DISAGREEMENT AMONG FORECASTERS IN G7 COUNTRIES

JONAS DOVERN, ULRICH FRITSCHE AND JIRI SLACALEK

March 27, 2009

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 (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

Dovern: Kiel Economics, Kiel, jonas.dovern@kiel-economics.de; Fritsche: University Hamburg, ulrich.fritsche@wiso.uni-hamburg.de, http://www.ulrich-fritsche.net/; Slacalek: European Central Bank, Frankfurt am Main, jiri.slacalek@ecb.int, http://www.slacalek.com/. We are grateful to Torsten Schünemann and David Sondermann for excellent research assistance; to Jonathan Wright for helpful comments and programs to estimate the UCSV model; to Bartosz Maćkowiak, Adina Popescu and seminar audiences at the Česká národní banka, ECB and ZEW Mannheim for valuable feedback; and to Philip Hubbard for information about the data. Online appendix with additional results is available at http://www.slacalek.com/research/dfs09disagreement/dfs09disagreement_onlineAppendix.pdf. The views presented in this paper are the authors', and do not necessarily reflect those of the European Central Bank.

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 with micro data.

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

[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 heterogenous 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.

to a lesser extent for nominal series, and disagreement is more strongly cross-correlated among variables within the groups than between them.

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 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 heterogenous 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

[3]More precisely, the work typically finds that the variance of the permanent component of inflation and GDP was declining before 2006 or so. See related evidence in Table 3 below 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

closely related body of work investigates heterogeneity in expectations, often 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. 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.

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, 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

(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.

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). 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.

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 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 year; the survey data thus provides series of *fixed event* forecasts.[10] However, we

[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.

[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

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 $y1$ made in month m of previous year, $y0 = y1-1$, 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:

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

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 interquartile range. 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

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 17 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. 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 not highly 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

[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).

variables in some countries.) Average expectation errors are typically positive, which may reflect forecasters' optimism or sluggishness (where the trend in the 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-section interquartile range—its evolution over time and its relationship to the business cycle and monetary policy.

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

The top panel of Table 2 summarizes the average disagreement by country and variable. 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

[12]Bias of inflation forecasts tends to 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.

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 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. 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

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

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 4–9 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 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 4–9 investigates how disagreement ("disagr") varies over time and during recessions using four 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 4. 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 20 percent during recessions, a fact that can be due to the increase in general macroeconomic uncertainty. Row 3 documents 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 5 and 6 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—44 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; see also the evidence in Table 3). 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 7, 8 and 9 respectively are again qualitatively consistent with the rest.

Qualitatively, the estimates (together with those of Tables 4–5) 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,

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

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 of using 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).[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:

$$x_t = \tau_t + \eta_t, \quad (2)$$

$$\tau_t = \tau_{t-1} + \varepsilon_t. \quad (3)$$

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 ($\eta_t \sim \mathcal{N}(0, \sigma^2_{\eta,t})$, $\varepsilon_t \sim \mathcal{N}(0, \sigma^2_{\varepsilon,t})$):

$$\log \sigma^2_{\eta,t} = \log \sigma^2_{\eta,t-1} + \nu_{\eta,t}, \quad (4)$$

$$\log \sigma^2_{\varepsilon,t} = \log \sigma^2_{\varepsilon,t-1} + \nu_{\varepsilon,t}. \quad (5)$$

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]

[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.

[20] The online appendix shows the diagnostics we used to assess the quality 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

Table 3 and Figures 14–19 summarize the dynamics of the variance of permanent shocks $\sigma^2_{\varepsilon,t}$. The top panel in Table 3 compares the full-sample averages of $\sigma^2_{\varepsilon,t}$ across countries and variables. These statistics correspond quite well to the average disagreement in the top panel of Table 2. For example, both shocks to investment and disagreement about it are substantially higher than for other variables.[22] 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.

The four bottom panels of Tables 2 and 3 highlight quite consistently across countries and variables that forecasters disagree more when the economy is hit with larger permanent shocks. In particular, these panels list average disagreement and average variance of permanent shocks relative to the relevant full-sample average during four periods: booms, recessions, pre-1999 and post-1998. Instances when the relative average exceeds one are shaded in grey. The key message to take away is that the grey areas in the two Tables largely overlap: both economic shocks and disagreement are more substantial during recessions and tended to be more muted in the second part of our sample.[23] 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 4–9 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[24] and the squared change in the policy interest rate (Δpolicy rate^2_t)—a proxy of the variation in monetary policy:

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

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

below in sections 3.4 and 3.5. One difference is that disagreement about inflation correlates more strongly with $\Delta_{12}INFL^2_t$ than with $\sigma^2_{INFL,\varepsilon,t}$. This is not surprising because both measures of uncertainty co-move quite closely, with correlation of about 0.5. (Estimation results and comparison plots of $\Delta_{12}x^2_t$ and $\sigma^2_{x,\varepsilon,t}$ are shown in the online appendix.)

[22]Similar to investment, disagreement about and shocks to industrial production are also substantially larger (not shown in the Tables).

[23]The relative averages are substantially higher during recessions than before 1999 partly because recessions are quite rare (and the full-sample relative average is one). However, raw averages (not scaled with the full-sample average) for both disagreement and variance of permanent shocks also tend to be considerably higher during recessions.

[24]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.

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 5 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 6 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 sample as GDP growth only rarely exceeds 5 percent.) In fact, the coefficient on shocks to GDP $\sigma^2_{INFL,t}$ is estimated to be positive, high and overwhelmingly significant. As for disagreement about inflation and interest rates, variation in interest rates analyzed in model 7 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 7 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 anti-cyclical 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 4–9 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 10.[25]

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 variables, interest rates and inflation, 41% and 35% 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 of model 2 (and for inflation even marginally larger than those with recession and post-1998 dummies of model 3) for nominal variables, this result reverses for real variables (where adjusted R^2s of model 8 are low).

Model 9 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 (except unemployment). For most variables, the point estimate of β_1 changes only modestly (relative to model 8). 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. While the first result, the quantification of effects

[25]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. Appendix Table 8 of Arnone et al. (2007) implies that political autonomy of central banks was relatively low in Japan, the UK, France, Canada and Italy in the late 1980s, has generally risen in G7 countries between the late 1980s and 2003, but still remained relatively low in 2003 in Japan, Canada and the UK.

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 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.

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 11–16 summarize the cross-country differences in the drivers of disagreement by estimating models 3 and 7 (of Tables 4–9) separately country by country.[26]

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

[26] To remind, model 3 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 7:

$$\text{disagr}_t = \beta_0 + \beta_2 \times x_t + \beta_3 \times \Delta_{12} x_t^2 + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}_t^2 + u_t.$$

Detailed results for all models are available in the the online appendix. Regressions of Panel C of of Tables 4–9 are not investigated as monetary policy institutions vary little within each country.

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 11 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 12 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 results for the remaining, real variables variables—GDP, consumption, investment and unemployment rate, shown in Tables 13, 14, 15 and 16 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.

The level and sensitivity of disagreement about inflation and interest rates relate quite closely to the fraction of the sample with an independent central bank, shown in the right-most column of Table 10: 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.

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.[27] 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. 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 with

[27] Cross-variable and cross-country correlations in disagreement are given in Tables 18 and 19 in the Appendix.

micro data. 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 turbulences accumulate.

References

Ager, Philipp, Marcus Kappler, and Steffen Osterloh (2009), "The Accuracy and Efficiency of the Consensus Forecasts: A Further Application and Extension of the Pooled Approach," *International Journal of Forecasting*, 25(1), 167–181.

Alesina, Alberto, and Roberta Gatti (1995), "Independent Central Banks: Low Inflation at No Cost?" *American Economic Review, Papers and Proceedings*, 85, 196–200.

Alesina, Alberto, and Lawrence H. Summers (1993), "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence," *Journal of Money, Credit and Banking*, 25, 151–162.

Ang, Andrew, Geert Bekaert, and Min Wei (2007), "Do Macro Variables, Asset Markets or Surveys Forecast Inflation Better?" *Journal of Monetary Economics*, 54, 1163–1212.

Arnone, Marco, Bernard J. Laurens, Jean-François Segalotto, and Martin Sommer (2007), "Central Bank Autonomy: Lessons from Global Trends," working paper 88, IMF.

Ball, Laurence (1992), "Why Does High Inflation Raise Inflation Uncertainty?" *Journal of Monetary Economics*, 29, 371–388.

Ball, Laurence, and Stephen Cecchetti (1990), "Inflation Uncertainty at Short and Long Horizons," *Brookings Papers on Economic Activity*, 1, 251–254.

Batchelor, Roy (2007), "Bias in Macroeconomic Forecasts," *International Journal of Forecasting*, 23, 189–203.

Beechey, Meredith J., Benjamin K. Johannsen, and Andrew T. Levin (2008), "Are Long-Run Inflation Expectations Anchored More Firmly in the Euro Area than in the United States?" FEDS discussion paper 23, Federal Reserve Board.

Bernanke, Ben S. (2004), "The Logic of Monetary Policy," remarks before the National economists club, Federal Reserve Board.

Bernanke, Ben S., and Jean Boivin (2003), "Monetary Policy in a Data-Rich Environment," *Journal of Monetary Economics*, 50(3), 525–546.

Blanchflower, David G., and Roger Kelly (2008), "Macroeconomic Literacy, Numeracy and the Implications for Monetary Policy," mimeo, Bank of England.

Bloom, Nicholas, Max Floetotto, and Nir Jaimovich (2009), "Really Uncertain Business Cycles," mimeo, Stanford University.

Branch, William A. (2004), "The Theory of Rationally Heterogeneous Expectations: Evidence from Survey Data on Inflation Expectations," *Economic Journal*, 114(497), 592–621.

Carroll, Christopher D. (1997), "Buffer-Stock Saving and the Life Cycle/Permanent Income Hypothesis," *Quarterly Journal of Economics*, 112(1), 1–55.

Carroll, Christopher D. (2003), "Macroeconomic Expectations of Households and Professional Forecasters," *Quarterly Journal of Economics*, 118(1), 269–298.

Cogley, Timothy, and Thomas J. Sargent (2001), "Evolving Post-World War II U.S. Inflation Dynamics," in Ben S. Bernanke and Kenneth Rogoff, editors, *NBER Macroeconomics Annual*, volume 16, 331–388, NBER.

Cukierman, Alex (1992), *Central Bank Strategy, Credibility, and Independence*, MIT Press.

Devereux, Michael B., Gregor W. Smith, and James Yetman (2009), “Consumption and Real Exchange Rates in Professional Forecasts,” working paper 1195, Queen’s University.

Döpke, Jörg, and Ulrich Fritsche (2006), “When Do Forecasters Disagree? An Assessment of German Growth and Inflation Forecast Dispersion,” *International Journal of Forecasting*, 22, 125–135.

Dovern, Jonas, and Ulrich Fritsche (2008), “Estimating Fundamental Cross-Section Dispersion from Fixed Event Forecasts,” discussion paper 1, University Hamburg.

Ehrmann, Michael, Marcel Fratzscher, Refet S. Gürkaynak, and Eric T. Swanson (2007), “Convergence and Anchoring of Yield Curves in the Euro Area,” working paper 817, European Central Bank.

Engel, Charles, Nelson Mark, and Kenneth D. West (2008), “Exchange Rates Models Are Not As Bad As You Think,” in Daron Acemoglu, Kenneth Rogoff, and Michael Woodford, editors, *NBER Macroeconomics Annual 2007*, volume 22, 381–441, University of Chicago Press.

Engel, Charles, and John H. Rogers (2008), “Expected Consumption Growth from Cross-Country Surveys: Implications for Assessing International Capital Markets,” International Finance Discussion Paper 949, Federal Reserve System.

Erceg, Christopher J., and Andrew T. Levin (2003), “Imperfect Credibility and Inflation Persistence,” *Journal of Monetary Economics*, 50(4), 915–944.

Faust, Jon, and Jonathan H. Wright (2007), “Comparing Greenbook Forecasts and Reduced Form Forecasts using a Large Realtime Dataset,” working paper 13397, NBER.

Grilli, Vittorio, Donato Masciandaro, and Guido Tabellini (1991), “Political and Monetary Institutions and Public Financial Policies in the Industrial Countries,” *Economic Policy*, 13, 341–392.

Gürkaynak, Refet S., Andrew T. Levin, and Eric T. Swanson (2006), “Does Inflation Targeting Anchor Long-Run Inflation Expectations? Evidence from Long-Term Bond Yields in the US, UK and Sweden,” working paper 9, Federal Reserve Bank of San Francisco.

Harvey, David I., Stephen J. Leybourne, and Paul Newbold (2001), “Analysis of a Panel of UK Macroeconomic Forecasts,” *Econometrics Journal*, 4(1), 37–55.

Iacoviello, Matteo (2005), “House Prices, Borrowing Constraints and Monetary Policy in the Business Cycle,” *American Economic Review*, 95(3), 739–764.

Isiklar, Gultekin, Kajal Lahiri, and Prakash Loungani (2006), “How Quickly Do Forecasters Incorporate News? Evidence from Cross-country Surveys,” *Journal of Applied Econometrics*, 21(6), 7033–725.

