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Looking into the rear-view mirror: Lessons from Japan for the Eurozone and the U.S? ☆

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ABSTRACT

This paper reconsiders the narratives surrounding Japan's economic performance since the 1980s in relation to the experiences of the U.S. and the Eurozone. There are important differences between these three economies and some striking parallels. It is found that the poor reputation of the Bank of Japan (BoJ) is, at times, underserved. To be sure, there were periods of excessive tightness in policy, but the same is true for the other two economies considered. Indeed, the BoJ has been more credible than the other two central banks considered at various times over the past three decades.

In addition, a look back at BoJ over the decades does not provide much support the hypothesis that a significant policy break translates into economic success. Instead, smaller changes are just as likely to lead to a tipping point with significant consequences. Indeed, some narrative-based significant regime shifts do not show in the data.

"How did you get bankrupt? Two ways. Gradually, and then suddenly." (E. Hemingway (1926), The Sun Also Rises (New York: Scribner), book 2, chapter 13).

"The crisis takes a much longer time coming than you think, and then it happens much faster than you would have thought." (R. Dornbusch (United States. Congress. Senate. Committee on the Budget (2012). Concurrent Resolution on the Budget Fiscal Year 2013. p. 95)).

1. Introduction

For decades central banks claimed to be forward-looking, that is, base current decisions on their expectations of future economic conditions. More recently, 'data dependence' is the watchword even though there are subtle differences in policy makers' understanding of the term. The current Federal Open Market Committee (FOMC) Chair, Jerome Powell (2019), states that data dependence translates into "…seeking new and better sources of information…" Regardless of the precise meaning, all definitions share the view that policy making involves a considerable amount of looking into the rear-view mirror. Unfortunately, this also leaves open the possibility that blind spots will develop or that assumptions are made that may not hold up to additional scrutiny.

For at least two decades Japan, in economic policy terms, was seen by several outside observers as a country mired in a form of paralysis that gave rise to the expression "the lost decades". Indeed, former Fed Chair Bernanke once commented that Japanese policy members suffered from "self-induced paralysis" and lacked "Rooseveltian resolve" (Bernanke, 2000). Krugman (2014), an early contributor to analyses of Japan's economy, refers to that country's "[T]imidity trap". These views suggest that Japan missed opportunities to deal with low inflation and stagnation, now associated with the label 'Japanification'. There is also

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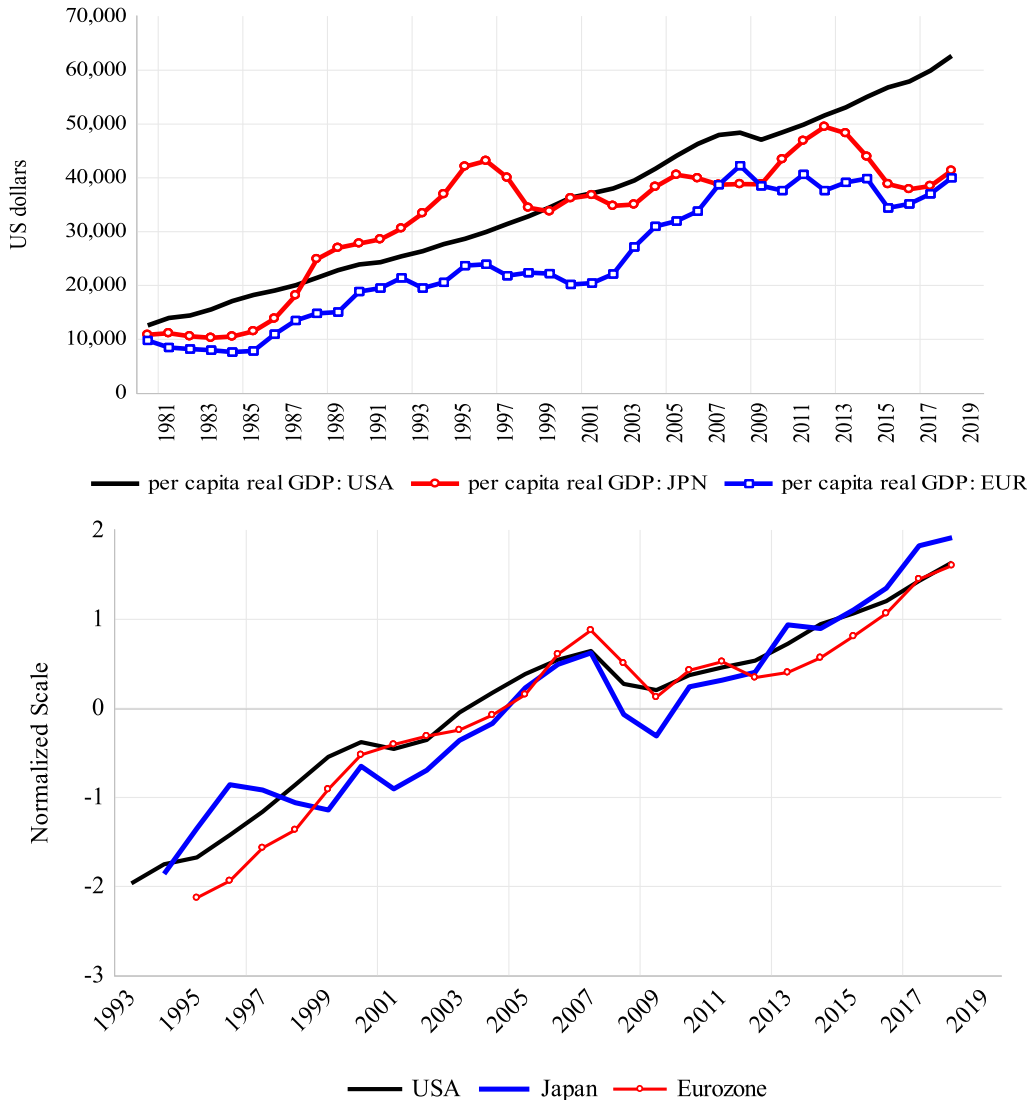


Fig. 1. Two Views of real GDP Developments in Japan, the US, and the Eurozone
Note: the USD dollar estimates are from World Bank World Development Indicators. The bottom: for US series GDPC1 (real GDP) divided by POPTHM (population); for Japan JPNTGDPEXP divided by POPTOTJPA647NWDB; for the Eurozone CLVMEURSCAB1GQEA19 divided but SPPOPTOTLEMU. The series mnemonics are from FRED. Since the original units differ across the three economies the series plotted are shown on a normalized scale.

the hint in these comments of a failure to pursue policies deemed credible.

Yet, there is also a suspicion that the foregoing narrative does not accurately describe Japan. "Time and again, Americans are told to look to Japan as a warning of what the country might become if the right path is not followed. But that presentation of Japan is a myth." (Fingleton, 2012). Plots of per capita real Gross Domestic Product (GDP) suggest two potential stories. As shown in Fig. 1, one's interpretation of the development of real economic activity is partly a function of whether the data are expressed in US dollar or in local currency terms. The former metric sees the Eurozone as under-performing the US throughout, with Japan overtaking the US until the 'lost decades' emerge. Even so the data appear to show a stagnant level of real GDP for Japan that does not show consistent improvement over time. A lost decade perhaps but not more. However, Japan's performance looks much improved when real GDP levels are expressed in local currency units. With a few exceptions it is the Eurozone that lags the US especially.

An early warning that Japan's economic policies were facing difficult challenges came from Krugman (1998) who impressed many with his assertion that Japan was in a liquidity trap despite skepticism and doubts about some of the policy implications stemming from his analysis (e.g., see Dominguez, 1998; Rogoff, 1998).[1] At the time, the liquidity trap narrative seemed persuasive primarily because the Bank of Japan's (hereafter BoJ) policy rate was nearing zero percent. Indeed, the year following the publication of Krugman's piece, the BoJ would announce its zero-interest rate policy (ZIRP). Other policies, now labelled 'unconventional', would soon follow.

What has remained constant is a sense that Japanese policy makers should have done things differently, or that others (e.g., U.S. policy makers) have done better while still others (e.g., the Eurozone) have unwittingly followed the path laid out by the Japanese. Suffice it to say, however, that the history of Japanese economic policy, as some observers outside of Japan have described it, may not faithfully describe its

[1] Subsequent events have not been kind to many of Krugman's views including the view that Japan was stuck in a liquidity trap (e.g., see Weberpals, 1997). For example, there is ample evidence of a continued desire to hold Japanese government bonds (JGB) while observers also underestimated Japanese households' willingness to search for higher yields abroad in spite of the underlying currency risks.

performance. Part of the reason, as we shall see, is that, with some notable exceptions, academic research has focused on certain episodes and events, or specific forms of intervention by policy makers, as opposed to a broader retrospective view of the sequence of events and policies over a longer span of time. Others have looked for large shifts in policy oblivious to the possibility that a series of small shifts may well produce the same result.

There are at least four challenges Japan has faced over the decades. In no order of importance, they are: the liquidity trap, monetary policy failures, the stop-go nature of fiscal policy, and the combined impact of changes in productivity and demographic pressures on Japanese society. Although the paper briefly mentions these narratives, it cannot do justice to all of them. Therefore, the present study instead focuses its attention on BoJ monetary policy since the 1980s.

Generally, the extant literature amounts to three narratives about financial crises and central bank responses. For Japan, it is largely "muddling through" a series of crises that began in the equity market in the late 1980s, eventually engulfing the banking sector and, finally, the entire economy. For the US, it is a "stitch-in-time-saves-nine" strategy. In other words, US authorities did respond in 2008, with a lag, enough to avoid a second Great Depression and facilitate a recovery. For the Eurozone, ideology substitutes, and arguably continues to do so, for good economic policy. This stems from the overarching need for budget discipline and low inflation, as far as the German authorities and their "northern" European supporters are concerned, while the rest of the Eurozone argues for more fiscal and monetary stimulus. As a result, the aftershocks of the sovereign debt crisis that peaked between 2010 and 2012 continue to plague the single currency area to this day.

