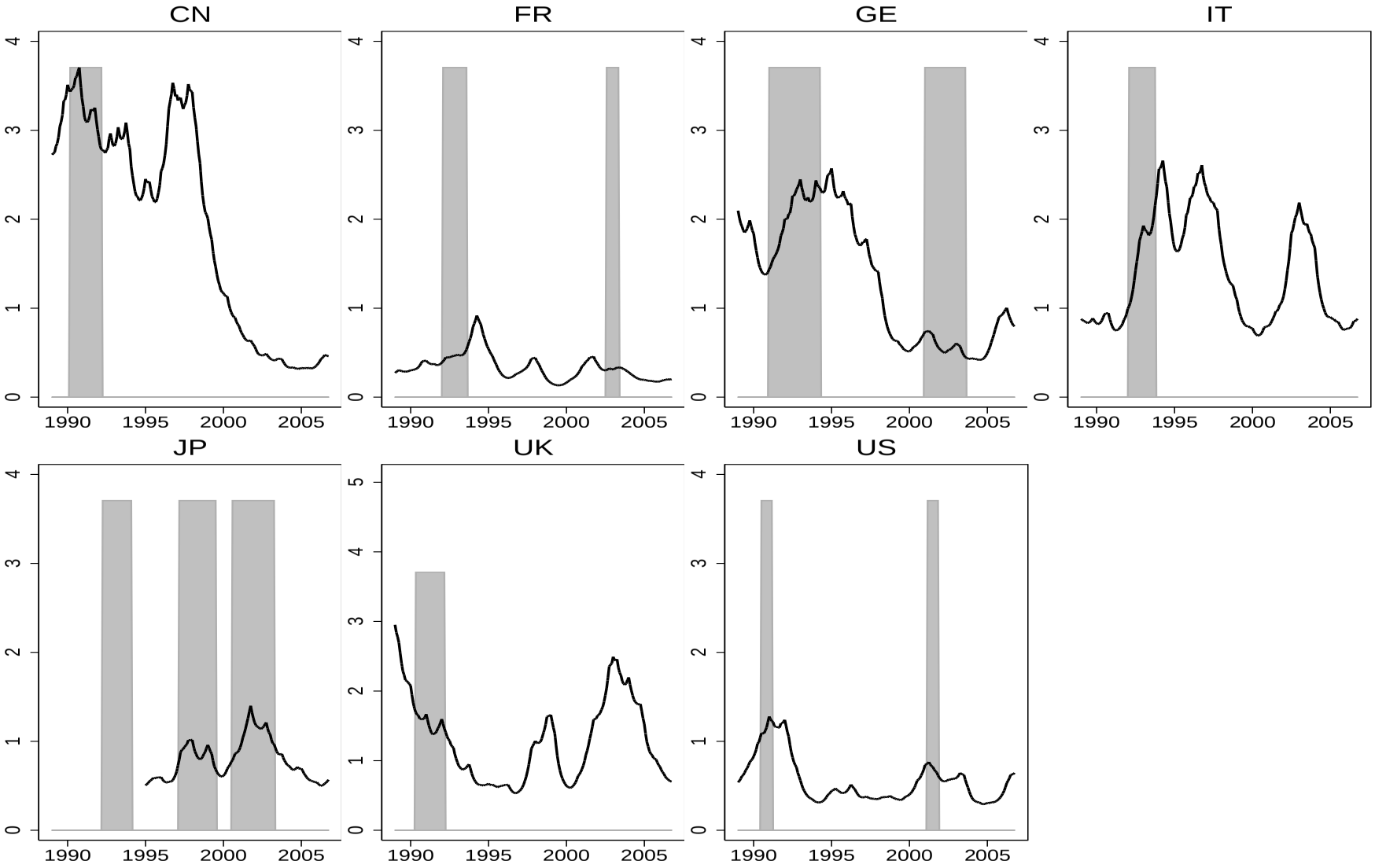
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 17. Variance of Permanent Component $\sigma^2_{\varepsilon,t}$—Consumption Growth