Kim, Don H., and Athanasios Orphanides (2005), “Term Structure Estimation with Survey Data on Interest Rate Forecasts,” FEDS discussion paper 48, Federal Reserve Board.

Krusell, Per, and Anthony A. Smith (1998), “Income and Wealth Heterogeneity in the Macroeconomy,” *Journal of Political Economy*, 106(5), 867–896.

Levin, Andrew T., Fabio M. Natalucci, and Jeremy M. Piger (2004), “Explicit Inflation Objectives and Macroeconomic Outcomes,” working paper 383, European Central Bank.

Mankiw, N. Gregory, Ricardo Reis, and Justin Wolfers (2003), “Disagreement on Inflation Expectations,” *NBER Macroeconomics Annual*, 209–248.

Morris, Stephen, and Hyun Song Shin (2005a), "Central Bank Transparency and the Signal Value of Prices," *Brookings Papers on Economic Activity*, 2, 1–66.

Morris, Stephen, and Hyun Song Shin (2005b), "The Social Value of Public Information," *American Economic Review*, 92, 1521–1534.

Patton, Andrew J., and Allan Timmermann (2008a), "The Resolution of Macroeconomic Uncertainty: Evidence from Survey Forecasts," mimeo, University of Oxford.

Patton, Andrew J., and Allan Timmermann (2008b), "Why Do Forecasters Disagree? Lessons from the Term Structure of Cross-Sectional Dispersion," mimeo, University of Oxford.

Piazzesi, Monika, and Martin Schneider (2008), "Bond Positions, Expectations, and the Yield Curve," working paper 2, Federal Reserve Bank of Atlanta.

Rogoff, Kenneth (1985), "The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics*, 100, 1169–1190.

Scheinkman, José, and Wei Xiong (2003), "Heterogeneous Beliefs, Speculation and Trading in Financial Markets," in *Paris–Princeton Lectures on Mathematical Finance*, volume 1847, Springer.

Souleles, Nicholas S. (2004), "Expectations, Heterogeneous Forecast Errors, and Consumption: Micro Evidence from the Michigan Consumer Sentiment Surveys," *Journal of Money, Credit and Banking*, 36(1), 39–72.

Stock, James H., and Mark W. Watson (2002), "Has the Business Cycle Changed and Why?" in Mark Gertler and Ken Rogoff, editors, *NBER Macroeconomics Annual*, MIT Press.

Stock, James H., and Mark W. Watson (2005), "Understanding Changes in International Business Cycle Dynamics," *Journal of the European Economic Association*, 3, 968–1006.

Stock, James H., and Mark W. Watson (2007), "Why Has U.S. Inflation Become Harder to Forecast?" *Journal of Money, Credit, and Banking*, 39, 3–33.

Woodford, Michael (2005), "Central Bank Communication and Policy Effectiveness," working paper 11898, NBER.

Wright, Jonathan H. (2008), "Term Premiums and Inflation Uncertainty: Empirical Evidence from an International Dataset," FEDS Discussion Paper 25, Federal Reserve Board.

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
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
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
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
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
UN							
Average # Forecasters	16.41	18.07	27.65	13.99	17.98	32.32	28.12
Average Expectation Error†	−0.02	0.43	0.04	0.79	−0.01	0.63	0.07
Average MSE	0.81	0.89	1.29	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	2.99	2.06	1.28	5.88	0.93

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

Table 2. Average Disagreement Across Countries and Variables

Variable	Canada	France	Germany	Italy	Japan	UK	US	Mean
Full Sample*—Absolute Average								
Inflation	0.34	0.21	0.24	0.26	0.33	0.38	0.33	0.30
Interest Rate	0.76	0.50	0.46	0.58	0.27	0.71	0.56	0.55
GDP	0.46	0.30	0.34	0.26	0.69	0.43	0.38	0.41
Consumption	0.47	0.31	0.40	0.34	0.65	0.55	0.38	0.44
Investment	2.60	1.17	1.56	1.01	2.42	1.66	1.93	1.76
Unemployment	0.29	0.24	0.41	0.33	0.25	0.31	0.22	0.29
Booms†								
Inflation	0.96	0.99	0.99	0.93	0.94	0.96	0.97	0.97
Interest Rate	0.94	0.93	0.91	0.94	1.09	0.94	0.98	0.98
GDP	0.94	0.99	0.88	0.96	0.88	0.93	0.94	0.90
Consumption	0.93	0.98	0.92	0.94	0.87	0.96	0.95	0.92
Investment	1.00	1.00	0.94	0.97	0.95	0.95	0.95	0.95
Unemployment	0.93	0.98	0.70	0.94	0.93	0.91	0.96	0.89
Recessions†								
Inflation	1.26	1.03	1.01	1.58	1.09	1.31	1.29	1.14
Interest Rate	1.42	1.42	1.16	1.50	0.88	1.45	1.20	1.07
GDP	1.44	1.06	1.22	1.36	1.18	1.53	1.62	1.42
Consumption	1.50	1.12	1.14	1.51	1.18	1.32	1.51	1.36
Investment	0.98	1.00	1.12	1.24	1.07	1.43	1.48	1.20
Unemployment	1.54	1.13	1.55	1.54	1.10	1.71	1.40	1.46
Pre-1999†								
Inflation	1.10	1.01	0.92	1.28	1.20	1.32	1.00	1.13
Interest Rate	1.22	1.11	1.13	1.29	1.45	1.22	0.99	1.19
GDP	1.15	0.95	1.12	1.00	0.98	1.19	0.98	1.05
Consumption	1.12	0.96	1.02	1.04	0.99	1.07	0.99	1.03
Investment	1.09	1.00	0.89	1.06	0.93	1.08	1.00	1.01
Unemployment	1.22	1.01	1.30	1.14	0.90	1.23	1.02	1.14
1999+†								
Inflation	0.89	0.98	1.09	0.67	0.77	0.62	0.99	0.84
Interest Rate	0.74	0.87	0.85	0.65	0.47	0.74	1.01	0.78
GDP	0.82	1.06	0.86	1.01	1.03	0.78	1.03	0.94
Consumption	0.86	1.05	0.98	0.95	1.02	0.92	1.01	0.97
Investment	0.89	1.00	1.13	0.93	1.08	0.90	1.00	0.99
Unemployment	0.74	0.99	0.65	0.84	1.11	0.73	0.97	0.84

Notes: Grey cells indicate relative averages ≥ 1.00. *: Absolute average (across the full sample). †: Averages relative to full-sample averages (shown in the top panel). Disagreement measure: cross-sectional IQR. All averages taken across time periods.

Table 3. Average Variance of the Permanent Component $\sigma^2_{\varepsilon,t}$ Across Countries and Variables

Variable	Canada	France	Germany	Italy	Japan	UK	US	Mean
Full Sample*—Absolute Average								
Inflation	0.14	0.04	0.06	0.03	0.08	0.06	0.09	0.07
Interest Rate	0.11	0.08	0.03	0.16	0.02	0.05	0.04	0.07
GDP	0.12	0.08	0.16	0.12	0.18	0.05	0.09	0.11
Consumption	0.15	0.10	0.24	0.22	0.25	0.12	0.07	0.16
Investment	1.89	0.34	1.28	1.41	0.79	1.23	0.56	1.09
Unemployment	0.03	0.01	0.02	0.01	0.01	0.01	0.01	0.01
Booms†								
Inflation	0.99	0.99	0.71	0.99	1.01	0.77	0.96	0.93
Interest Rate	0.89	0.76	0.84	0.62	1.14	0.75	0.90	0.81
GDP	0.89	0.94	0.83	0.97	0.83	0.82	0.95	0.85
Consumption	0.80	1.04	0.70	0.85	1.07	0.90	0.93	0.84
Investment	0.90	0.96	0.95	0.98	0.80	0.97	0.93	0.94
Unemployment	0.87	0.92	0.98	0.92	1.00	0.81	0.93	0.92
Recessions†								
Inflation	1.05	1.08	1.53	1.10	0.98	2.81	1.39	1.28
Interest Rate	1.82	2.48	1.30	4.29	0.81	3.01	2.07	1.79
GDP	1.76	1.34	1.31	1.31	1.23	2.41	1.57	1.64
Consumption	2.43	0.76	1.56	2.32	0.90	1.81	1.69	1.68
Investment	1.75	1.22	1.10	1.18	1.26	1.22	1.68	1.27
Unemployment	1.96	1.51	1.04	1.72	1.00	2.50	1.72	1.35
Pre-1999†								
Inflation	0.66	0.88	1.18	1.41	1.30	1.33	0.56	0.94
Interest Rate	1.60	1.66	1.28	1.72	1.68	1.53	1.03	1.58
GDP	1.18	1.06	1.33	1.23	0.88	1.38	1.16	1.15
Consumption	1.42	1.51	1.34	1.40	1.43	1.31	1.16	1.38
Investment	1.56	1.21	1.45	1.18	0.91	0.88	1.10	1.27
Unemployment	1.44	1.08	0.78	0.99	0.70	1.45	1.09	1.15
1999+†								
Inflation	1.40	1.14	0.79	0.52	0.65	0.61	1.52	1.07
Interest Rate	0.29	0.22	0.66	0.15	0.20	0.37	0.96	0.31
GDP	0.79	0.93	0.61	0.73	1.14	0.55	0.81	0.83
Consumption	0.51	0.40	0.60	0.53	0.49	0.63	0.81	0.55
Investment	0.34	0.75	0.47	0.79	1.05	1.14	0.88	0.70
Unemployment	0.48	0.90	1.26	1.01	1.36	0.47	0.90	0.82

Notes: Grey cells indicate relative averages ≥ 1.00. *: Absolute average (across the full sample). †: Averages relative to full-sample averages (shown in the top panel). All averages taken across time periods.

Table 4. 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.	0.287***	0.064***					0.029
	(0.004)	(0.019)					
3.	0.327***	0.050***	−0.082***				0.129
	(0.005)	(0.017)	(0.014)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times INFL_t + \beta_3 \times \sigma^2_{INFL,t} + \beta_4 \times \text{output gap}_t +$ $+ \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
4.	0.237***		0.026***				0.076
	(0.006)		(0.005)				
5.	0.235***		0.025***	0.057			0.076
	(0.007)		(0.006)	(0.135)			
6.	0.224***		0.021***	0.232	−0.018***		0.071
	(0.008)		(0.006)	(0.160)	(0.006)		
7.	0.223***		0.019***	0.236	−0.017***	0.057**	0.094
	(0.008)		(0.006)	(0.157)	(0.006)	(0.023)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times INFL_t + \beta_3 \times \sigma^2_{INFL,t} +$ $+ \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
8.	0.420***	−0.152***					0.169
	(0.006)	(0.025)					
9.	0.381***	−0.150***	0.004	0.241*	−0.020***	0.033*	0.230
	(0.013)	(0.031)	(0.007)	(0.139)	(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 10.

Table 5. 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.	0.519***	0.161***					0.052
	(0.007)	(0.044)					
3.	0.624***	0.124***	−0.214***				0.232
	(0.009)	(0.036)	(0.026)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times R3M_t + \beta_3 \times \sigma^2_{R3M,t} + \beta_4 \times \text{output gap}_t + + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
4.	0.319***		0.046***				0.276
	(0.011)		(0.005)				
5.	0.333***		0.038***	0.348*			0.288
	(0.012)		(0.007)	(0.181)			
6.	0.364***		0.027***	0.473**	−0.015		0.227
	(0.013)		(0.008)	(0.192)	(0.010)		
7.	0.364***		0.027***	0.432**	−0.015	0.041*	0.230
	(0.013)		(0.008)	(0.188)	(0.010)	(0.023)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times R3M_t + \beta_3 \times \sigma^2_{R3M,t} + + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
8.	0.783***	−0.294***					0.165
	(0.011)	(0.035)					
9.	0.554***	−0.174***	0.018**	0.295	−0.021**	0.034	0.273
	(0.025)	(0.046)	(0.009)	(0.182)	(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 10.

Table 6. 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.	0.378***	0.165***					0.126
	(0.005)	(0.028)					
3.	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 + $ $+ \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
4.	0.482***		−0.035***				0.107
	(0.007)		(0.006)				
5.	0.386***		−0.028***	0.722***			0.162
	(0.012)		(0.005)	(0.163)			
6.	0.384***		−0.026***	0.698***	−0.000		0.129
	(0.013)		(0.007)	(0.185)	(0.008)		
7.	0.377***		−0.025***	0.695***	−0.001	0.049	0.137
	(0.013)		(0.007)	(0.182)	(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} + $ $+ \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
8.	0.458***	−0.061*					0.010
	(0.007)	(0.034)					
9.	0.423***	−0.060*	−0.022***	0.686***	−0.004	0.038	0.150
	(0.017)	(0.031)	(0.006)	(0.180)	(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 10.

Table 7. 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.	0.414***	0.164***					0.127
	(0.005)	(0.024)					
3.	0.419***	0.161***	−0.012				0.128
	(0.006)	(0.024)	(0.015)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times CONS_t + \beta_3 \times \sigma^2_{CONS,t} + \beta_4 \times \text{output gap}_t +$ $+ \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
4.	0.512***		−0.031***				0.073
	(0.007)		(0.007)				
5.	0.475***		−0.030***	0.217***			0.095
	(0.010)		(0.007)	(0.083)			
6.	0.454***		−0.024***	0.279***	−0.002		0.081
	(0.011)		(0.008)	(0.078)	(0.007)		
7.	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 $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times CONS_t + \beta_3 \times \sigma^2_{CONS,t} +$ $+ \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
8.	0.469***	−0.031					−0.001
	(0.007)	(0.030)					
9.	0.458***	−0.007	−0.023***	0.256***	−0.002	0.043*	0.087
	(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 10.