As we shall see, a unifying theme in all of the narratives describing the evolution of monetary policy making especially has been the importance attached to regime breaks, shifts or changes as a necessary condition to overcome crisis conditions and restore economic performance and policies to some semblance of normality. Bernanke et al. (2019), Romer (2014), and Geithner (2014) are recent illustrations of the argument that what is needed in a crisis is a regime "shift". As we shall see, the arguments sound persuasive *ex post* while data and tests discussed below do not always support of the hypothesis.

Difficulties emerge because regime shifts, as observed by historians or other observers at the time, may not show up as such when empirical evidence is brought to bear on the issue.[2] Matters are still more complicated when one considers that the large number of series policy makers examine to assess the current state of the economy need not provide the same signals let alone indicate a regime shift at the same time. Even if a regime shift is deemed necessary to emerge from the aftermath of a financial crisis, it may be inadequate when dealing with fundamental problems of the structural, that is, non-monetary policy variety.

Finally, for monetary policy expectations are also crucial. Yet, the extant literature has tended to assume the problem away by asserting that, so long as a policy shift is credible, the new regime will be successful. However, based on evidence to be shown later, this condition is not often met.

The importance placed on a sharp break from the past, as proponents cited earlier favor, is often based on casual observation and assumes that only significant policy responses can dislodge expectations. It is also assumed that all such responses are credible. Yet, it is hard to find support for consistently high levels of credibility in monetary policy (e.g., see Bordo and Siklos, 2016, 2017, 2018; and references therein). For example, difficult to observe norms must also change (Akerlof, 2007, 2019). Alternatively, it is equally plausible that a series of small shocks can lead to a tipping point giving rise to the impression that a regime shift has taken place (Akerlof and Yellen, 1985a, 1985b; Schelling, 1988) when, instead of a shift, there has simply been an evolution in policy, not a sea change. Indeed, financial crises often emerge from the build-up of economic imbalances (e.g., see Tooze, 2018).

The rest of the paper is organized as follows. The next section is a review of what we know about the record of policy making in Japan including, but not limited to, the role of monetary policy, as well as how this has echoed abroad in the U.S. and the Eurozone. The relevant literature is vast and I can only scratch the surface. Section 3 provides empirical evidence about regime shifts and whether they are informative about the conduct of monetary policy. Some stylized facts are discussed, followed by a variety of econometric evidence about the relative effectiveness of monetary policies in Japan, the U.S., and the Eurozone in response to the changing credibility of their respective central banks. Section 4 concludes and broadly assesses existing narratives about Japan's record in monetary policy.

While the other two economies under study may have fared better in some respects, there is little indication that 'Japanification' is a unique phenomenon. Second, the usual interpretation that Japan was mired in deflation exaggerates the role of falling prices on expectations. Central bank credibility is found to have a powerful effect on inflation. Hence, paraphrasing Romer and Romer (2014), it is a "dangerous idea" to assume that monetary policy has lost its ability to influence economic activity.

Finally, it is difficult to identify clear regime shifts in the data that foretell success in monetary policy shifts. In particular, the Great Financial Crisis (GFC) looms large in both narrative and statistical accounts of the impact of monetary policy. Other shocks, such as the change in monetary policy strategy at the BoJ in 2013 seem to pale in comparison even if the announcement was seen by policy makers as a regime shift.

2. Lessons from Japan and echoes from abroad

2.1. Some history

Understanding developments in monetary policy especially must begin with a brief look back at the global consequences of events that took place beginning in the 1970s.[3] In the aftermath of two oil price shocks the resulting high inflation and stagnation in advanced economies is one reason why central banks obtained increased autonomy, together with a mandate to achieve price stability. Of course, economic theory and evidence contributed to this debate. However, the success of four countries, namely Germany, Japan, Switzerland, and the U.S. placed them at the top of indicators of central bank independence. In contrast Japan generally fared poorly in such rankings. It is Japan's success, especially after the second oil shock of the 1970s, alongside Germany and Switzerland, in controlling inflation that arguably gave policy makers in Japan reason to believe that they were able to deliver price stability in an era of rapid economic growth. Whether this led the Bank of Japan to fall into a complacency trap is debatable. The 1980s were less kind to Japan in rankings of central bank independence also because a lingering banking crisis would divert attention away from the still undefined goal of price stability.[4] To be sure, there were banking crises in the U.S. and in Europe around the same time (not shown but see the appendix Table A6.1) but their size and scope did not appear to match that which affected the Japanese economy. It is plausible to think that this experience fostered

[2] There is potentially more than one kind of regime shift. Observers are not always clear whether this is a reference to a temporary shift, a permanent one, a shift in the intercept in, say, the trajectory of a variable of interest, a change in the trend of the same variable, or both.

[3] This section is intended as a brief introduction to some of the forces influencing policy making during the 1980s and beyond in Japan. Readers are asked to consult, for example, Shizume (2018a, 2018b), and Wakatabe (2015), for broader overviews of the history of the Bank of Japan and Volcker and Gyoten (1992) for an account of policy making in Japan and the U.S. during the 1970s.

[4] It has been suggested to me that the ambiguity regarding what policy makers thought was meant by price stability partly reflects the traditional ambiguity of the Japanese language but also the political turmoil in that country in the mid to late 1990s.

a form of tunnel vision at the BoJ. Whereas, prior to the banking crisis, the Finance Ministry was largely responsible for financial stability cooperation between the BoJ and the Treasury became essential. Moreover, institutional changes followed when Japan's Financial Services Agency was created. Of course, prior to the new BoJ Law of 1998, the central bank was not as independent in the statutory sense as noted above and this too may have contributed to central bank myopia.[5]

International observers were also interested in the conduct of policy in Japan. A succinct way of understanding how outsiders saw the evolution of policies in Japan is to consider surveys and assessments published by the Organization for Economic Cooperation and Development (OECD) and the International Monetary Fund (IMF). I relegate to an appendix highlights extracted from bi-annual surveys conducted by the OECD since 1980 and article IV reports published by the IMF.[6] The OECD notes in its 1992 Survey that price stability "has virtually been achieved" though there is no precise definition of the term. Prior to that, the remarkable growth of the economy is highlighted, together with approval of "structural" reforms enacted, while monetary policy was more often than not interpreted as being "expansionary". These themes are consistently present in surveys published since 1980. Shortly after success in achieving price stability in the early 1990s the call for "structural reforms" comes to dominate the content of several surveys and this theme continues to be repeated to this day. Along the way, there are calls to introduce a more "aggressive" monetary policy to end deflation (e.g., the 2004 and 2005 Economic Surveys) and this theme is highlighted on several occasions in later years.[7] It is beginning the middle part of the decade of the 2000s that worries over the consequences of population aging and the need to consider fiscal consolidation are expressed more frequently.[8]

Many of the IMF article IV reports contain recommendations comparable to ones found in the OECD surveys. A couple of themes in the IMF's consultation, however, stand out. First, "deep-seated" structural problems of varying degrees of importance are underscored in almost every report published during the 2001–2018 period. Second, calls for monetary policy to be more aggressive, and the necessity of conquering deflation, are listed as priorities. These two factors contribute importantly to the state of the Japanese economy though a formal causal link, for example, between the conduct of monetary policy and overall economic performance is never clearly established.[9]

2.2. Japan's economy and echoes from abroad: non-monetary policy aspects

Any attempt to survey the relevant research dealing with assessments of various forces that explain economic performance in the three economies being investigated since the 1980s must be highly selective. As pointed out in the introduction there exist a few broad narratives to describe the conduct of policy in general, including monetary policy. Clearly, these narratives are also inspired, at least in the case of the U.S. and the Eurozone, by the events culminating in the GFC and the subsequent Eurozone sovereign debt crisis. A partial list of relevant readings that deal primarily with the U.S. and European experiences would include, in no order of importance, Bernanke (2015), Brunnermeier et al. (2016), El-Arian (2016), King (2016), Blinder (2013), Eichengreen (2015), Geithner (2014), and Mody (2018).

Also relevant for the Japanese case is that many retrospectives of monetary policy over the past decade have focused on the consequences of unconventional interventions by central banks, especially in the systemically important advanced economies. These interventions were mainly intended to ease financial conditions, although it may still be too soon to reach a consensus on the macroeconomic effects of unconventional monetary policies (UMP). Contributions in this area include Dell'Ariccia et al. (2018), Kuttner (2018), and Lombardi et al. (2018). Nevertheless, with the exception of Kuttner (2009), and Lombardi et al. (2018), comparisons have tended to shy away from contrasting the Japanese experience with more recent policy undertakings in, for example, the U.S. and the Eurozone. It is worth adding that policy makers in Japan have usually been ahead of their colleagues elsewhere in experimenting with instruments and policies to maintain the effectiveness of monetary policy (e.g., see Shirakawa, 2010; Bernanke, 2017).

Turning to Japan there are several surveys and overviews of Japan's experience over the decades. These include Cargill et al. (1997); Kuttner and Posen (2001); Fujiki et al. (2001); Okina et al. (2001); Okina and Shiratsuka (2002); Ugai (2007); Koo (2003, 2008, 2015, 2018); Ikeda and Kurozumi (2019); Nakaso (2001); Shirakawa (2010); Syed et al. (2009); Hamada and Noguchi (2005), and Wakatabe (2015), and Aramaki (2019). More recently, Bernanke (2017) revisits some of his earlier work dealing with Japan (e.g., see Bernanke, 1992) while acknowledging that economists in general underestimated the importance of fiscal and monetary policy coordination in the story of the 'lost decades' of Japan. Indeed, preoccupation with whether Japan's predicament is replicated elsewhere has often been a concern of policy makers, especially in the U.S. (e.g., see El-Arian, 2019).