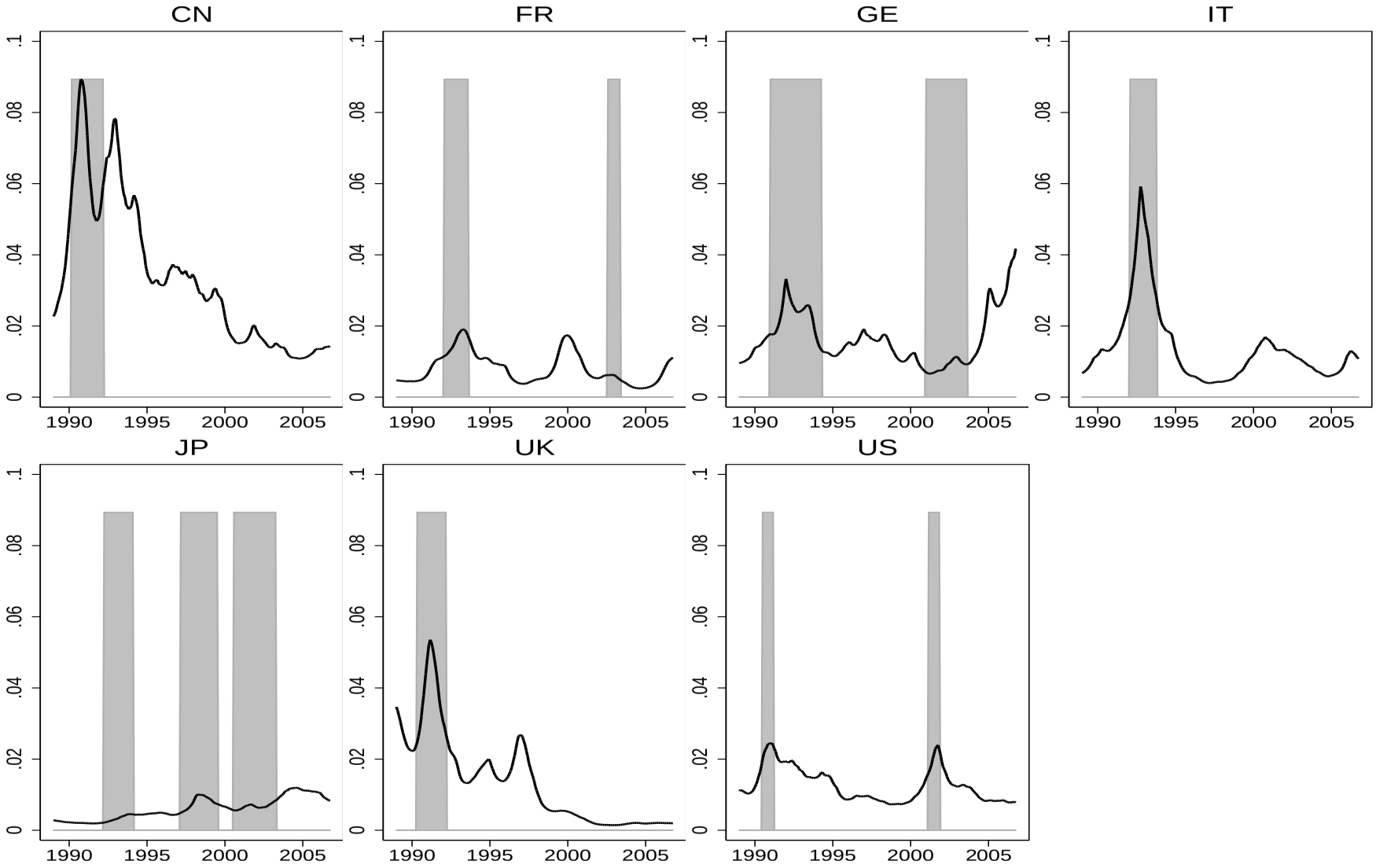
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 18. Variance of Permanent Component $\sigma^2_{\varepsilon,t}$—Investment Growth