Table 8. 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.	1.701***	0.329***					0.030
	(0.019)	(0.104)					
3.	1.702***	0.329***	−0.002				0.029
	(0.025)	(0.103)	(0.071)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times INV_t + \beta_3 \times \sigma^2_{INV,t} + \beta_4 \times \text{output gap}_t + + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
4.	1.784***		−0.025***				0.027
	(0.019)		(0.008)				
5.	1.598***		−0.019**	0.160**			0.052
	(0.036)		(0.008)	(0.064)			
6.	1.587***		−0.017*	0.178***	0.006		0.046
	(0.037)		(0.009)	(0.066)	(0.028)		
7.	1.584***		−0.016*	0.175***	0.007	0.064	0.045
	(0.037)		(0.009)	(0.066)	(0.028)	(0.118)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times INV_t + \beta_3 \times \sigma^2_{INV,t} + + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
8.	1.833***	−0.086					−0.003
	(0.019)	(0.107)					
9.	1.599***	−0.020	−0.016*	0.177***	0.006	0.060	0.045
	(0.057)	(0.096)	(0.010)	(0.068)	(0.029)	(0.119)	

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 10.

Table 9. 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.	0.261***	0.169***					0.125
	(0.005)	(0.044)					
3.	0.297***	0.156***	−0.074***				0.169
	(0.006)	(0.041)	(0.018)				
Panel B: Disagreement and Macro Variables $\text{disagr}_t = \beta_0 + \beta_2 \times UN_t + \beta_3 \times \sigma^2_{UN,t} + \beta_4 \times \text{output gap}_t + + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
4.	0.299***		−0.001				−0.006
	(0.023)		(0.013)				
5.	0.330***		−0.015	5.325***			0.080
	(0.022)		(0.015)	(1.644)			
6.	0.382***		−0.022	5.451***	−0.008		0.082
	(0.028)		(0.019)	(2.026)	(0.009)		
7.	0.382***		−0.022	5.387***	−0.009	0.011	0.082
	(0.028)		(0.019)	(2.040)	(0.009)	(0.015)	
Panel C: Disagreement and Central Bank Independence $\text{disagr}_t = \beta_0 + \beta_1 \times \text{CB Independence}_t + \beta_2 \times UN_t + \beta_3 \times \sigma^2_{UN,t} + + \beta_4 \times \text{output gap}_t + \beta_5 \times \Delta\text{policy rate}^2_t + u_t$							
8.	0.344***	−0.064**					0.011
	(0.023)	(0.029)					
9.	0.533***	−0.098***	−0.031	4.968**	−0.019*	−0.006	0.109
	(0.036)	(0.038)	(0.020)	(1.947)	(0.011)	(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 10.

TABLE 10. 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 11. 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***	−0.315	−0.004	0.069***	0.177
	(0.044)	(0.010)	(0.244)	(0.010)	(0.017)	
FR	0.203***	−0.013	0.671	−0.004	0.000	−0.001
	(0.028)	(0.011)	(0.631)	(0.010)	(0.024)	
GE	0.252***	−0.007	0.011	−0.012	0.022	0.042
	(0.022)	(0.012)	(0.484)	(0.008)	(0.073)	
IT	0.076***	0.040***	1.042	−0.016*	0.081***	0.362
	(0.027)	(0.010)	(0.991)	(0.009)	(0.020)	
JP	0.160***	−0.007	2.048***	0.003	0.006	0.226
	(0.037)	(0.016)	(0.459)	(0.008)	(0.009)	
UK	0.314***	−0.007	0.383	−0.137***	0.232***	0.527
	(0.057)	(0.026)	(0.678)	(0.027)	(0.072)	
US	0.281***	0.001	0.291**	−0.022***	0.120**	0.110
	(0.044)	(0.015)	(0.119)	(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 12. 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	0.542***	0.026	−0.270	−0.053**	0.075**	0.214
	(0.080)	(0.021)	(0.574)	(0.026)	(0.036)	
FR	0.441***	−0.017*	1.672***	0.007	0.035	0.458
	(0.037)	(0.010)	(0.387)	(0.016)	(0.089)	
GE	0.232***	0.041***	0.876	−0.032***	−0.046	0.248
	(0.053)	(0.015)	(1.325)	(0.011)	(0.198)	
IT	0.252***	0.045**	0.057	−0.045***	0.008	0.435
	(0.058)	(0.018)	(0.287)	(0.012)	(0.067)	
JP	0.243***	−0.020	1.691	0.071***	0.020	0.580
	(0.025)	(0.015)	(2.254)	(0.011)	(0.013)	
UK	0.635***	−0.020	3.162***	−0.109***	−0.101	0.463
	(0.104)	(0.021)	(1.096)	(0.038)	(0.085)	
US	0.624***	−0.024	0.451	−0.007	0.111	0.058
	(0.072)	(0.015)	(0.978)	(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 13. 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 $\text{disagreement}_t = \beta_0 + \beta_1 \times GDP_t + \beta_2 \times \sigma^2_{GDP,t} +$ $+ \beta_3 \times \text{output gap}_t + \beta_4 \times \Delta\text{policy rate}_t^2 + u_t$						
CN	0.229***	0.003	1.712***	−0.022**	0.012	0.324
	(0.082)	(0.013)	(0.522)	(0.011)	(0.021)	
FR	0.409***	−0.032**	−0.613	0.038***	0.103**	0.114
	(0.071)	(0.016)	(0.615)	(0.012)	(0.052)	
GE	0.255***	−0.022**	0.827***	−0.017	0.074	0.229
	(0.033)	(0.010)	(0.243)	(0.014)	(0.118)	
IT	0.316***	−0.029**	−0.070	0.010	0.021	0.084
	(0.038)	(0.012)	(0.348)	(0.010)	(0.030)	
JP	0.710***	−0.031	0.152	−0.001	0.030	0.028
	(0.167)	(0.032)	(0.652)	(0.019)	(0.053)	
UK	0.315***	−0.011	2.623***	−0.026	0.108	0.477
	(0.048)	(0.010)	(0.669)	(0.020)	(0.075)	
US	0.437***	−0.042***	0.611	0.027**	0.451***	0.429
	(0.061)	(0.011)	(0.379)	(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 14. 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	0.348***	−0.013	1.128***	0.007	0.038	0.322
	(0.077)	(0.022)	(0.285)	(0.012)	(0.043)	
FR	0.355***	−0.006	−0.318***	−0.020**	0.013	0.052
	(0.027)	(0.007)	(0.121)	(0.009)	(0.041)	
GE	0.350***	−0.025**	0.409***	−0.018	−0.067	0.151
	(0.029)	(0.011)	(0.102)	(0.011)	(0.094)	
IT	0.308***	−0.023**	0.380**	0.026**	0.002	0.197
	(0.022)	(0.009)	(0.163)	(0.013)	(0.027)	
JP	0.776***	−0.021	−0.379	0.014	0.039	0.007
	(0.132)	(0.027)	(0.415)	(0.033)	(0.033)	
UK	0.501***	−0.022	0.884	0.019	0.179**	0.215
	(0.106)	(0.014)	(0.642)	(0.025)	(0.071)	
US	0.294***	−0.008	1.836***	0.019**	0.252***	0.292
	(0.057)	(0.012)	(0.315)	(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 15. 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	1.644***	0.017	0.579***	0.182*	0.120	0.170
	(0.253)	(0.020)	(0.163)	(0.094)	(0.178)	
FR	1.240***	−0.026*	−0.035	0.034	0.050	0.037
	(0.099)	(0.014)	(0.164)	(0.043)	(0.238)	
GE	1.746***	−0.029*	−0.080	0.047	0.034	0.061
	(0.119)	(0.016)	(0.092)	(0.035)	(0.514)	
IT	0.676***	−0.039***	0.354***	0.170***	0.001	0.213
	(0.124)	(0.015)	(0.086)	(0.060)	(0.087)	
JP	2.219***	0.059	0.041	−0.187***	−1.417	0.110
	(0.345)	(0.037)	(0.478)	(0.071)	(0.928)	
UK	1.723***	−0.047***	0.019	0.051	0.308	0.228
	(0.184)	(0.011)	(0.120)	(0.050)	(0.294)	
US	1.832***	−0.031	0.352	−0.002	0.970	0.167
	(0.265)	(0.023)	(0.278)	(0.054)	(0.629)	

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 16. 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	0.238	−0.011	4.491***	−0.004	−0.011	0.322
	(0.154)	(0.023)	(1.713)	(0.011)	(0.011)	
FR	0.556***	−0.038**	7.150**	−0.050***	0.091	0.190
	(0.142)	(0.015)	(3.335)	(0.015)	(0.077)	
GE	2.049***	−0.173***	2.345	−0.043	0.464	0.530
	(0.433)	(0.043)	(1.576)	(0.028)	(0.313)	
IT	−0.131	0.026	21.943***	−0.030	−0.036	0.222
	(0.200)	(0.017)	(8.104)	(0.020)	(0.038)	
JP	0.336***	−0.006	−7.214	−0.027***	−0.013**	0.124
	(0.068)	(0.024)	(6.950)	(0.008)	(0.005)	
UK	0.106***	0.017**	10.438***	0.036*	0.054	0.608
	(0.029)	(0.008)	(2.169)	(0.018)	(0.041)	
US	0.303***	−0.029**	5.821**	−0.005	−0.025	0.069
	(0.059)	(0.014)	(2.654)	(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 17. 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 18: 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 19: 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)

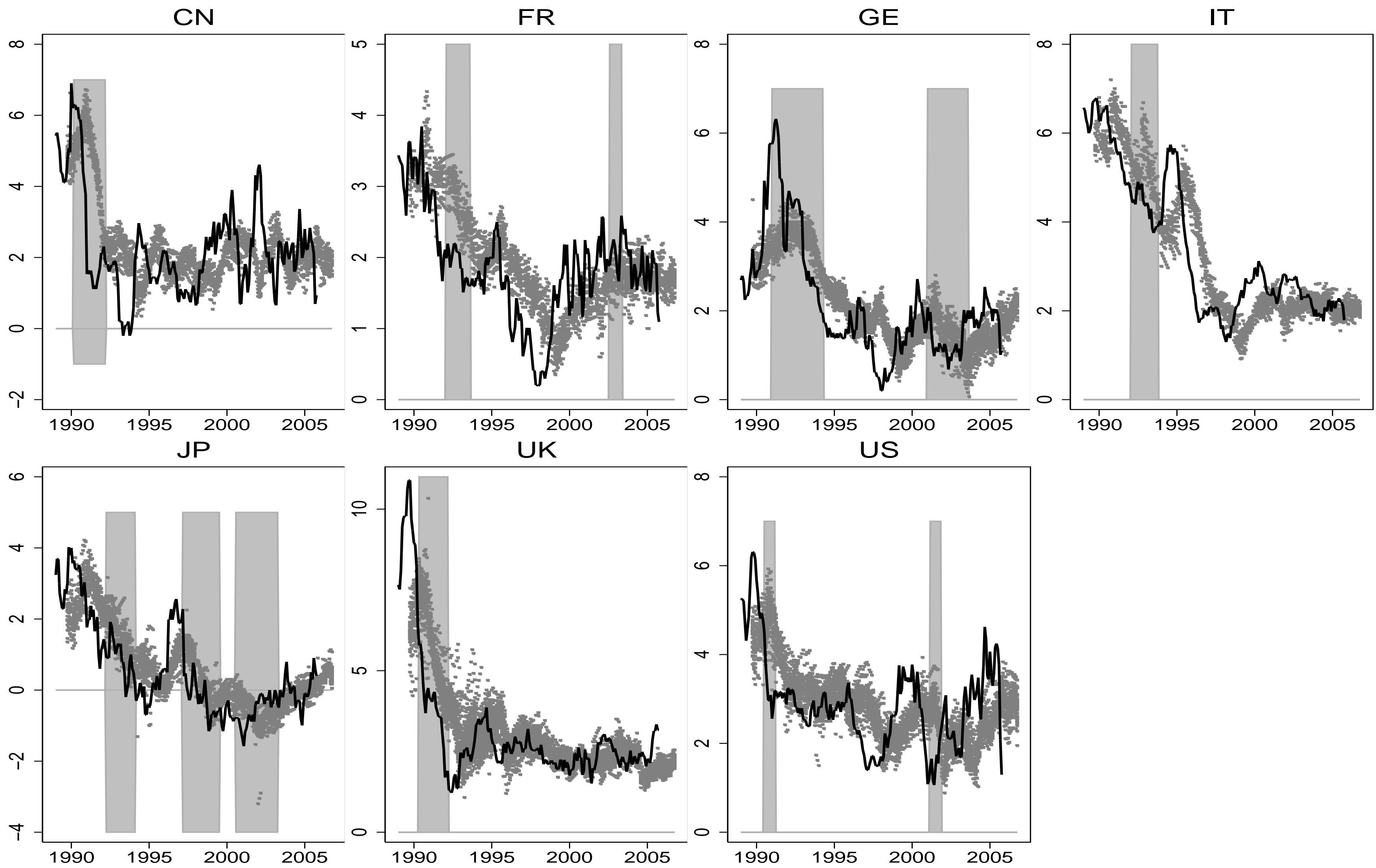


FIGURE 2. Expected and Actual Short-term Interest Rates (Percent)