Another narrative that describes the Japanese experience focuses on longer run factors such as demographics (i.e., Japan's aging population) and the decline in productivity (i.e., labor or total factor productivity; hereafter TFP) due to the consequences of prolonged financial crisis conditions. Indeed, as a result, there has been a revival of the secular stagnation hypothesis (e.g., see Summers 2014) and its effects are now being explicitly incorporated into standard economic models (e.g., see Eggertsson et al., 2019). Based on the usual metrics of labor productivity and total factor productivity (not shown but see the appendix Figure A1.4) Japan does not stand out, for example, from the Eurozone's experience.[10] However, in view of the mixed messages from the data, due possibly to measurement issues, it is difficult to reach a definitive conclusion. Nevertheless, Hayashi and Prescott (2003) argue that the 'lost decade' of the 1990s is explained by lower productivity while Ikeda and Kurozumi (2014) also highlight the role of a slowdown in TFP in Japan. However, Posen (1998; 2001; 2002) disputes Japan's decline in

[5] Cargill and O'Driscoll (2018) specifically refer to Japan and the US to argue that the independence concept, which they never actually define, reflects a "crony" relationship between the government and the central bank. Therefore, central bank independence (CBI) does not result in 'optimal' policy outcomes. Setting aside the precise nature of central bank – government links, CBI was never intended to sever links between the two but simply to clarify the scope of independent decision-making of the two institutions. Indeed, it is arguably the failure to appreciate the critical need for fiscal and monetary policy to operate in harmony that is the source of the current predicament several advanced economies find themselves in.

[6] The information is in Tables A3.1 and A4.1. Article IV reports were only available online back to 2001. Article IV reports are prepared by staff at the IMF and are referred to as consultation reports, that is, an assessment of overall economic conditions normally conducted on an annual basis. See https://www.imf.org/en/Publications/SPROLLs/Article-iv-staff-reports#sort=%40imfdate%20descending.

[7] As early as in the Economic Survey of 2004 there are calls for the BoJ, as part of its QE campaign, to purchase a wider range of financial assets.

[8] Interestingly, however, the potential economic difficulties surrounding population ageing is also mentioned as early as in the 1990 Economic Survey.

[9] I mention this because, by the early 2000s, empirical research was being published that cast doubt on the view that all deflations were of the 'bad' variety. Rather, it appears that bad deflations were more likely the result of collapsing asset prices, as in the late 1980s bursting of the stock market bubble in Japan (see the next section), and not a bout of mild deflation. See, for example, Burdekin and Siklos (2004), Borio and Filardo (2004), and Borio et al. (2015). The theme of "structural reforms" is also a perennial one in G7 and G20 Summit Declarations. Hence, it is far from clear that this issue is one where Japan is an outlier. See the appendix Tables A5.1 and A5.2.

[10] TFP for Japan, obtained from two sources, clearly reveals important differences with one suggesting that Japan does not do badly on this score while the other paints a much less flattering picture of the Japanese experience.

potential growth and finds fault elsewhere, namely 'misguided' macroeconomic and financial policies. Subsequently, both the IMF (2003) and the OECD (2004) would argue that Japan's potential output suffered in the first 'lost decade' (i.e., the 1990s).

As noted earlier, there was reluctance among observers early on to suggest that fiscal policy can come to the aid of monetary policy when conditions require it. This is surprising since it is a tenet of macroeconomic theory that aggregate policies work best when the monetary and fiscal authorities cooperate. Failure to do so in Japan's case is apparently one of the culprits for the inability to exorcize deflation expectations (e.g., see Eggertsson and Woodford, 2003). However, in an era of central bank autonomy, a confusion arose between the advantages of pursuing a common objective, say raising growth or eliminating deflation, and appearing subservient to the fiscal authorities. Indeed, among advanced economies, monetary dominance came to define policy making while fiscal policy mostly took a back seat. Moreover, just as monetary policy was criticized for its stop-go strategy (e.g., see Goodfriend (1991) and Chappell et al. (2019) for the U.S. case) Japanese fiscal policy generated the same criticism in part because of the government's habit of regularly announcing supplementary budgets or fiscal stimulus packages only to backtrack when debts and deficits raised broader economic concerns. Koo (2003, 2008, 2015, 2018) has pointed out repeatedly that fiscal policy had beneficial effects in Japan but inconsistency and a failure to sustain fiscal interventions over time was lacking. While estimates of cyclically adjusted budget balances for Japan are comparable to ones for the U.S., and the Japanese government has been a net borrower since the early 1990s, it is the rise of government debt to GDP has raised concerns both domestically and in international financial markets.[11]

2.3. Monetary policy and regime shifts

Empirical assessments of the conduct and effectiveness of monetary policy in Japan (and elsewhere) have ordinarily taken two forms. Monetary policy rules, generally variants of a Taylor type rule, are estimated to determine how much weight the BoJ, on average, has placed on inflation versus output gap control. On this basis, and as a device to evaluate the BoJ's track record, interpretations are made about whether policy was too loose or too tight. Conclusions from these studies run the gamut. Some indicate that Taylor type rules suggest similar monetary policy responses in the three economies investigated here (e.g., Gerdesmeier et al., 2007). Others ask whether certain policy changes (e.g., the ZIRP period) led to changes in the BoJ's reaction function (e.g., Jinishi et al., 2000), while still others raise serious questions about the viability of estimating a policy rule when output gap are estimates are highly sensitive to how they are constructed (Kuttner and Posen, 2004).

Although many estimated policy rules are of the simple linear variety, frequent policy changes (see the next section), together with some potential technical challenges around interest rates at the Zero Lower Bound (ZLB) for a considerable period of time, have also generated more sophisticated policy rule models. These include non-linear and quantile regression-based variants (e.g., see Chen and Kashiwagi, 2016; Chevapatrakul et al., 2009; Kim and Mizen, 2010; and Wolters, 2012) though it is not entirely clear whether these provide new insights into our understanding of the conduct of monetary policy.

Another strand of the literature estimates macro models. Typically, these are grounded in prevailing views about the central importance of price stability in delivering the best macroeconomic outcomes as most clearly spelled out by Woodford (2003). Here the emphasis is on the role and influence of inflation expectations. For example, Hattori et al. (2019), Hattori and Yetman (2017), and Fukuda and Soma (2019) focus on the determinants of inflation expectations and the sources of inflation forecast disagreement. Although these studies tend to conclude that various policy changes were 'successful' and impacted expectations (e.g., the introduction of a numeric inflation target in 2013 followed by the adoption of quantitative and qualitative easing) all are forced to acknowledge that past attempts at raising inflation expectations have yet to reach their objective.

Alternatively, the aim of several of these studies is to ascertain the nature of the monetary policy transmission process. Cross-country comparisons have also been published. For example, Muellbauer and Murata (2009) argue, due to housing markets differences, that the transmission mechanisms of monetary policy in Japan and the U.S. differ sharply from each other. McAdam (2003) contrasts business cycle activity in Japan, the U.S., and the Eurozone. This study concludes that Japan's performance includes some unique features such as a near absence of cyclical content while, more broadly, business cycles in the three economies are "distinct".

Often, a VAR of some kind is estimated and the responses to shocks are reported. Other estimation techniques, such as Markov switching models, have also proved popular. The bottom line, based on a wide variety of models, restrictions and increasingly sophisticated attempts to pinpoint the impact of various monetary policy easing interventions by the BoJ (i.e., Quantitative Easing (QE) type policies), is that they do influence inflation, inflation expectations, and real economic activity. However, their impact is modest and temporary. Ichiue and Ueno (2018), Koeda (2018), Michaelis and Watzka, 2017, and Okimoto (2019) are recent examples of studies of this kind. Girardin and Moussa (2011), however, conclude that QE's impact is 'considerable'. Others, such as Shibata and Kasada (2018), and De Michelis and Iacoviello (2017), are less complimentary about UMP citing a lack of credibility in the 2013 policy regime shift (i.e., Qualitative and Quantitative Easing (QQE)), and an excessive reliance on such monetary policy interventions to stimulate economic activity. Finally, any examination of the connection between policy announcements and regime shifts tend to be episodic, that is, they focus on particularly significant policy change announcements (e.g., QE in 2001, and QQE in 2013) as opposed to trying to determine whether some events more than others qualify as regime shifts.

The notion of a regime shift is a subtle one since the concept is based either on a historical analysis or on a series of statistical tests. Complicating matters are significant developments over the past two decades in how regime shifts are estimated or detected (see below). Romer (2014), cited earlier, is an example. Historical illustrations, namely a comparison of the Great Depression and the more recent U.S. experience, where a regime shift is assumed to have taken place based on the behavior of key macroeconomic aggregates and the events surrounding their development, are used to argue that it takes a 'regime shift' to deal with the aftermath of large economic or financial shocks. Similarly, Bordo and Siklos (2018) define policy regime shifts in historical terms since the late 19th century in ten economies, Japan included. However, that study's historical analysis includes statistical testing to determine the compatibility of the two methodologies to date regime shifts. An additional difficulty is that many types of 'regime' changes are conceivable. There are fiscal regimes, exchange rate regimes, regulatory regimes. While there is a risk in focusing too narrowly on monetary policy regimes, both theory and a considerable amount of empirical evidence suggests that it is the credibility of the monetary policy regime that is a necessary, if not sufficient, condition. Arguably, the Volcker disinflation of the 1980s, or former President Mario Draghi's promise in 2012 to do "…whatever it takes…And believe me it will be enough…", serve as examples of the critical importance of monetary policy credibility.

While major events (e.g., the Great Depression of the 1930s) can bring about a regime change there are plenty of other candidates that serve as examples of a regime shift, but which may not appear to be as dramatic when visual comparisons of time series are made. Indeed, Akerlof and Yellen (1985a, 1985b) remind us that it is conceivable that a series of small shocks can also produce large real economic effects. Similarly, Schelling (1988) describes what has since been called the 'tip-

[11] Cyclically-adjusted budget balance estimates suggest considerably tighter fiscal policy in the Eurozone than in either the U.S. or Japan. See the appendix Figures A1.5 and A1.6.

ping point' theory wherein a series of past events, each of which may be small, eventually produce large consequence. Hence, a regime shift may be necessary, but not sufficient, to generate a new equilibrium. Instead, for example, the timing and credibility of policies, not to mention how they are communicated, may be at least as important, if not more so, than an abrupt policy change.

3. Empirical evidence

Empirical testing proceeds in two steps. First, I introduce and describe some of the key macroeconomic and financial variables that will form the basis of subsequent empirical testing relying on data from Japan, the Eurozone and the US. Key concepts such as credibility and regimes shifts are then defined. Next, the econometric methodology is described and tests are carried out with the aim of drawing insights from a comparison of the macroeconomic experiences of the three economies since the 1980s.