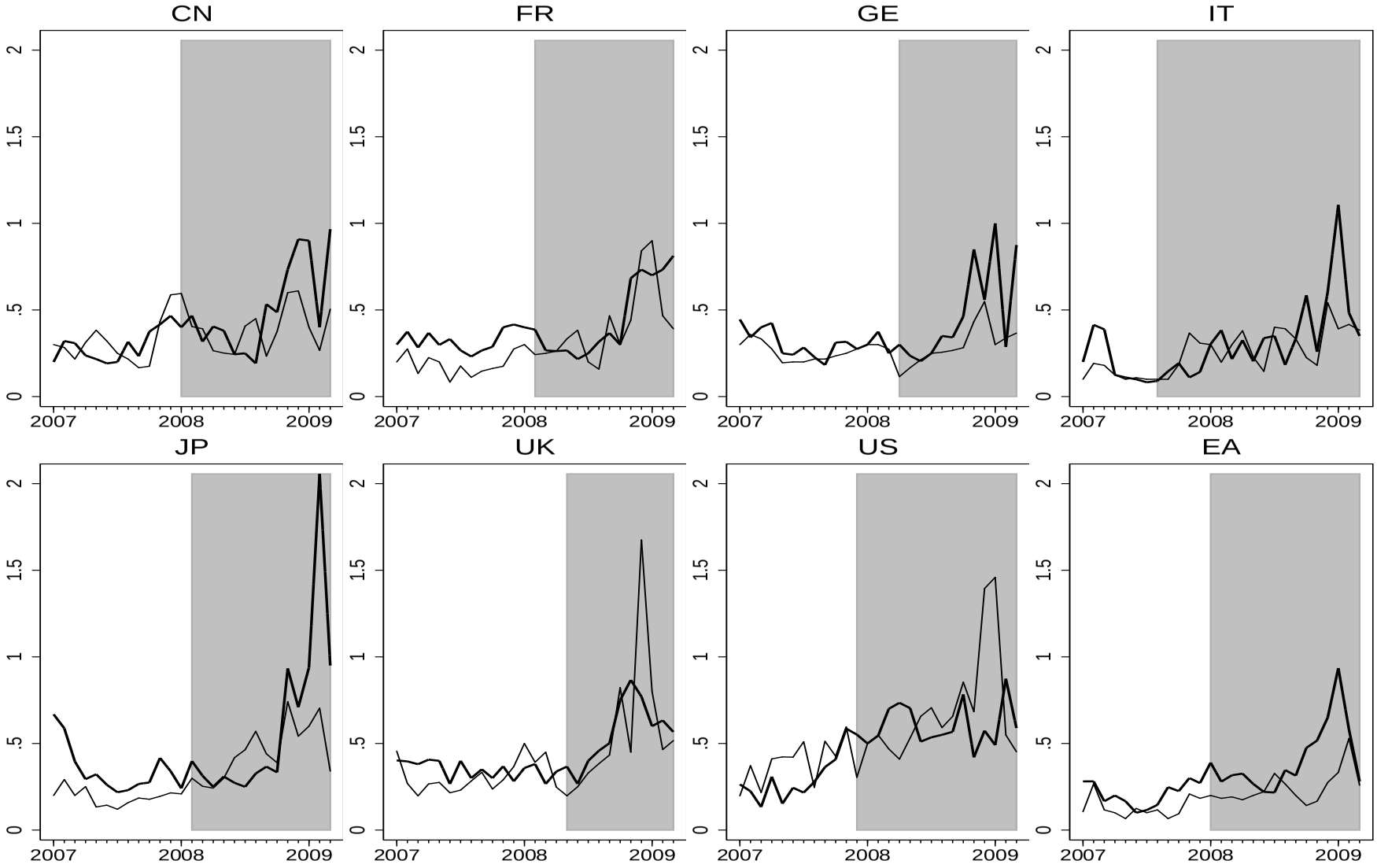
Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 19. Variance of Permanent Component $\sigma^2_{\varepsilon,t}$—Unemployment Rate



Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method).

FIGURE 20. Disagreement about GDP (thick line) and Inflation (Percent; January 2007–March 2009)



Note: Shaded areas denote recessions as identified by the Economic Cycle Research Institute (using the business cycle method) and, for the euro area, by CEPR's business cycle dating committee.