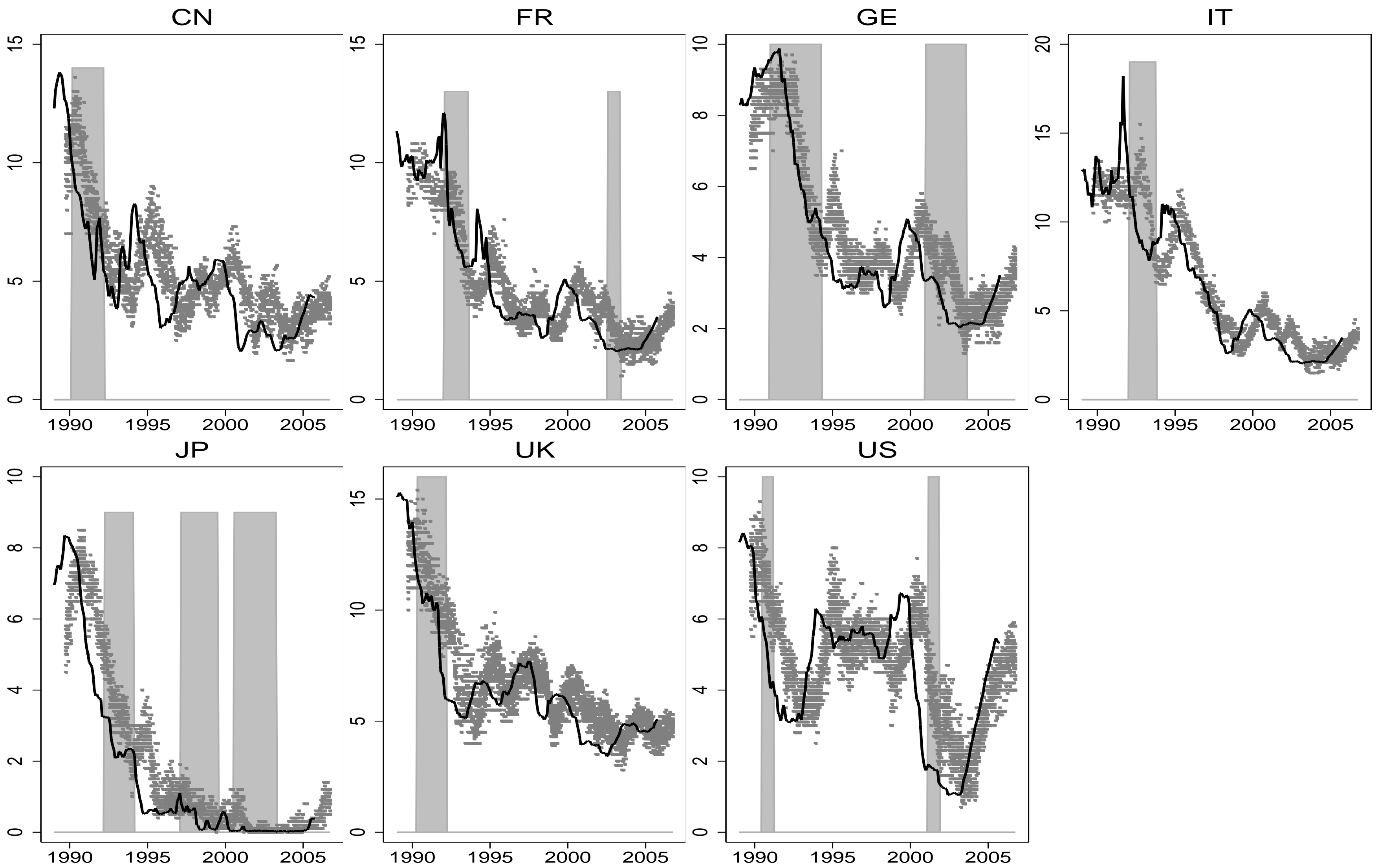


Figure 3. Expected and Actual GDP Growth (Percent)

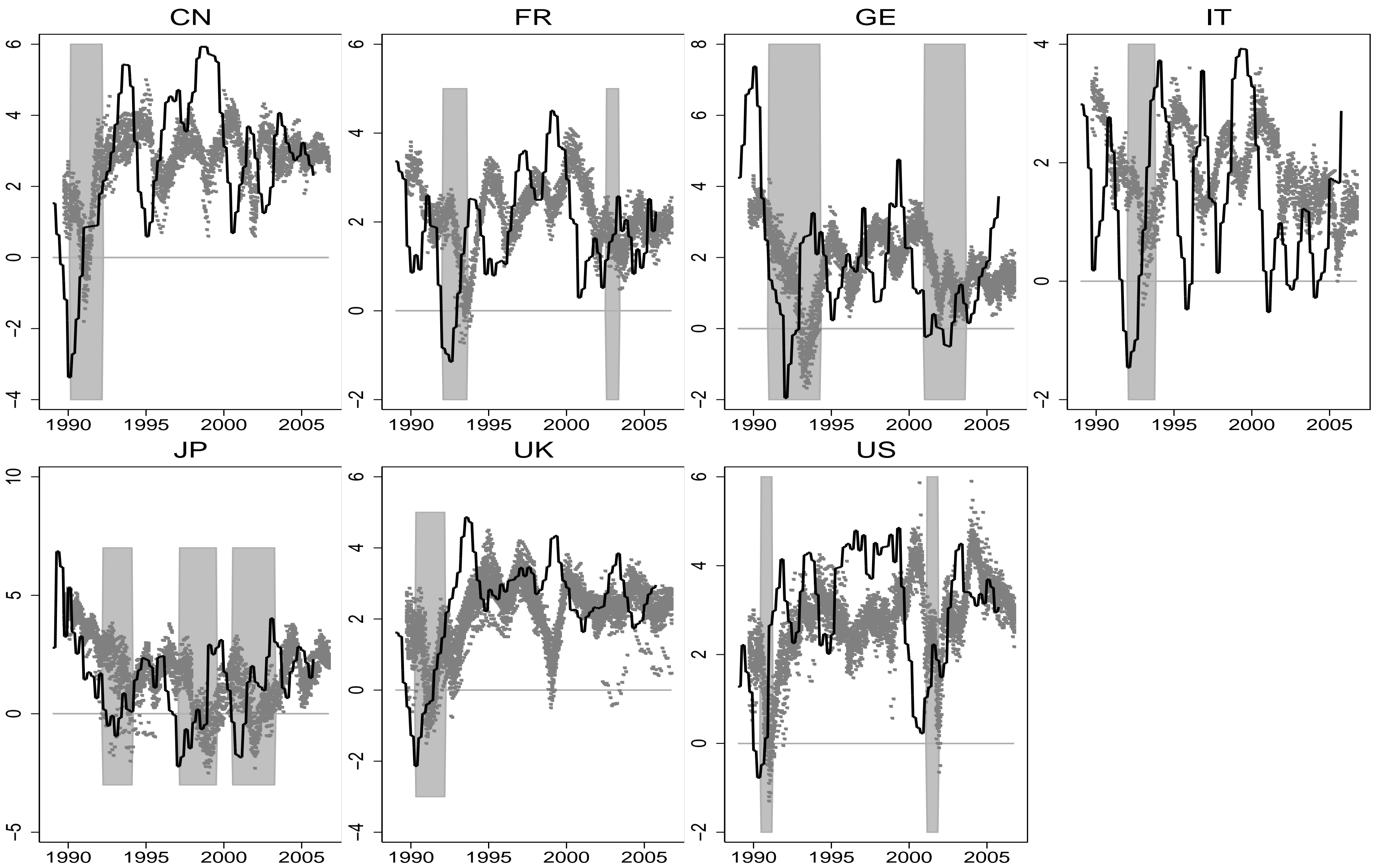


Figure 4. Expected and Actual Consumption Growth (Percent)

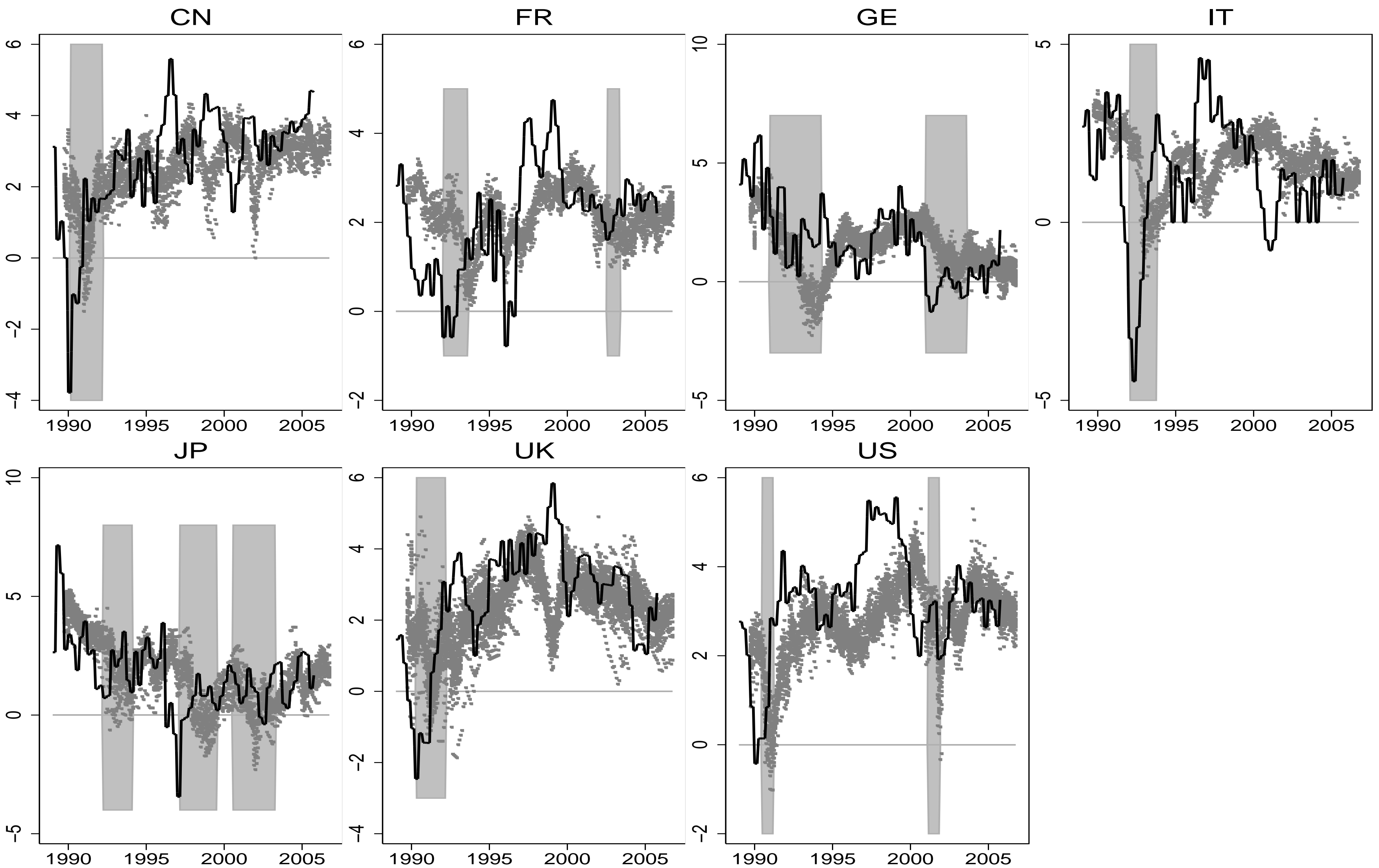


Figure 5. Expected and Actual Investment Growth (Percent)