3.1. Data

The estimated models (see Section 3.3) consist of at least five core variables sampled at the quarterly frequency. Samples can vary but they begin in 1980Q1 and end in 2018Q4. Some individual time series are available until early 2019 (Q1 or Q2) but not all series were available when the data were collected through the Spring and Summer of 2019. The sample for Eurozone data is shorter with data beginning in 1999Q1 when the euro is adopted.[12]

The core series are inflation, defined as the annualized quarterly inflation rate in the CPI[13]; the output gap defined as the median estimate from six different estimates of the output gap (see below); an estimate of central bank credibility; a proxy for financial conditions estimated from a time-varying factor model (see below); and an estimate of the real exchange rate gap.[14] The proxy for financial conditions is used for two reasons. First, the debate about which kind of financial shock is most important in influencing macroeconomic conditions is unresolved.[15] Depending on the economy, and the episode in question, variables including credit, term spreads, housing prices, and lending standards all appear to significantly impact economic conditions, including inflation. The factor model approach combines these indicators into one series. This approach is now also widely used by several central banks and international organizations. Another advantage is that, by combining several relevant indicators, fewer degrees of freedom are lost.

Since there is also nothing approaching a consensus on how to estimate the output gap, I estimate or collect several variants. For the US and Japan 'official' estimates are available, respectively from the Congressional Budget Office and the BoJ.[16] Next, the mean-adjusted growth rate in real GDP is used, as is an estimate of the gap generated by applying Hamilton's (2018) filter, a one-sided H-P filter and, finally, a fixed length band pass filter (Christiano and Fitzgerald, 2003). For the Eurozone there were no 'official' output gap estimates.[17] Hence, the median of five separate estimates is used.[18]

The estimated financial factor is obtained as follows: Each economy is identified by j. If $\mathbf{X}$ denotes a vector of variables, we can write

$$\mathbf{X_{jt}}=\boldsymbol{\alpha}_{\mathbf{jt}}\mathbf{F_t}+\boldsymbol{\varepsilon}_{jt} \quad (1)$$

where $\mathbf{X}$ are vectors of observable time series from which factors $\mathbf{F}$ are estimated, α are the factor loadings. The first principal component (PCA) is extracted which then serves as the proxy for the financial factor.[19] The same factor models are estimated in a rolling manner for samples a decade in length beginning with the 1980Q1–1989Q4 sample. The sample is rolled ahead two years at a time. This produces a series of overlapping samples. The estimated factor scores are averaged when samples overlap to produce a unique factor estimate that is time-varying (also, see Siklos, 2018).

Next, I provide a brief explanation of the proxy for central bank credibility (CRED). Readers are also asked to consult Bordo and Siklos (2017, 2019) and Siklos (2013) for more details. The version of the proxy for credibility used here is an aggregation of two components, namely one portion that captures a penalty for deviating from some inflation objective, which need not be observed, and an estimate of monetary policy uncertainty (MPU) that is assumed to originate from differences in inflation and real GDP growth forecasts across forecasters. Deviations from the inflation target make allowances for the fact that the loss of credibility is likely to be small around some tolerance range (i.e., 1% around the target) but grows larger once inflation exceeds the target range.[20] Aggregation of squared differences in forecasts vis-à-vis the median forecasts of inflation (π^{M}) and real GDP growth rates (y^{M}) represents MPU.[21] More formally, the definition of credibility improves on earlier estimates of monetary policy credibility (Bordo and Siklos, 2015; 2017) by combining inflation that deviates from a target and an element that captures the implications of forecast disagreement about inflation and real GDP

[12] All data were obtained from the following sources: Federal Reserve Bank of St. Louis Economic Data (FRED; https://fred.stlouisfed.org/) for U.S. data, the Bank of Japan (https://www.boj.or.jp/en/statistics/index.htm/), the Euro Area Wide Business Cycle Network Model data base (https://eabcn.org/page/area-wide-model) and the ECB Statistical Data Warehouse (https://sdw.ecb.europa.eu/). Financial data (e.g., credit, housing prices, central bank policy rates, real effective exchange rates) are obtained from the BIS (https://www.bis.org/statistics/index.htm).

[13] For the Eurozone I use the Harmonized Price Index (HICP). For Japan it is common to use inflation that excludes fresh food because the Policy Board's inflation outlook is set in these terms, although the impact on the results is minimal when all items CPI is used. For the US many studies prefer to use the Personal Consumption Expenditures index. Conclusions are unchanged when the CPI is used. Hence, to ensure cross-economy comparability Headline CPI is used.

[14] The real exchange rate gap is the difference between the log of the real effective exchange rate and a one-sided H-P filter with a smoothing parameter of 1600 estimated using the Ravn-Uhlig (2002) rule (power is set to 2).

[15] Thus, for example Borio et al. (2019) suggest that their indicator of the financial cycle, comparable but not identical to the ones used in this paper, outperforms the term spread considered to be the most widely used recession indicator. Of course, the present study is not focused on recessions alone but economic activity throughout the business cycle.

[16] https://www.boj.or.jp/en/research/research_data/gap/index.htm/.

[17] The European Commission does publish an output gap measure although it is not, strictly speaking, comparable to ones produced in the other two countries. Also, the series does not appear to go back far enough for the purposes of this study.

[18] Real GDP is known, along with a very few macro-financial times series, to be subject to revisions. These revisions are not explicitly considered in the paper for at least four reasons. First, most of the other series in the various estimated specifications are not subject to the same revisions. Second, incorporating the impact of such revisions is unlikely to change the conclusions (e.g., see Siklos, 2019). Third, by averaging over several output gap estimates, any errors from relying on final data are likely to be mitigated. Fourth, even if real time data might make a difference, there is no guidance about which data vintage should be used in the analysis. It would be impractical to use all available vintages and using only some might suggest selectivity bias.

[19] Owing to the sample lengths I elected not to include more than one principal component. However, the first component usually explains over 50% of the variation in the series included (results not shown).

[20] It is constructed as in Bordo and Siklos (2019) except that the 'global' component is omitted since the three economies studied here are systemically important and generate the lion's share of the global component. Second, unlike Bordo and Siklos (2019) where forecasts from only two sources were available, a much larger number of forecasts are available for use here. An appendix provides the source of inflation and real GDP growth forecasts (Table A7.1).

[21] For Japan 11 different inflation forecasts are used, and 7 real GDP growth forecasts; for the U.S., 14 inflation and 9 real GDP growth forecasts; for the Eurozone 9 inflation and 5 real GDP growth forecasts are used.

growth.[22] Therefore, write:

$$(\bar{\pi}^f_{t+1} - \pi^*_t), \text{if } \pi^*_t - \theta \leq \bar{\pi}^e_{t+1} \leq \pi^*_t + \theta$$
$$(\bar{\pi}^f_{t+1} - \pi^*_t)^2, \text{if } \pi^*_t - \theta > \bar{\pi}^e_{t+1} > \pi^*_t + \theta$$
$$\theta = 1$$
$$MPU = \sum_{k=1}^{N} [(\pi^k_{t+1} - \pi^M_{t+1})^2 + (\dot{y}^k_{t+1} - \dot{y}^M_{t+1})^2]$$

The first two lines define the credibility 'penalty' central banks incur when they miss their targets (π^*), and where $\bar{\pi}^e_{t+1}$ is the mean expected inflation for the year ahead $(t+1)$ which is proxied by $\bar{\pi}^f_{t+1}$, the one year ahead fixed horizon mean inflation forecast. Specifically, the tolerance level around the target is set at 1% as indicated by the value of θ as shown in the third line above. Once inflation expectations exceed the tolerance band, given by the inequality in the first two lines, the penalty becomes a quadratic compatible with most definitions of central bank loss functions. Positive and negative misses are penalized symmetrically but now in terms of the absolute value of the level of misses when these are inside the tolerance range so that misses inside and outside the target range are treated differently. I consider three different proxies for the gap between expected inflation and the target (i.e., $\pi^f_{t+1} - \pi^*_t$). They are: the average one year ahead inflation expectations; last year's observed inflation; and, finally, a two-year moving average of inflation.

The inflation target (π^*_t) is not always observed.[23] I proxy the *de facto* inflation target as the mean from 3 different filters applied to observed inflation. They are: a 5-year moving average of inflation, the inflation obtained by a band pass filter for frequencies ranging from 2 to 8 quarters, and a one-sided Hodrick-Prescott filter previously described. These are applied to the full available span of the data. The other component of credibility is monetary policy uncertainty as explained above.

Once the individual components of credibility are estimated they are aggregated. Normalized estimates are used in subsequent testing. Therefore, credibility is:

$$CRED_{jt} = \begin{cases} (\bar{\pi}^f_{j,t+1} - \pi^*_{jt}), \text{if } \pi^*_{jt} - \theta \leq \bar{\pi}^e_{i,t+1} \leq \pi^*_{jt} + \theta \\ (\bar{\pi}^f_{j,t+1} - \pi^*_{jt})^2, \text{if } \pi^*_{jt} - \theta > \bar{\pi}^e_{i,t+1} > \pi^*_{jt} + \theta \end{cases} + MPU_{jt} \qquad (2)$$

where CRED is the estimate of monetary policy credibility for economy j (=JPN (Japan), USA United States), EUR (Euro area)) at time t and all other terms were previously defined. Positive values for each component imply a reduction in credibility since the gap between observed and expected inflation widens, while greater monetary policy uncertainty, which also rises when there is more disagreement among inflation and real GDP growth forecasts, also raises CRED. Normalized estimates of CRED then range from 0 (perfect credibility) to 1 (no credibility).[24]

3.2. Stylized facts

A first test considers whether regime change can explain the relative success, or lack thereof, of monetary policy in delivering the notional amount of inflation. It is useful, in this connection, to consider as markers not only important milestones in monetary policy but events with likely significant economic implications more generally. Table 1 lists a few, in the main monetary policy, events for the three economies under study that are worth keeping in mind when interpreting subsequent econometric results. Dating some of these can be done precisely (e.g., louver Accord) while others have longer duration because they represent periods when a series of smaller interventions took place (e.g., UMP during 2008Q4–2010Q1 in Japan).