FIGURE 21. Cross-sectional Dynamics of GDP and Inflation Expectations (Percent; 2007–2009)—"Big" Economic Regions

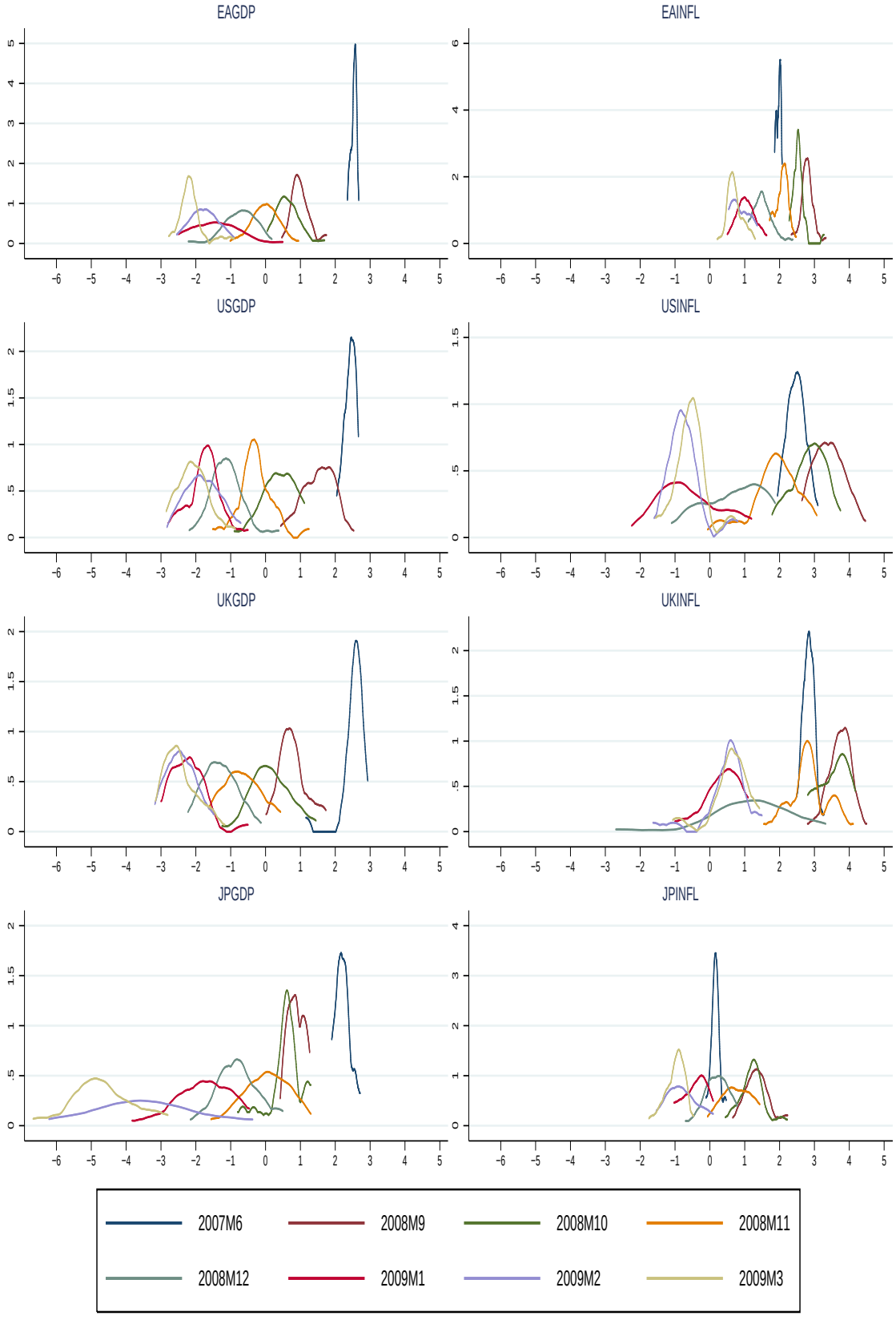


FIGURE 22. Cross-sectional Dynamics of GDP and Inflation Expectations (Percent; 2007–2009)—"Smaller" Economic Regions