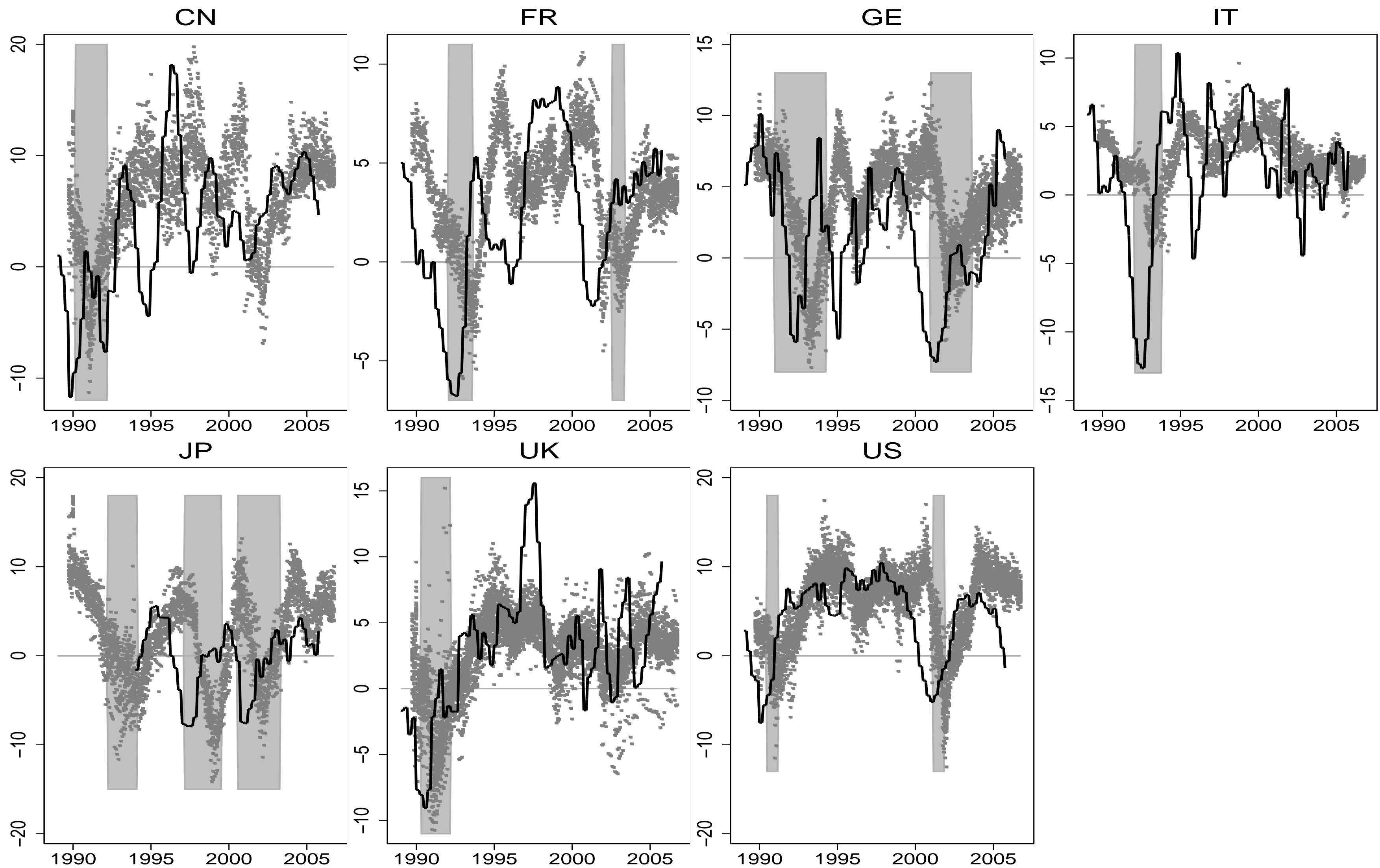


Figure 6. Expected and Actual Unemployment Rate (Percent)

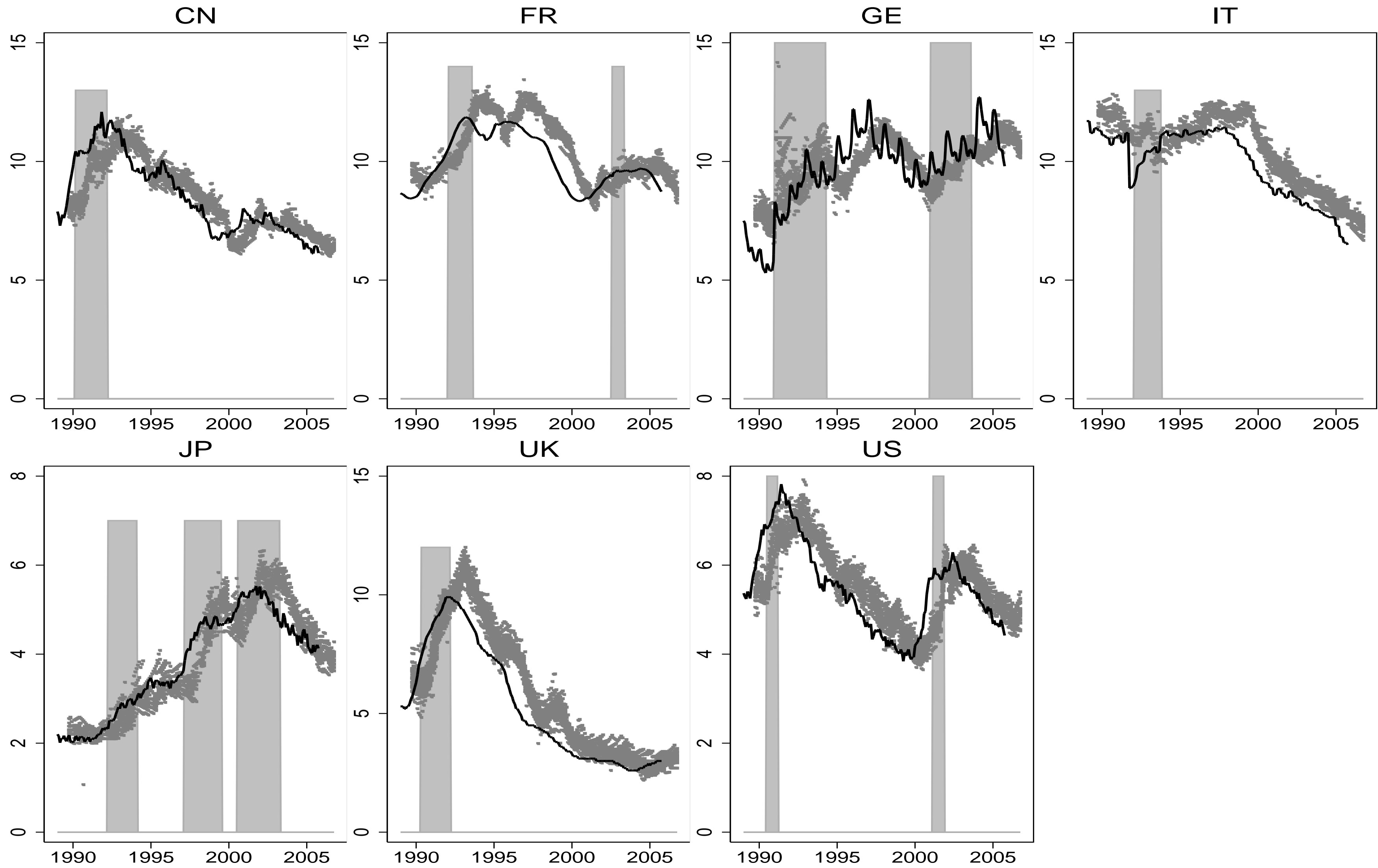
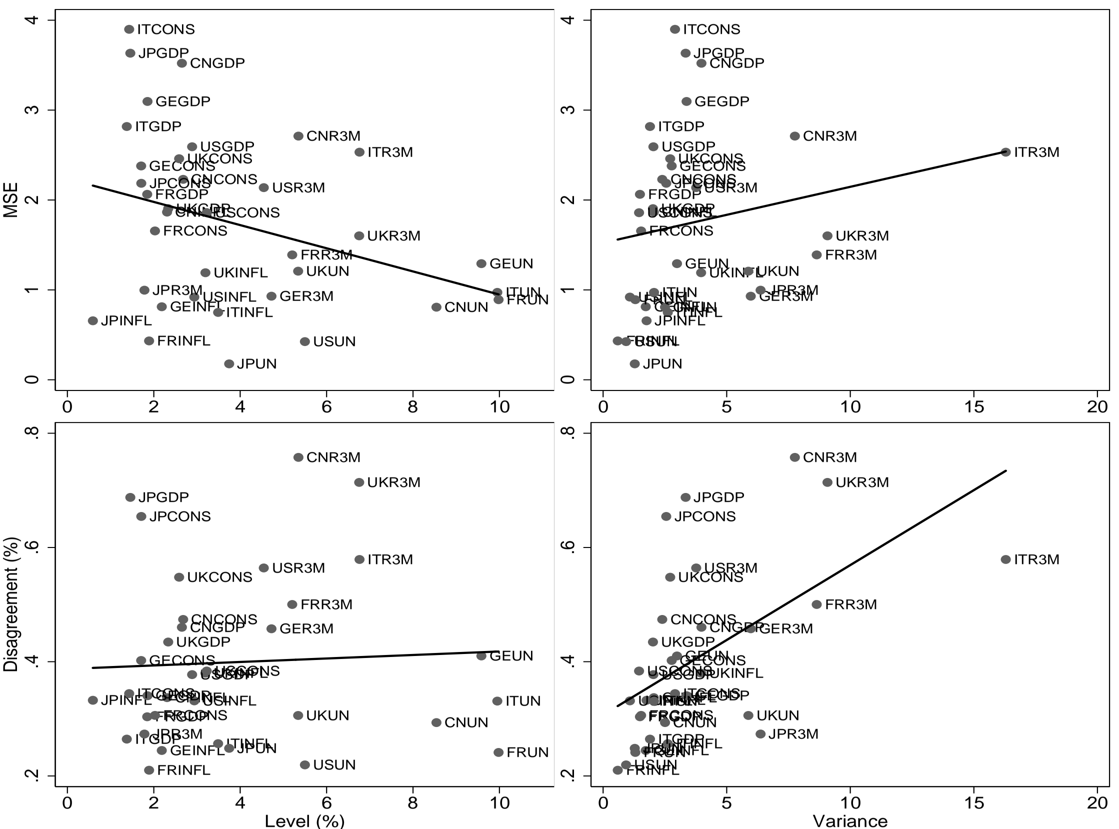
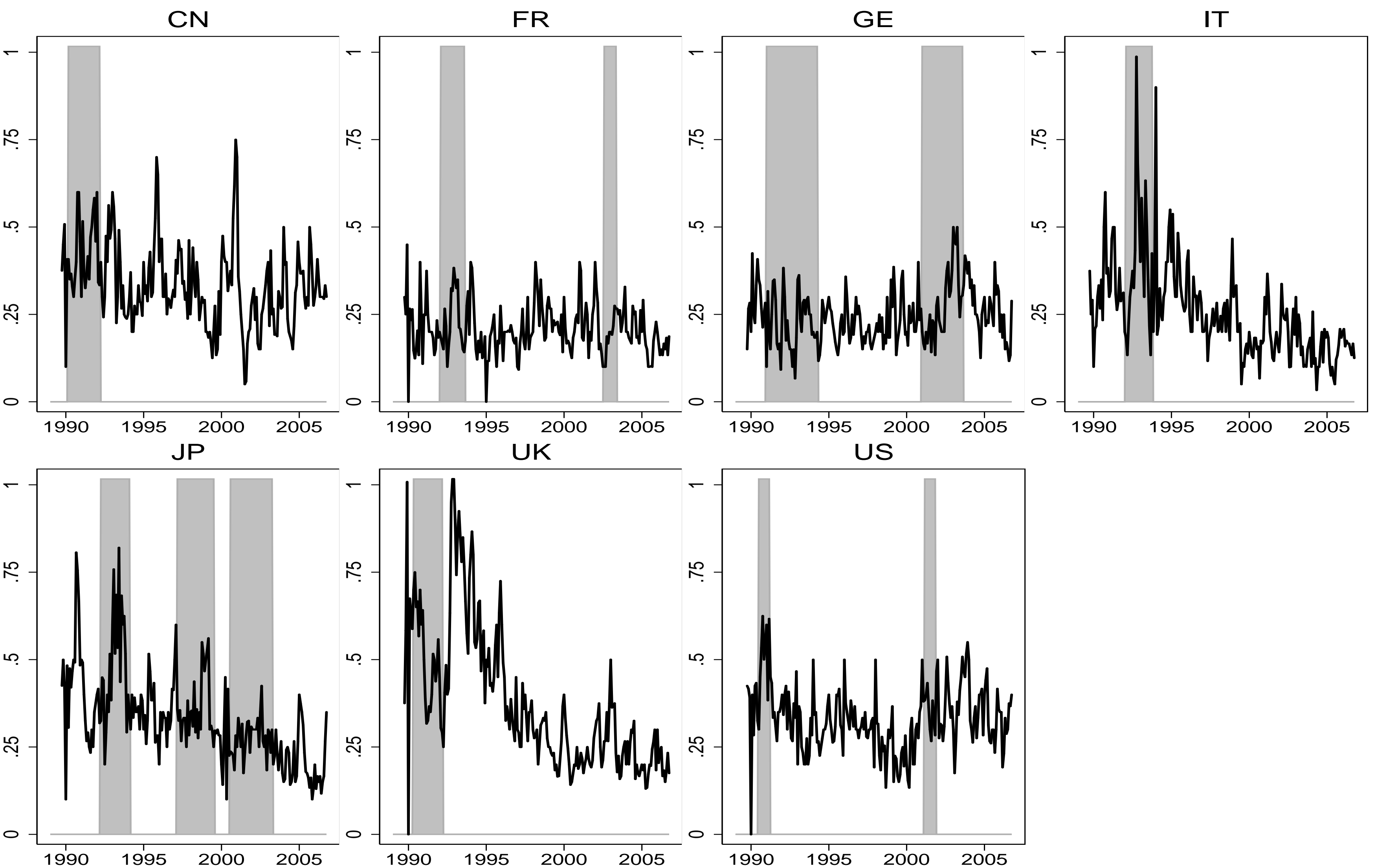