Nevertheless, since *a priori*, it is unclear which events are likely to emerge as significant regime shifts in a statistical sense, a separate appendix provides a more complete list of other events of a regulatory, fiscal, and economic nature (e.g., recession chronologies, see Table A1.1) that may assist with a narrative approach to identifying regime shifts. These include major pieces of legislation, selected fiscal events that may have had reverberations for monetary policy as well as other events, non-monetary or financial in nature but which may have had consequences for the stance of monetary policy (e.g., 2001 terrorist attacks on the U.S., earthquakes in Japan, international summits (G7, G20)).

Fig. 2 plots the four elements that make-up the vector representing financial conditions from which the PC are extracted (see Section 3.1) for the three economies considered. The vertical lines and shaded areas highlight selected events, monetary and otherwise, that may provide some insights about the evolution of these variables for Japan (also see Table 1).

In the case of credit Japan's experience (top left plot) stands out until the GFC in at least two ways. First, levels of credit, as a percent of GDP, rise quickly until the bursting of the stock market bubble and the peak in land prices and remain high until the banking crisis of the early to mid-1990s. Thereafter, levels fall slowly but steadily until they become largely indistinguishable from each other in all three economies shortly before the GFC. The timing of some of the broader movements in the credit to GDP ratio are clearly linked to major economic events.

Lending conditions are shown next in the top right-hand corner of Fig. 2. A rise signifies a tightening of lending conditions according to surveys of senior loan officers at commercial banks. In Japan, lending conditions tighten as the banking crisis of the 1990s progresses but there is a dramatic loosening by the time this episode is thought to have ended in 1997. Notice also how lending conditions tighten gradually during the 1980s but loosen dramatically approximately three years prior to the banking crisis. There appears to be no obvious link between the tightness of lending conditions and the various interventions with monetary policy implications for Japan since the early 1990s. Lending standards in the U.S. are more volatile than in either of the other two economies considered but we see the substantial weakening of standards in the run-up to the GFC followed by a sharp tightening which is rapidly reversed once the Fed begins to intervene in financial markets. Similarly, there is a tightening prior to the GFC in the Eurozone followed by a loosening which is temporary only to be reversed since the sovereign debt crisis peaked in 2012.[25]

Turning to the growth in housing prices, shown in the bottom left-hand corner of Fig. 2, Japan only stands out once the post-bubble in land prices bursts until around 2010 when price growth once again becomes positive. Notice that, other than this period, the growth in housing prices in all three economies parallel each other and the drop seen in the early 1990s is common everywhere but more dramatic in Japan's case. In contrast, it is the precipitous drop in U.S. housing prices on the eve of the GFC that stands out from the rest. The final plot is the term spread shown in the bottom right-hand corner of Fig. 2. What is salient in the figure, other than the sharp drop in the spread in Japan during the mid-1980s, is the steady drop in the spread in Japan since the GFC. The spread

[22] Jurado et al. (2015) point out that disagreement can originate from model differences and not only uncertainty about the future. Since forecasters' models are rarely observed we cannot be certain how large is the role played by model uncertainty. Nevertheless, as explained below, the MPU proxy does appear to capture changes in uncertainty about monetary policy. Lahiri and Sheng (2010) also argue that uncertainty can deviate from disagreement if shocks are volatile. Yet, there are a very large number of methods used to identify these shocks with no consensus about which one(s) are true measures of aggregate shocks.

[23] Other than Japan, where the 2% target since 2013 is notional with a target date that has been pushed back over time, the Fed's target during the sample is a medium-term one that it has set without a formal agreement with the Treasury and only since 2012. The same is true for the ECB's below, but close to, 2% target which it has set for itself but only since 2003.

[24] Readers will notice that the two components of (2) are equally weighted. Although one could, obviously, experiment with different weights no theoretical guidance is available yet.

[25] The importance of lending standards in measuring financial conditions is recognized by an increasing number of central banks that survey loan officers. See, for example, Filardo and Siklos (2020).

Table 1
Selected Monetary Events in Japan, the U.S., and the Eurozone Since 1980.

Japan	*United States*	*Eurozone*
plaza accord 1985q3	1979q4–1982q4: monetary targeting	1999q1: euro introduced
louver accord 1987q1	1987q4: black monday	2008q4: ltro#
1989Q4/1990: Nikkei peaks followed by bubble bursting	2000Q1: dot.com bubble bursts	2010Q2: SMP
Banking crisis: 1992–1997*	QE 1: 2008Q4–2010Q3	2012Q3: OMT
1999Q1–2000Q3: Zero Interest Rate Policy	QE2: 2010Q4–2011Q2	2015Q1: QE
2001Q1–2006Q1: Quantitative Easing (QE)	QE 3: 2012Q3–2014Q4	
2008Q4–2010Q1: Variety of BoJ interventions**		
2013Q2-: Quantitative and Qualitative Easing (QQE) and Yield Curve Control (2016Q3)		

Note: See text and the appendix Table A5.1 for sources. The above list is not intended to be comprehensive. Additional events (e.g., major earthquakes in Japan) are relegated to the same appendix. LTRO: long-term refinancing operation; SMP: securities market program; OMT: Outright monetary transactions (follows former ECB President Mario Draghi's July 2012 speech defending the euro).

* There are differing views about the dating of Japan's banking crisis. The dates shown here are the most 'generous' in terms of the span of time.

** There were interventions after 2010Q1 . Arguably, these were of a different variety. Again, there is room for disagreement on this point (e.g., see Wakatabe 2015). # consists of more than one program (for example, a new program announced 2011Q4). Also, see Fawley and Neely (2013).

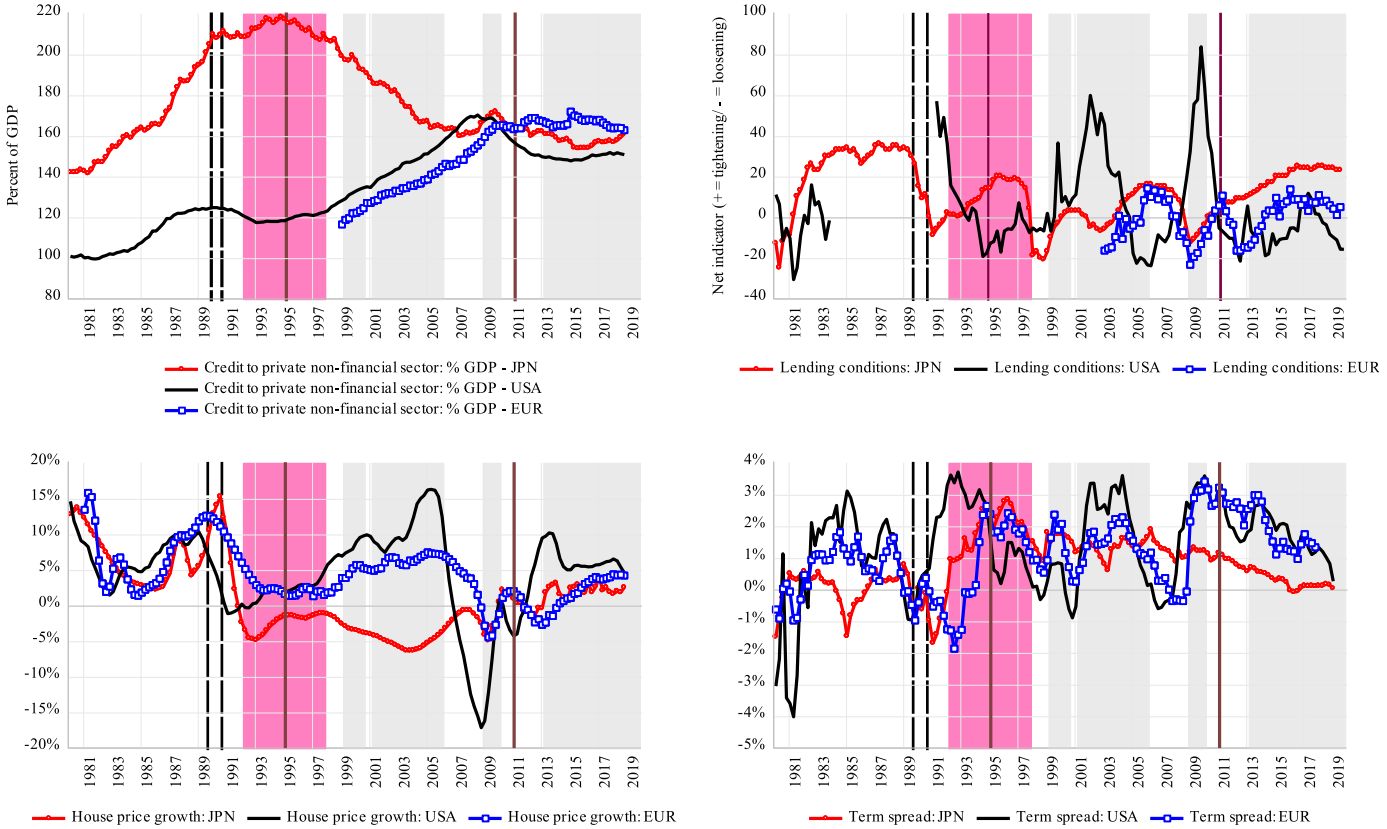


Fig. 2. Indicators of Financial Conditions in Japan, the U.S., and the Eurozone
Note: Definition and sources are provided in the text. For Japan the lending survey data represent the diffusion-index (i.e., an indicator of the tendency of loan officers to tighten or loosen lending standards) for the lending attitude vis-à-vis medium-sized enterprises, all industries. The gap in lending standards for the U.S. is due to the non-collection of data during this period. Filardo and Siklos (2018) also contains much more details about international lending standards data. Interpolation using the Chow-Lin method is used to fill the gap. Shaded areas and vertical lines are events highlighted in Table 1.

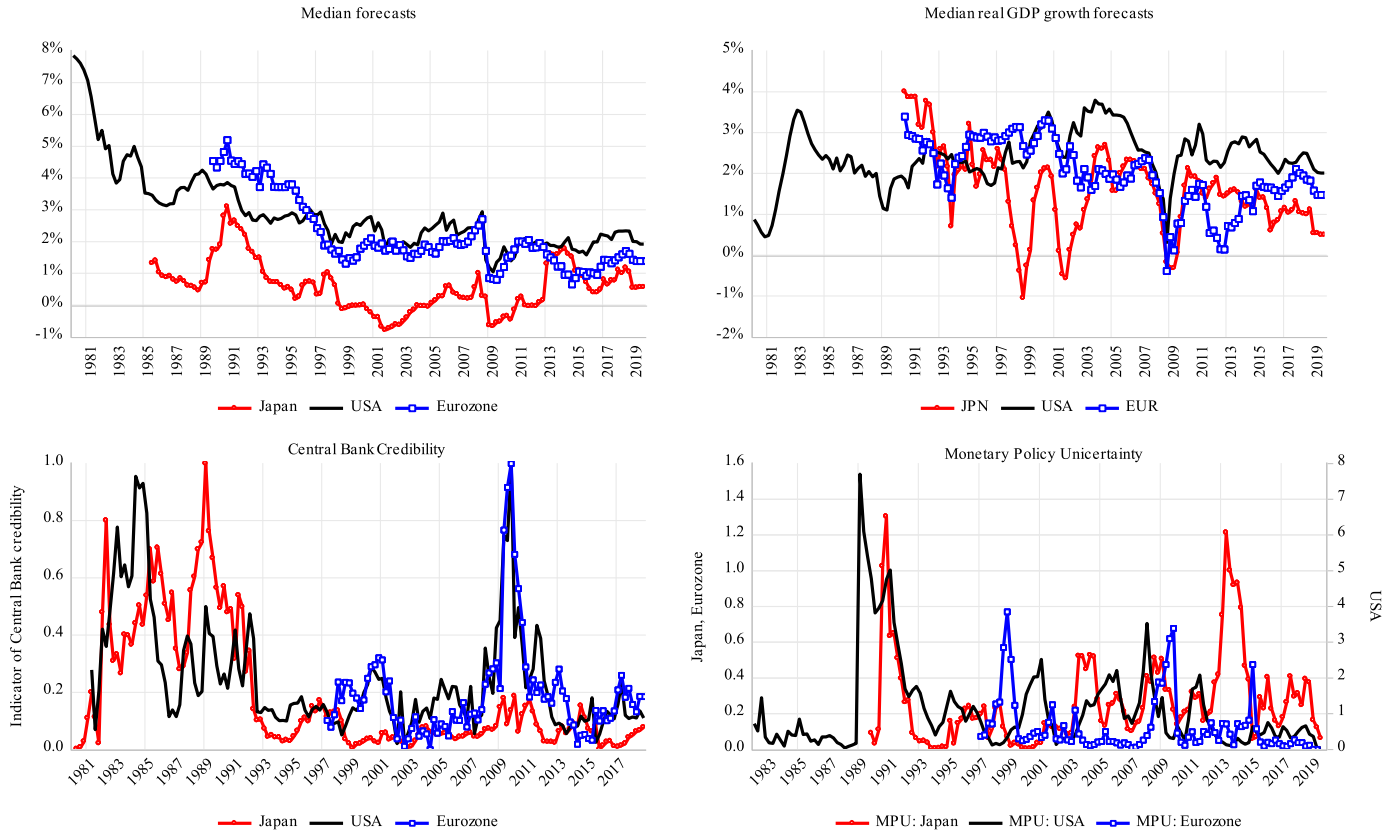


Fig. 3. Expected Inflation, real GDP Forecasts, Monetary Policy Uncertainty and Credibility in Japan, the U.S., and the Eurozone
Note: Median estimates of inflation and real GDP growth forecasts are based on multiple forecasts. Credibility and monetary policy uncertainty (MPU) are also defined in the main body of the text. In the case of MPU the plots are based on available forecasts. Longer series are available for Japan prior to 1990 when only TANKAN and WEO forecasts are available in contrast to many more forecasts available beginning and after 1990.

remains substantially lower in Japan but, towards the end of the sample, that is, by the end of 2018, spreads in all three economies show signs of converging. Hence, all indicators of financial conditions reveal for the three economies what appear to be some common features although clearly there are also idiosyncratic movements that may be explained by specific episodes or events unique to each economy in question.

The top two plots in Fig. 3 show median inflation and real GDP growth forecasts for Japan, the U.S., and the Eurozone. The bottom two plots show the estimates for MPU and CRED. Other than a brief spurt of inflation in the late 1980s and early 1990s in Japan expectations hover close to zero for most of the sample. Nevertheless, based on the median of several forecasts, from professional and households, there is no evidence of a permanent slide beyond a mild deflation. One might well ask why several BoJ Governors felt it necessary to speak out against the notion that a deflationary spiral was in the offing? There appears to be little evidence of this to speak of.[26] There are two episodes, in 2001–2 and again in 2009–11, when there are signs of deflation. The latter is clearly associated with the GFC as seen from the equally sharp decline, but from higher levels, in U.S. and Eurozone inflation. The earlier episode takes place at the conclusion of the ZIRP (see Table 1). Overall, we see the steady decline in inflation expectations in the U.S. and the Eurozone until the early 2000s and again after 2011. Policy makers in Japan (e.g., see Bank of Japan, 2016) contend that expectations are strongly backward-looking, and this hampers the BoJ's ability to meet its inflation objective. However, using the same specification as the BoJ's report of QQE's impact on expectations (Bank of Japan, 2016), Table 2 reports that, if median expectations are used, there is nothing, at least statistically, that distinguishes Japan's record from that of the U.S. or the Eurozone even when breaks in the relationship are considered.

Real GDP growth forecasts are consistently higher in the U.S. beginning in the 2000s except during the GFC. Otherwise, there is little that separates forecasts for Japan and the Eurozone though a divergence begins to emerge in the last three years of the sample with data for Japan showing a steady decline in forecasted real GDP growth beginning around 2011.

Turning to MPU and CRED, the bottom portion of Fig. 3 reveals that higher inflation, combined with higher MPU, reduces central bank credibility. Note, however, that whereas the Fed and the ECB suffer large credibility losses as a result of the GFC there are only small changes in BoJ credibility during this period. The BoJ is seen as losing a lot of credibility before the stock market bubble bursts in the late 1980s while there seem to be no dramatic rises or decreases in BoJ credibility since the early 2000s. A modest gain in BoJ credibility is evident around 2014 but this change does not stand out from other episodes of changes in the stance of monetary policy. This interpretation holds in spite of the apparent importance of the policy shift at the BoJ as part of the 'three arrows' of Abenomics. Notice also, however, that MPU in Japan rises sharply after QQE is introduced and generally remains higher than in the other two economies considered.

[26] This is even more dramatically illustrated when individual inflation expectations data are examined (see the appendix, Figures A1.1 to A1.3). For example, former Governor Shirakawa spoke at a news conference in 2009 where he advised listeners: "At the moment, Japan faces no risk of falling into a deflationary spiral (Shirakawa, 2009). A previous Governor, Fukui, explained in 2003 that the "drastic monetary easing measures" were essential to prevent deflation from going out of control. And, more recently, current Governor Kuroda also interpreted the most recent monetary policy regime changes as necessary to escape from the "deflationary trap" Japan found itself in (Kuroda, 2016).

Table 2
How Entrenched are Inflation Expectations? Some Evidence for Japan, the U.S., and the Eurozone.

Economy	SAMPLE (YR:Q)	(1): λ	(2): λ	BREAKS: (N1)	BREAKS: (N2)
JP	91:4–17:3	.26	.20	NIL	95:2
USA	91:4–17:3	.31	.33	NIL	02:4/12:3
EUR	00:1–17:3	.35	.26	NIL	13:1 (3 if sample starts in 1980; 96:3/00:2/13:2)

Note: the estimates of λ are based on the following two regressions (also see BoJ 2016).
In N1 and N2 π^e and π^T are CPI expected and target inflation rates as defined in the text, and t is the time subscript. Breaks are estimated via the Bai-Perron (1998) method as follows: a trend and an intercept are included in the specification, but only additive outliers are permitted. The test is then one for a break in the intercept. Testing is limited to a maximum of 3 breaks using sequential testing (i.e., the Null of B_l+1 versus B_l breaks, where B_l and $l=0$ to 3).