Figure 7. Disagreement and MSE of Expectations vs. Level and Variance of the Underlying Variable



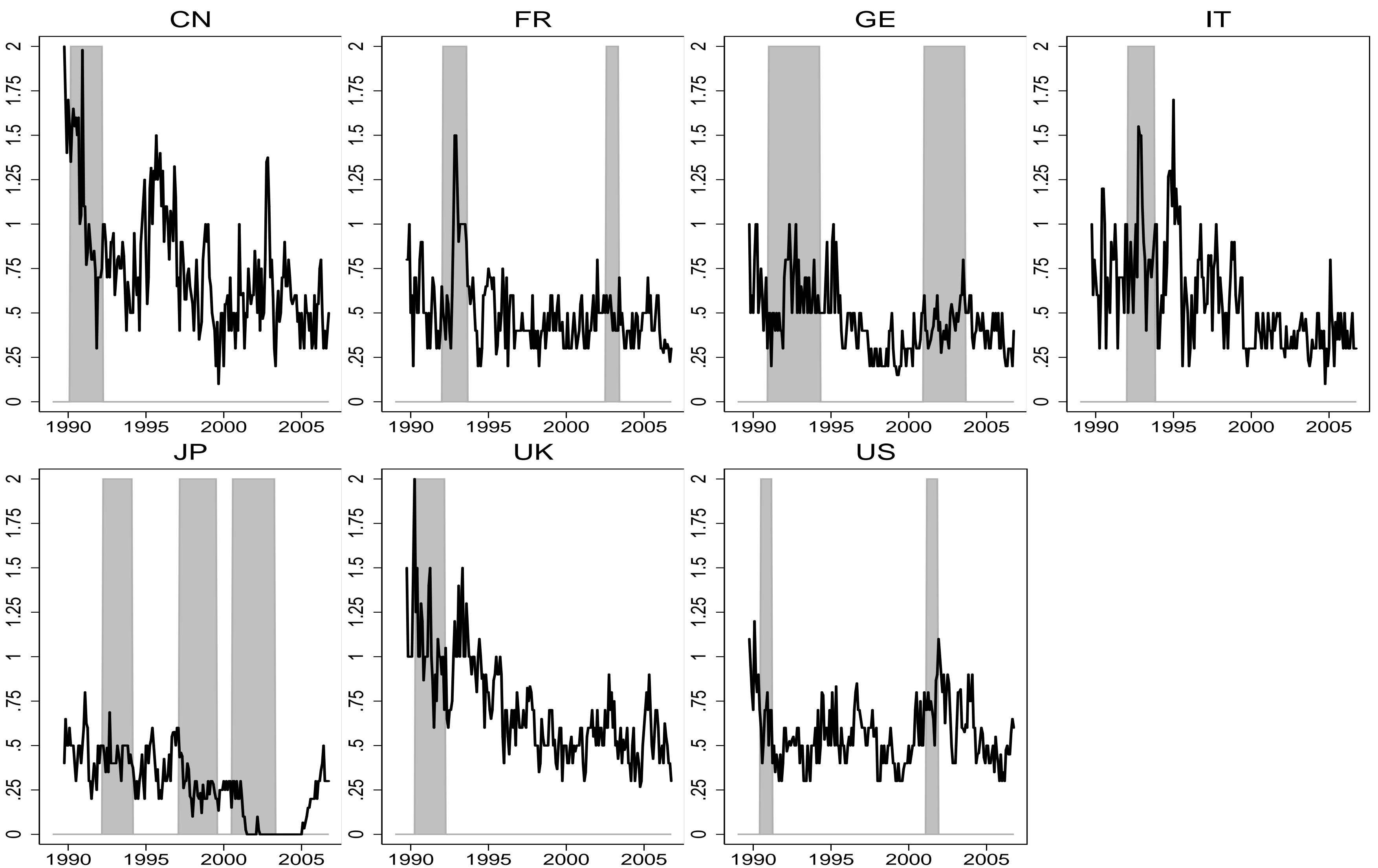
Notes: Disagreement is measured with the cross-sectional interquartile range.

Figure 8. Disagreement about Inflation Rate (Percent)



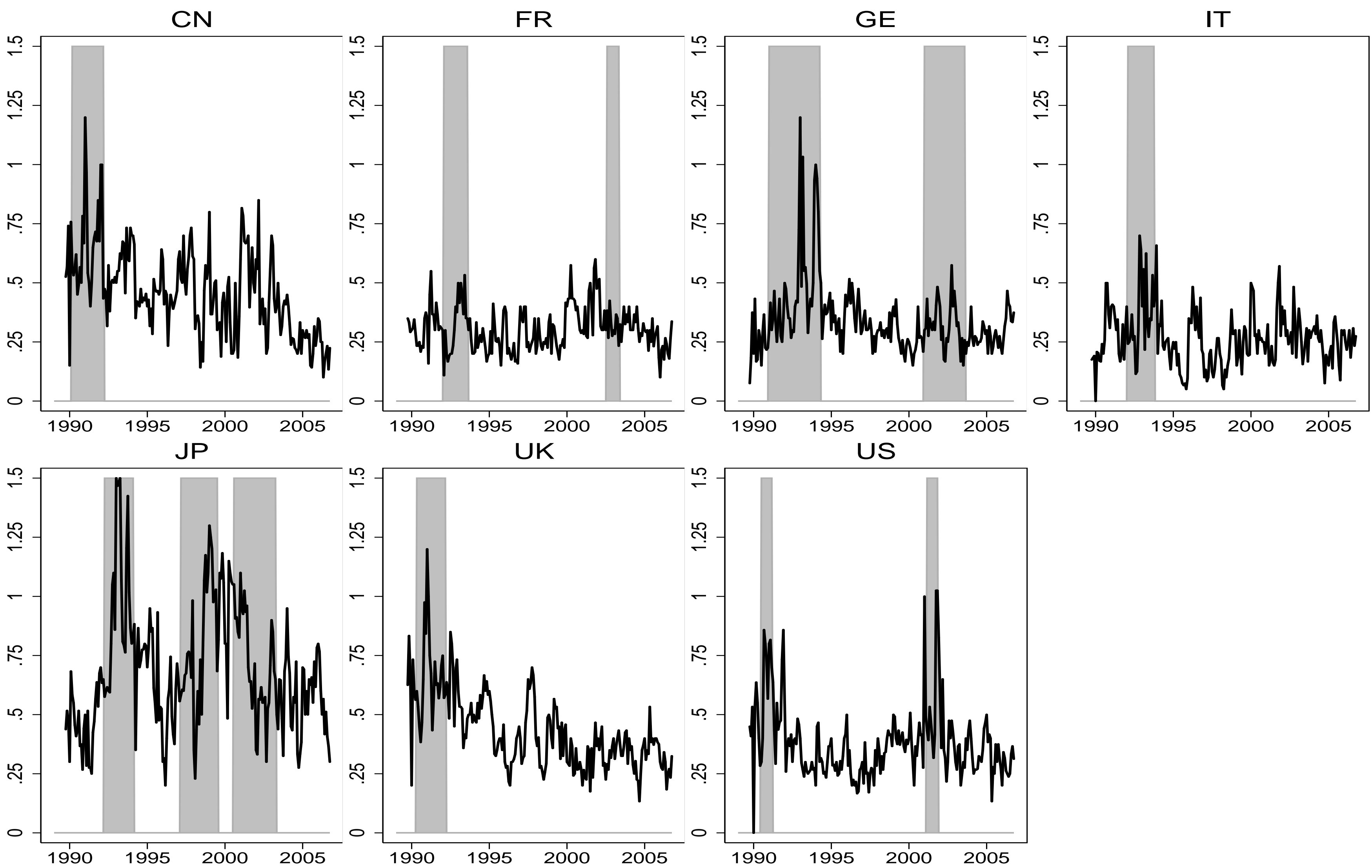
Notes: Disagreement is measured with the cross-sectional interquartile range.

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



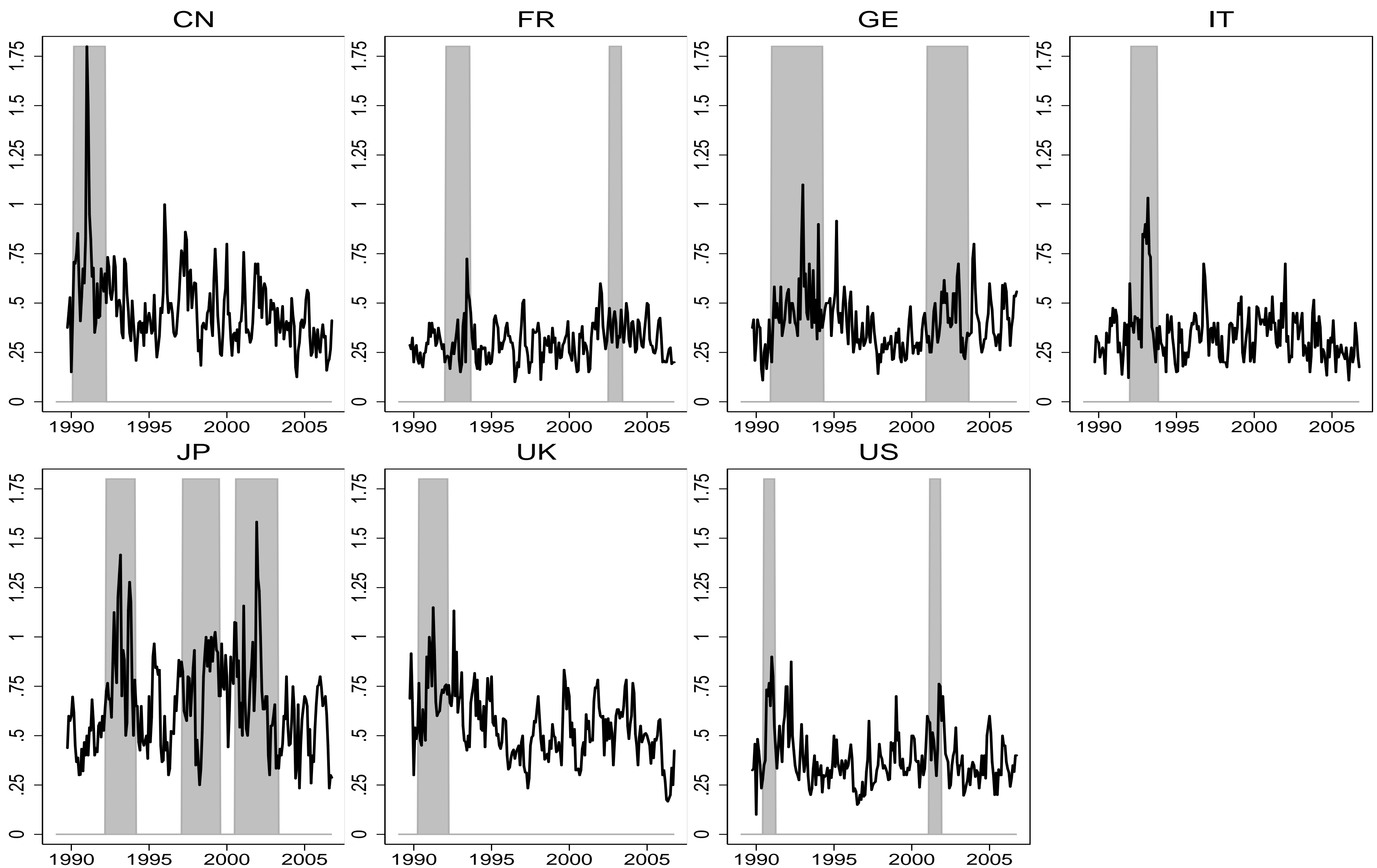
Notes: Disagreement is measured with the cross-sectional interquartile range.