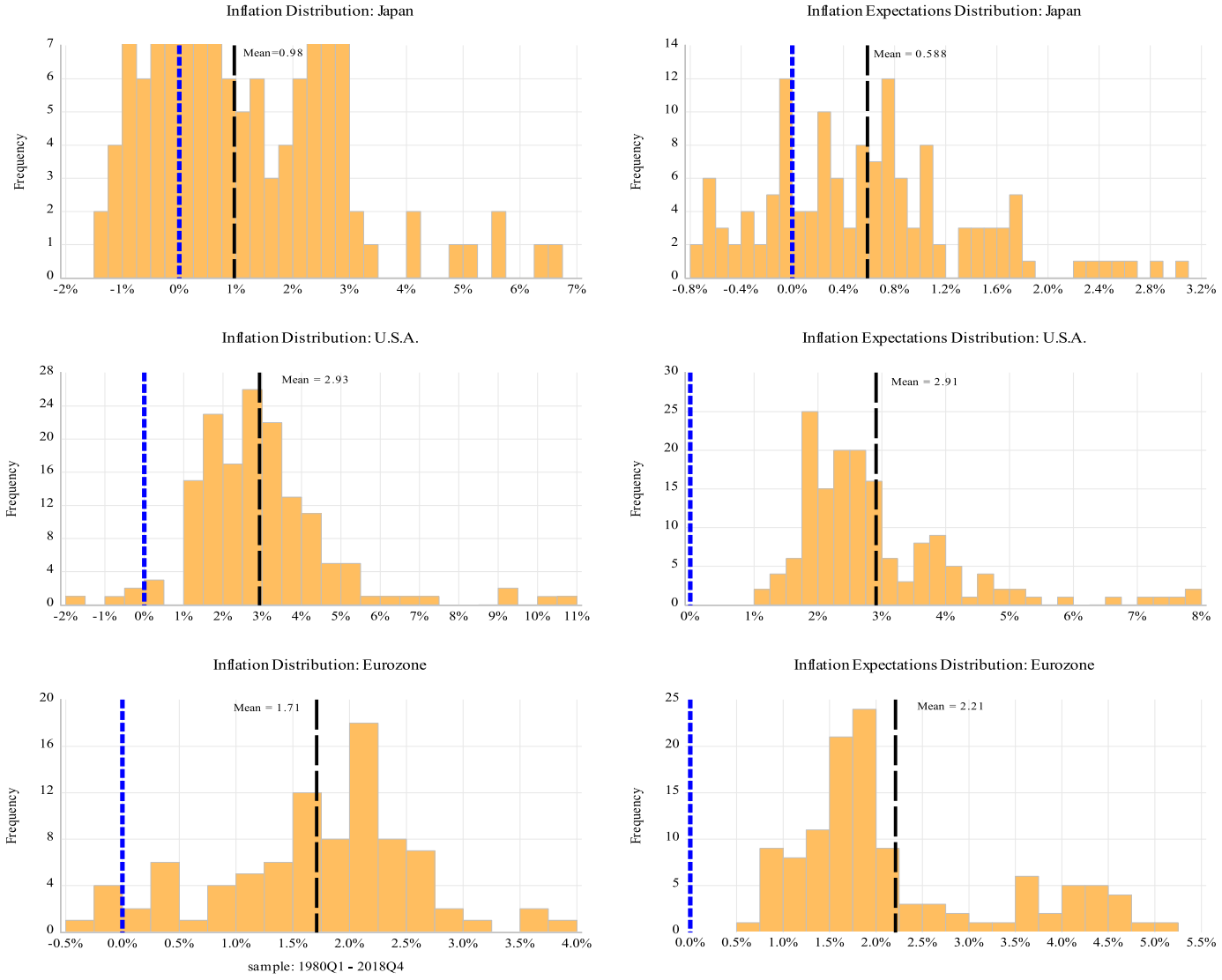


Fig. 4. The Distribution of Inflation Rates in Japan, the U.S. and the Eurozone
Note: Sources and definitions of the variables are in the text. The number of forecasts over which the median estimates are taken changes over time. See the appendix Table A7.1 for data availability for individual series. Prior to 1999 data for the Eurozone is a synthetic version from the sources listed in the paper. Samples are: 1980–2018 (Japan, USA), and 1997–2018 (Eurozone).

I conclude the description of stylized facts with Fig. 4. This plots the distribution of inflation and inflation expectations for all the available data.[27] Mean inflation is significantly lower in Japan than in either the Eurozone or the U.S. The same result holds when comparing mean inflation expectations. Inflation expectations show no signs of being negative in the Eurozone and the U.S. whereas this is not the case for Japan. Nevertheless, the simple hypothesis that the mean of inflation expectations is negative in Japan is soundly rejected.[28] In any case the mass of data for expectations below zero percent is clearly larger in Japan than in either of the other two economies, but the data are overwhelmingly to

[27] Because of data limitations for some of the other variables the sample are shorter when econometric estimates are discussed.

[28] The foregoing discussion is based on simple hypothesis testing (t-test) of the mean against the sample estimated one (results not shown).

the right of zero. Finally, notice that the overall distribution of inflation expectations for the U.S. and the Eurozone is shifted to the left based on the areas to the left of the mean. The bottom line is that observed and expected inflation display significantly different behavior. Moreover, it will also be helpful to keep in mind there is some evidence that expectations behavior may be partly driven by outliers.[29]

3.3. Policy rules, regime shifts and central bank credibility

As noted previously, a common barometer of the effectiveness and stance of monetary policy is the estimation or reporting of calibrated Taylor type rules.[30] In the three equations below i_t^T is the policy rate that emerges from different calibrations of the policy rule; π_t, π_t^* are inflation and the inflation goal or target of the central bank, y_t is an estimate of the output gap, and $r_t^*$is the policy neutral real interest rate. Notice that r_t^* is time-varying in the equations below.[31] This is a recent modification of the Taylor rule specification stemming from empirical evidence suggesting that longer run factors, including demographic and secular slump factors raised earlier, have contributed to reducing the neutral real rate relative to the 2% often assumed when this variable is treated as a constant (e.g., Taylor, 1993; Holston et al., 2016). Similarly, as central banks became more forward looking by targeting inflation, inflation in Taylor rules were often replaced by some indicator of expected inflation (see Clarida et al., 1999). The numerical coefficient (1, 0.5, and 2) attached to each one of these variables represents the weights placed on these twin objectives.

Three versions of the Taylor rule are especially noteworthy as they have often been used by academics and policy makers to represent 'best practice' in delivering monetary policy. They are: Taylor (1993), the originally published rule slightly modified (also, see Taylor,1999) as shown as Eq. (2) below; the so-called balanced rule, shown as Eq. (3), that places greater weight on real economic performance possibly because inflation rates have trended down since Taylor's originally proposed rule; finally, Taylor (1999), shown below as Eq. (4), that places relatively greater emphasis on inflation control by ensuring that a surge of inflation is short-circuited via higher real interest rates.[32]

$$i_t^T = r_t^* + \pi_t + 0.5(\pi_t - \pi^*) + 1y_t \tag{2}$$

$$i_t^T = r_t^* + \pi_t + 0.5(\pi_t - \pi^*) + 2y_t \tag{3}$$

$$i_t^T = r_t^* + \pi_t + 1.5(\pi_t - \pi^*) + 0.5y_t \tag{4}$$

The approach taken here is to back out that the effective policy rate ought to be depending on the assumed determinants of policy setting. They are: expected inflation, the inflation objective, the output gap, and the neutral real interest rate, as well as the weights placed on the inflation and output goals.[33] Since we have at least two measures of inflation, observed and (median) expected, and two indicators of real economic activity, namely the (median) output gap and expected real GDP growth, then, together with the three versions of the policy rule, we can evaluate twelve different versions of Eqs. (2) to (4).[34] Next, we ask what is the size of the deviation from any of the rules listed above and observed policy rates, that is, I calculate

$$DEV_t = i_t - i_t^T \tag{5}$$

A positive value implies that observed policy rates are higher than what the policy rule would recommend. In such situations monetary policy is tighter than necessary, negative values for DEV imply, of course, the opposite.

Fig. 5 reports two set of estimates for Eq. (5), namely the smallest deviation (DEV) between the observed and calibrated policy rates as well as the median (MED) estimates for the same deviation. A useful benchmark is zero percent since this indicates that a central bank sets a policy rate such that it follows the median of 12 potential estimates of the three rules considered. The median and smallest values are calculated for every observation *t*. In essence, the smallest value (MIN) is the rule that provides the most favorable view of the policy rate adopted by each central bank.[35] As a result, we obtain a snapshot of two points in the distribution of potential policy responses.

Both the MIN and MED estimates suggest sharp monetary policy tightening pre-GFC with a short delay in Japan and the Eurozone. Indeed, in Japan and the euro area, but not the US, observed policy rates exceed the Taylor rule recommendation. In all three economies the tightening is quickly reversed once the severity of the crisis becomes clear. The MED estimates suggest that all three central banks have, by far, tended to stick closest to the balanced policy rule followed by the Taylor (1999) rule. At least for the samples considered, Taylor (1993) does not emerge as a rule that is followed. Interestingly, Taylor (1999) is followed prior to the adoption of ZIRP, QE, and the GFC in Japan, during the Volcker disinflation of the early 1980s and again pre-GFC in the U.S., and in 2012 in the Eurozone, that is, around the peak period of the sovereign debt crisis.[36]

Next, since Eq. (5) is evaluated in terms of the observed policy rate, I ask whether observed deviations can be explained by any variables that are believed to impact monetary policy but are normally excluded

[29] There is some evidence of excess skewness in observed inflation in US and Eurozone data (Japan: 1.04; USA: 1.54; Eurozone: −0.27). Skewness in inflation expectations also differs as suggested above and appears excessive in the US case (Japan: 0.80; USA: 1.81; Eurozone: 1.01). Quantile-Quantile plots (not shown) suggest that US data (both observed and expected inflation) may be driven in part by outliers (both ends of the distribution) but there is no such evidence for the Eurozone.

[30] These need not be optimal in the optimal control sense. Indeed, as shown by Orphanides and Williams (2008), such models are highly sensitive to the assumption of rational expectations which clearly does not hold. Moreover, many of the rules estimated below are considered robust to mis-specification.

[31] Although detailed discussion of demographic factors is beyond the scope of the paper it is sometimes part of the narrative surrounding the "Japanification" concept. Unsurprisingly, the topic is one that has elicited considerable attention especially since an aging population is a phenomenon that extends well beyond Japan. See, for example, Shirakawa (2011, 2012, 2016), and Sudo and Tazizuka (2018) for the Japanese case and Goodhart and Pradhan (2020) for a global perspective.

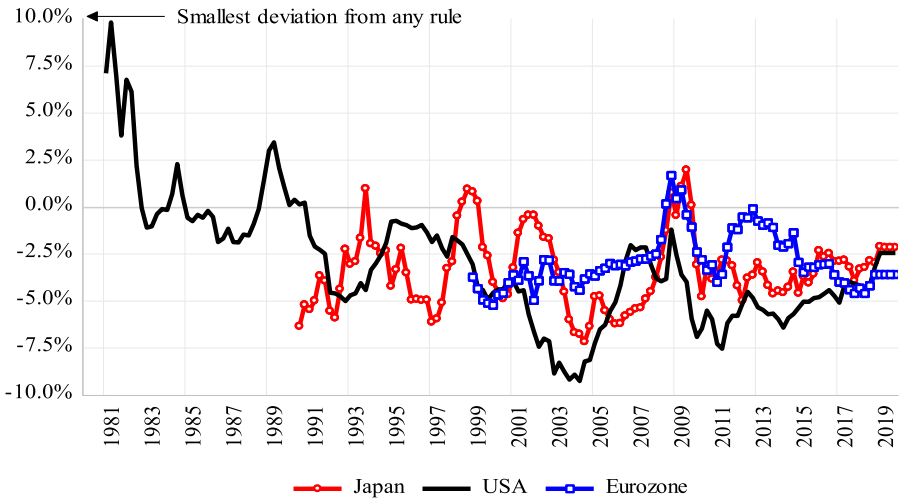
[32] Estimation or reporting of such rules is not uncommon at many central banks. The Fed's *Tealbook* frames some policy stance discussion around the performance of the rules shown as Eqs. (2)–(4). Indeed, a fourth rule is also often discussed, namely the first difference rule which, as the name suggests, is expressed in terms of changes in the relevant variables. See, for example, https://www.federalreserve.gov/monetarypolicy/files/FOMC20130130tealbookb20130124.pdf

[33] During the period under study all three central banks introduced various forms of unconventional monetary policies (UMP). As a a result. Observed policy rates were no longer meaningful after the mid 1990s in Japan, 2008 in the US, and 2010 in the euro area. Shadow rates have been created as an alternative (e.g., Wu and Xia, 2016; Krippner, 2013; and Lombardi and Zhu, 2018). Implicit in (2) to (4) is that UMP impact the parameters and variables of interest and there is no constraint preventing the nominal policy to be negative. The appendix (Figures A1.7 to A1.10) contains plots comparing calibrated rules estimated here vis-à-vis published shadow rates.