Figure 10. Disagreement about GDP Growth (Percent)



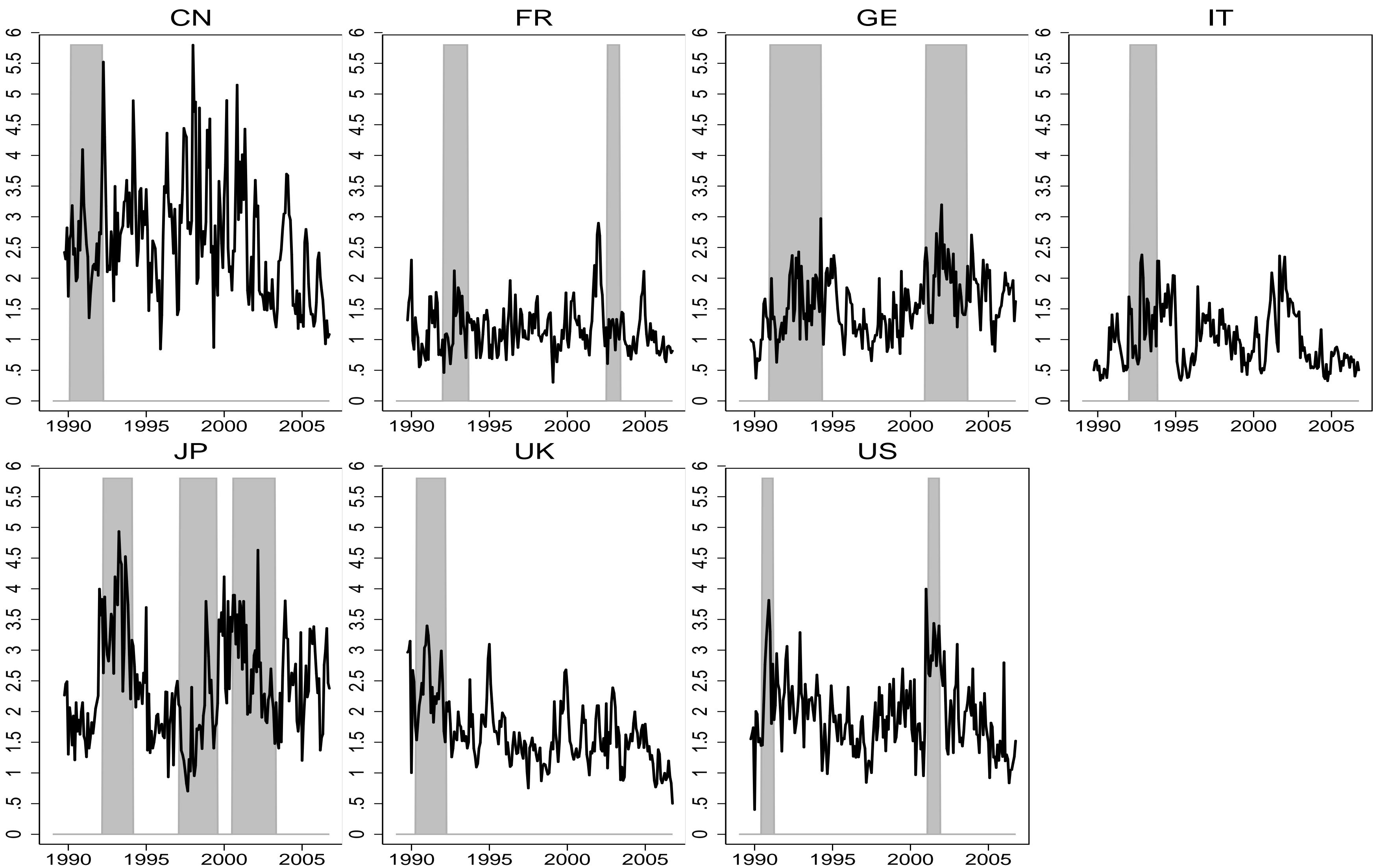
Notes: Disagreement is measured with the cross-sectional interquartile range.

Figure 11. Disagreement about Consumption Growth (Percent)



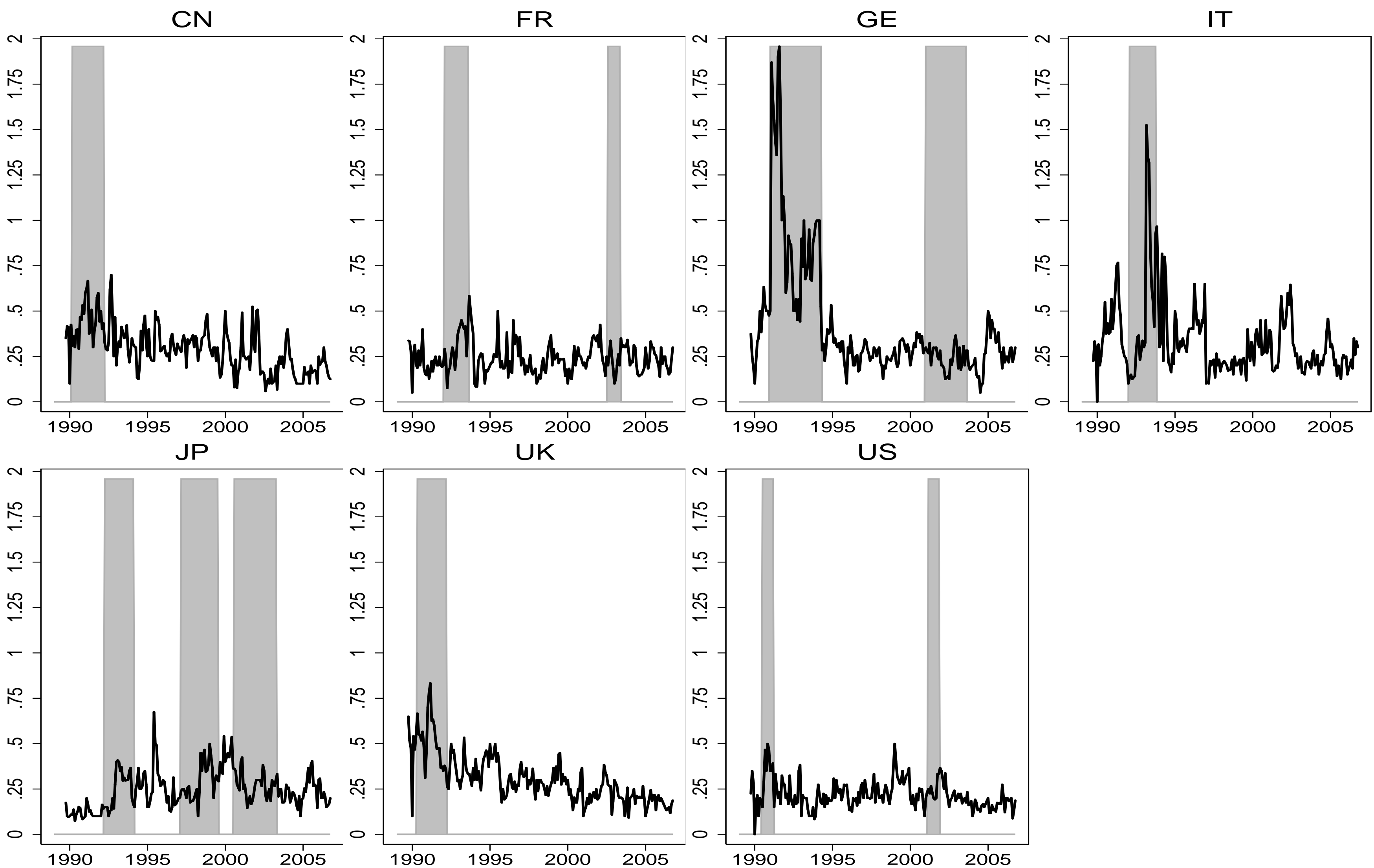
Notes: Disagreement is measured with the cross-sectional interquartile range.

Figure 12. Disagreement about Investment Growth (Percent)



Notes: Disagreement is measured with the cross-sectional interquartile range.

FIGURE 13. Disagreement about Unemployment Rate (Percent)



Notes: Disagreement is measured with the cross-sectional interquartile range.

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

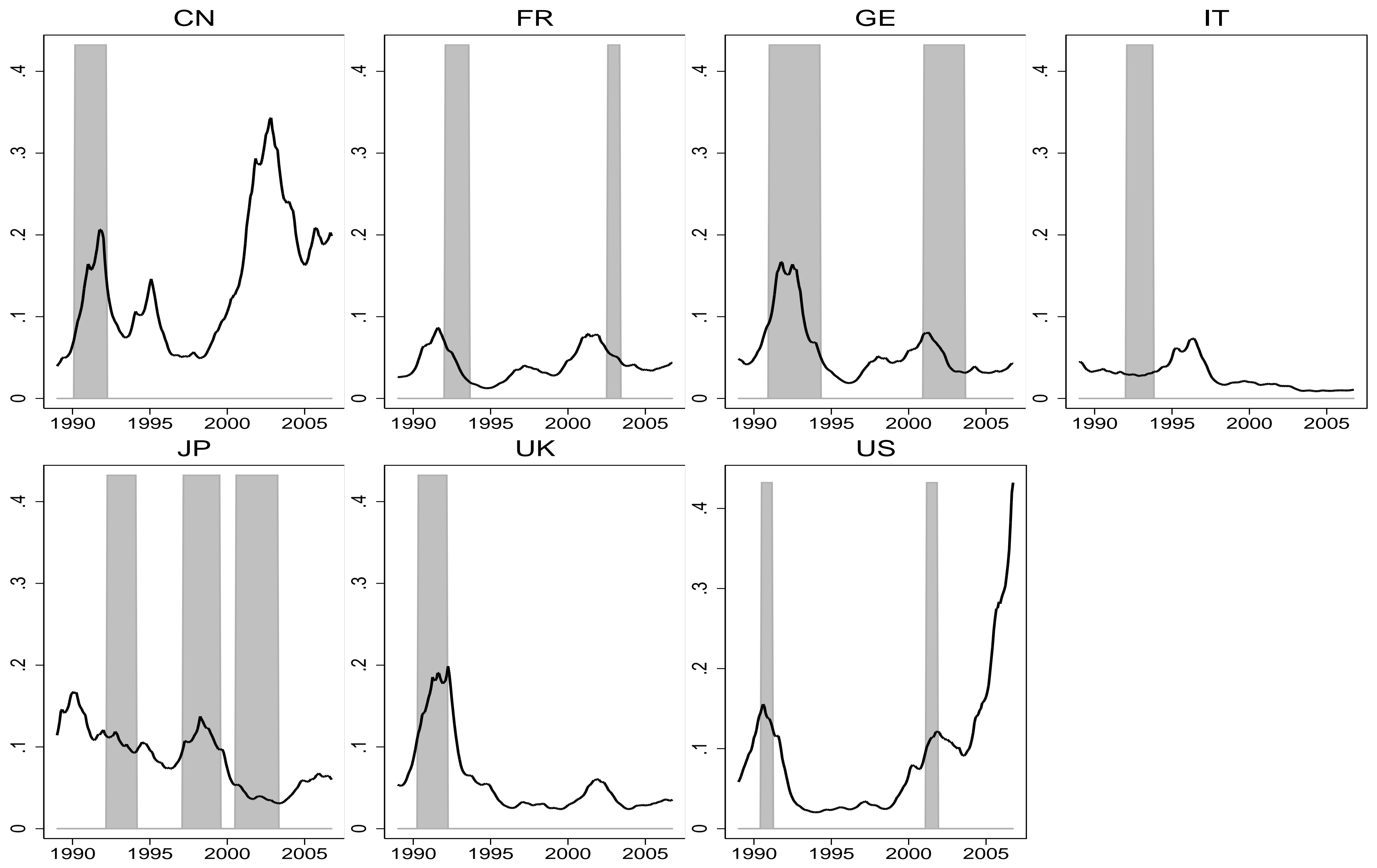


Figure 15. Variance of Permanent Component $\sigma^2_{\epsilon,t}$—Interest Rate

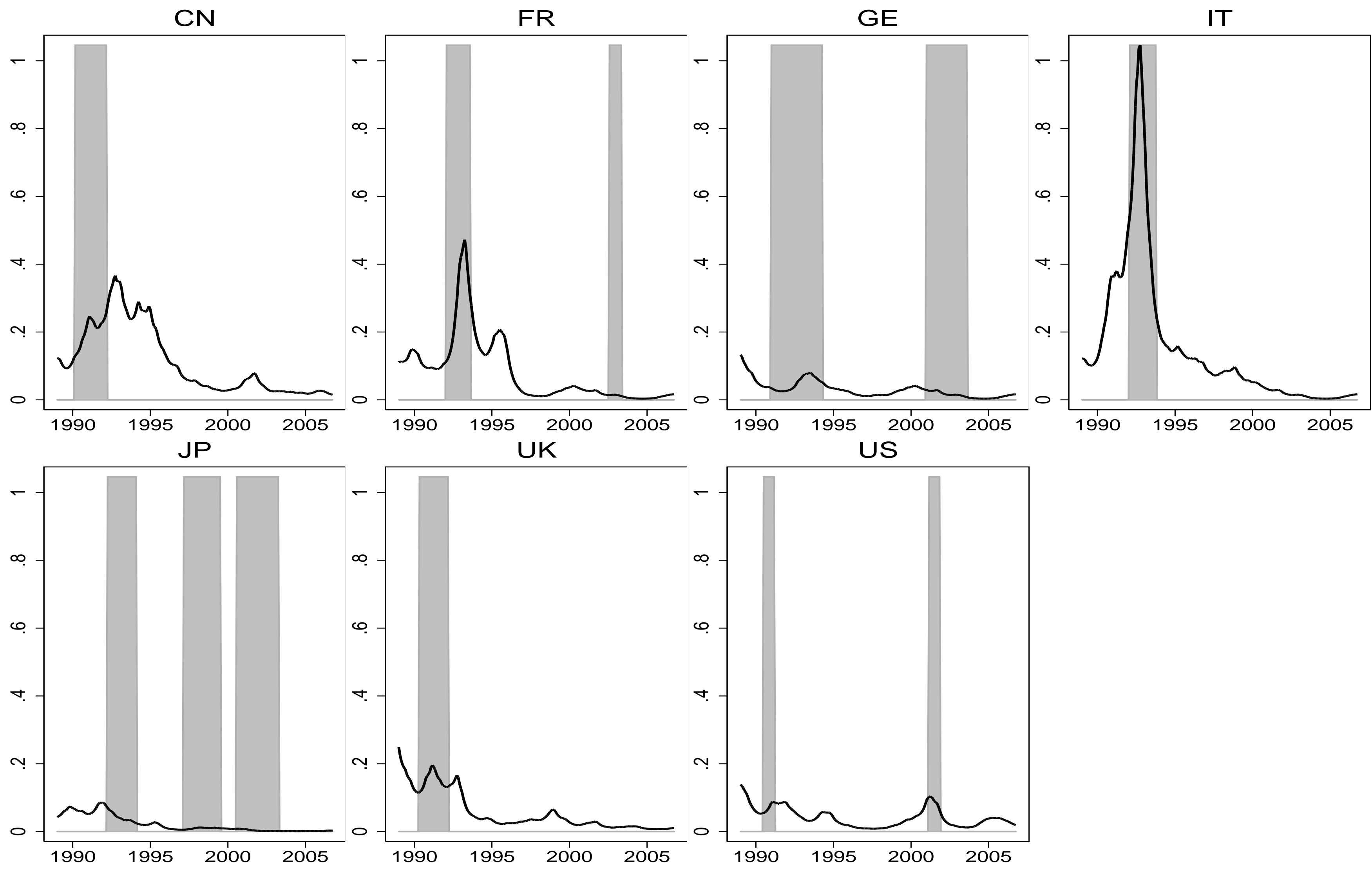


Figure 16. Variance of Permanent Component $\sigma^2_{\epsilon,t}$—GDP Growth

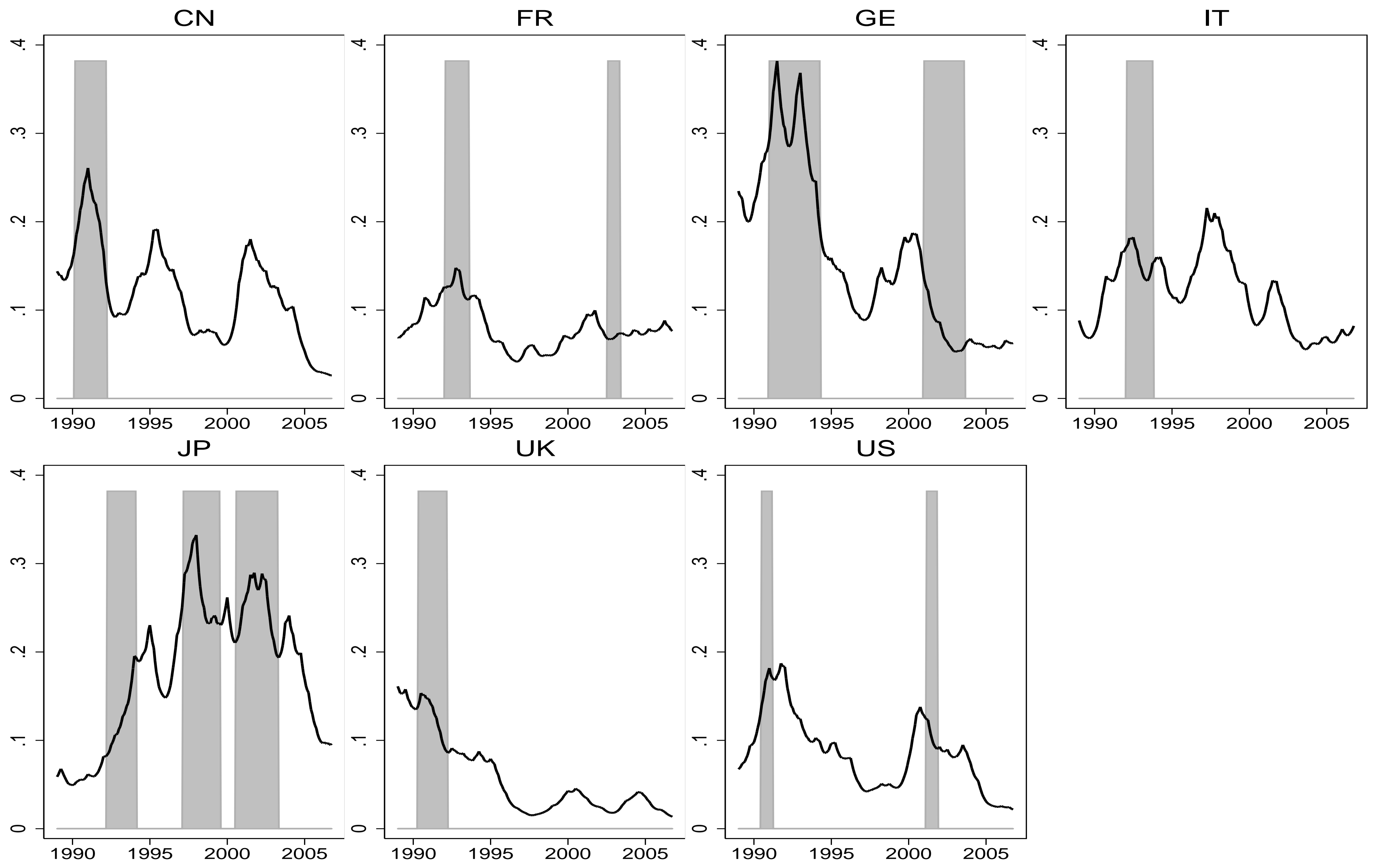


FIGURE 17. Variance of Permanent Component $\sigma^2_{\epsilon,t}$—Consumption Growth

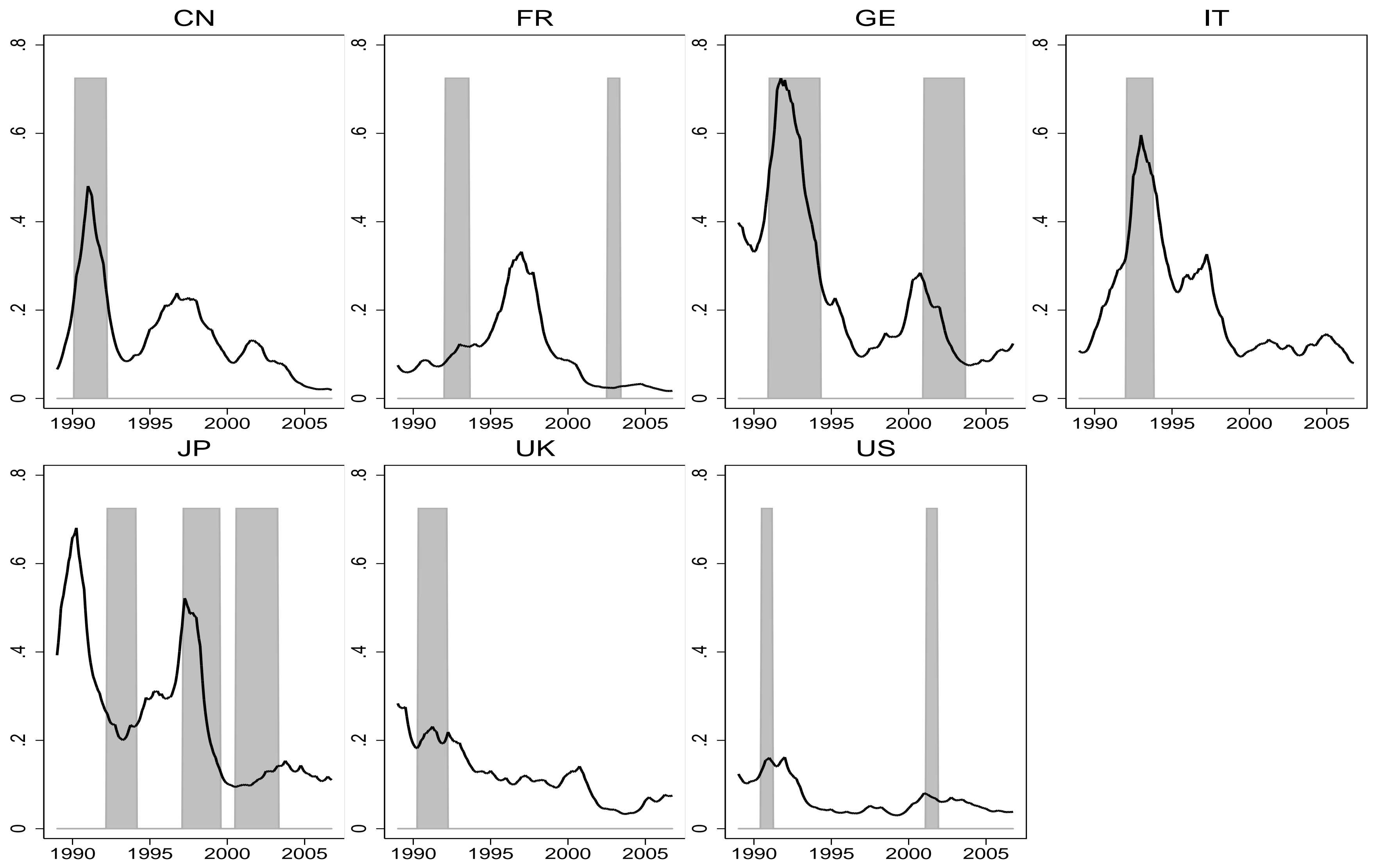


Figure 18. Variance of Permanent Component $\sigma^2_{\epsilon,t}$—Investment Growth

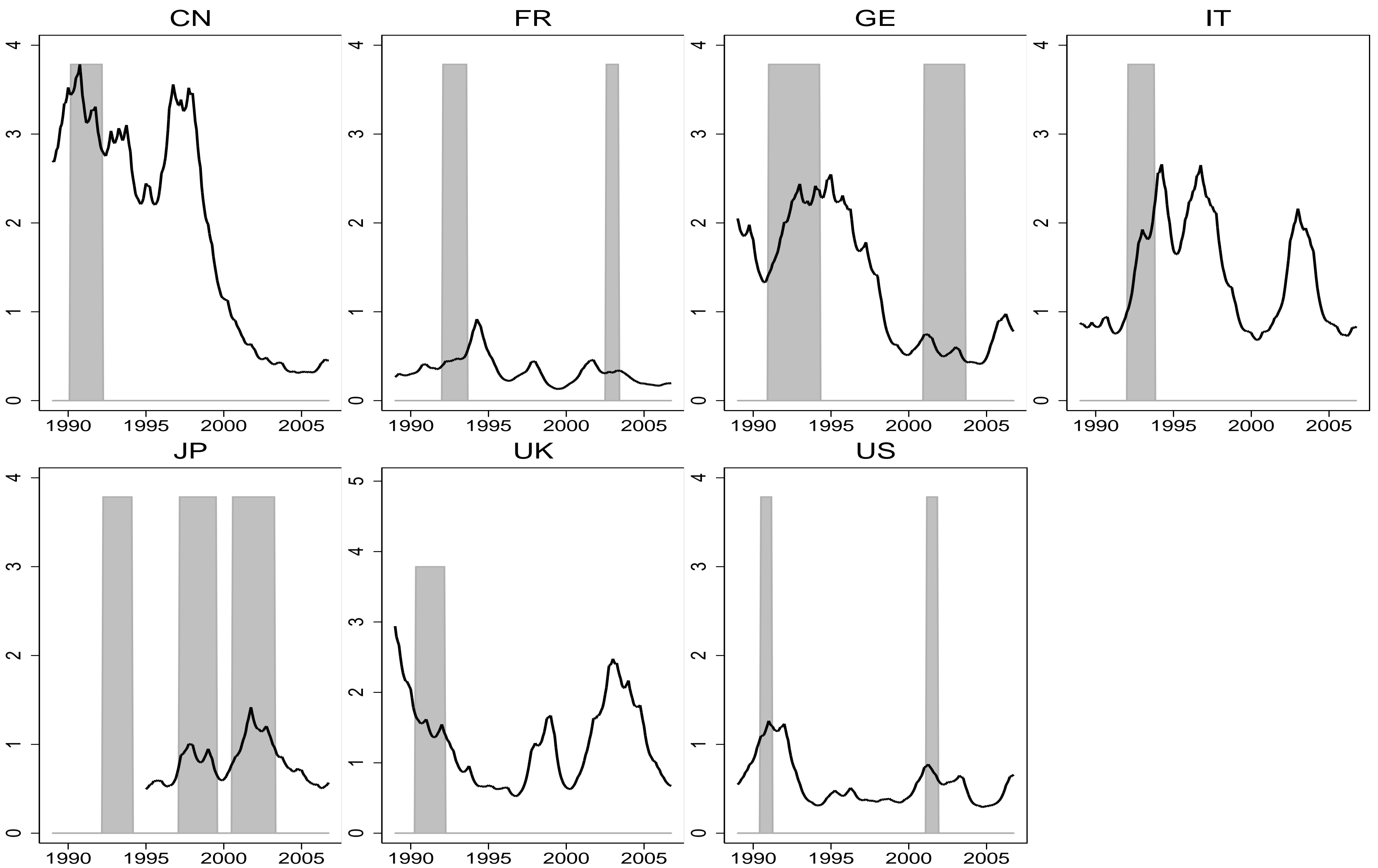


Figure 19. Variance of Permanent Component $\sigma^2_{\epsilon,t}$—Unemployment Rate