[34] As before plots showing the estimates, and details of regressions mentioned below, are relegated to an appendix (Figures A1.7 to A1.10).

[35] In generating the calibrated estimates, I rely on the neutral real rate estimates for the US, and the Eurozone published by Holston et al. (2016) while the ones for Japan are obtained from Howorth et al. (2019).

[36] The Appendix (see n. 34) provides some information about which policy rule comes closest each quarter to one of the specified rules. Also, see the notes to Fig. 4. Incidentally, comparisons with Krippner's (2013) shadow rates support the view that BoJ policy was too tight after 2013 but well within what might be expected according to (2) to (4). This is consistent with the earlier result that the 2013 policy change may not have represented a regime shift. Also interesting is that, for the US, Fed policy was mostly correct beginning the early 2000s but too loose prior to that. Similarly, ECB policy was too tight since the sovereign debt crisis and just about correct during the first ten years of the euro's existence.



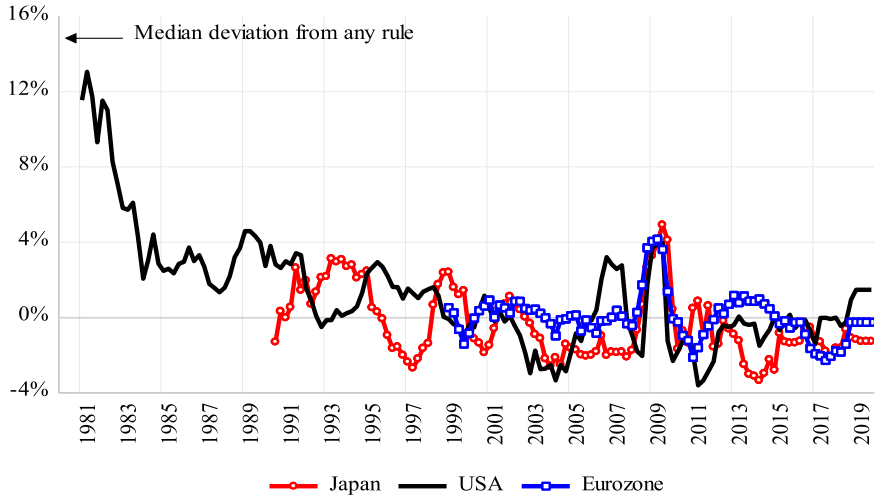


Fig. 5. Departures from Selected Policy Rules
Note: DEV is defined in Eq. (5). The figures above display median estimates obtained from 12 estimated of calibrated Taylor rules. The smallest deviations represent the most favorable rule (i.e., the one providing the greatest easing). The box below provided the details.

Calibration #	Taylor Rule Type	Coefficient on Inflation Gap, Output Gap
1, 4, 7, 10	Taylor 1993	.5, 1
2, 5, 8, 11	Balanced	.5, 2
3, 6, 9, 12	Taylor 1999	1.5, .5
MEASUREMENT OF VARIABLES Inflation: one-sided H-P filter; Output gap: Median estimate: 1, 2, 3 Inflation: one-sided H-P filter; Output gap: Median forecast: 4, 5, 6 Inflation: median inflation forecast; Output gap: Median estimate: 7, 8, 9 Inflation: median inflation forecast: Output gap: Median forecast: 10, 11, 12		

from Taylor rule type estimation.[37] This is done by estimating, via least squares, regressions where DEV_t is the dependent variables and a proxy for financial conditions, the real effective exchange rate gap, and central bank credibility, are the independent variables.[38] Since Fig. 5 also suggests that there is some persistence is DEV a one period lag in this variable is also added. Selected results are shown in Table 4, which accompany the ones shown n Fig. 5 (additional results are in the appendix Figures A1.11 and A1.12), suggest that Taylor rule type deviations are influenced by these variables, but the size and statistical significance of the various determinants is sensitive according to whether MED or MIN deviations are considered. Hence, one's interpretation of central bank responses to shocks is conditional on whether one examines the median or some other portions of the distribution of DEV. Below, I return to considering additional implications of this finding.

The most economically important factor is central bank credibility.[39] Moreover, in all three economies, lower credibility leads to a narrowing of DEV. This suggests that central banks do respond to the factors

[37] There is a large literature that adds variables such as exchange rates and financial stability proxies to Taylor rules of the kind shown in Eqs. (2)–(4).

[38] The proxy described earlier, estimated from PCA, is used because it provides the longest sample. Nevertheless, conclusions are unchanged when the IMF's proxy for financial conditions is used (see IMF *Global; Financial Stability Report*, April 2017; https://www.imf.org/en/Publications/GFSR/Issues/2017/03/30/global-financial-stability-report-april-2017). Separate testing (not shown) shows that there is a slight phase delay between the IMF's estimate of financial conditions and ones derived here from the financial variables described earlier. In particular, the PCA generated proxy is more synchronous with actual financial developments than is the IMF's proxy which appears to contain a forward-looking component.

[39] Although credibility is related to inflation performance it is, at best, a highly variable and non-linear relationship since it is constructed from inflation and real GDP growth forecasts and not directly from observed inflation (see Bordo and Siklos, 2019). It should be stressed that the interpretations below are not intended to be causal.

that contribute to changing credibility and are especially sensitive to a loss of credibility. Other than the financial conditions proxy, all other determinants are economically small when they are statistically significant. Regardless of the chosen proxy a tightening of financial conditions is associated with a decline in DEV. This suggests that all three central banks may be interpreted as engaging in some 'leaning against the wind'. However, the size of the estimated coefficients indicates that the U.S. Fed engaged in the least amount of LAW. It is worth noting that while credibility is usually highly significant, whether the MIN or MED versions of DEV are examined, the size of the coefficient on this variable is considerably larger for the MIN case. Therefore, deviations from some version of the Taylor rule (almost always of the balanced variety) responds most sharply when the most favorable view of how all three central banks set monetary policy is assumed. As with many of the other characteristics of policy setting the bottom line is that how central banks respond, and what they respond to, may well be sensitive to how far inflation is from some objective.

I explore the foregoing possibility in more detail in Fig. 6 which shows, for all three economies considered, how inflation responds to central bank credibility among other potential determinants. Estimates are based on a factor-augmented quantile regression (RS-FAQR), conditional on previously estimated regime shifts, which can be written as

$$Q\left(\tau\left|\mathbf{X}_{jt},\boldsymbol{\beta}_s(\tau)\right.\right)=\mathbf{X}'_{j(t-i)}\boldsymbol{\beta}_s(\tau)+\boldsymbol{\delta}_{jt}\mathbf{D}_t+\varepsilon_t(\tau) \tag{6}$$

where Q indicates that the regression of inflation is estimated over quantiles τ, that the estimated coefficients are regime-specific, and where $\mathbf{X}$ is the matrix of independent variables j. $\mathbf{D}$ is a regime shift vector obtained either from common break tests, where the regime shifts are endogenously estimated, or via the imposition of regime shift dummies based on the historical narratives for each economy considered (see Table 1).

The variables that make up $\mathbf{X}$ are the same as the ones used to explain variations in DEV (see Eq. (5)). To repeat, they consist of: a measure of financial conditions, here the index constructed from the PCA approach outlined earlier, the real exchange rate gap, the median output gap, and central bank credibility.[40] One lag for each right-hand side variable is deemed adequate (i.e., $i=1$). The dating of regime changes is based on the results in Tables 1 and 3 where either break dates are estimated or are chosen based on historical evidence. The endogenously estimated regime switch dates are based on Bai and Perron (1998, 2003a, 2003b) as extended to the search for a common break by Bai (2010). Coefficient estimates for quantiles ranging from 0.1 to 0.9 are shown in Fig. 6 with statistically significant quantiles (at the 10% level) highlighted by the shaded areas.

In general, all three economies reveal that greater central bank credibility reduces inflation in the first estimated regime. That said, in the first regime, while all quantiles are statistically significant for Japan (i.e., coefficient c(4)), only the lower quantiles are significant for the U.S. while changes in credibility impact only the upper quantiles for the Eurozone. Therefore, there is a tendency for changes in credibility in the tail to matter for inflation in the U.S. and the Eurozone while inflation throughout the distribution of credibility influences inflation in Japan. The situation changes in the second regime (i.e., coefficients c(13) and c(14)). Now, changes in credibility in the lower tail (i.e., $\tau<0.3$ for Japan and $\tau<0.5$) no longer impact inflation in Japan and the Eurozone while the entire distribution of central bank credibility impacts U.S. inflation (i.e., c(14)). Estimates for a third regime are available only for Japan (i.e., coefficients c(22) and c(23)) when the historical narrative approach is applied. Once again only some of the lower and upper tail quantiles for credibility (i.e., $\tau=$ [0.2,0.3] and [0.8,0.9]) lagged one period impact inflation.

Overall, estimates based on dating chosen via historical narratives are compatible with the estimated ones for all three economies based on the sign of the relationship between credibility and inflation, even if the estimated coefficients are not the same size. The bottom line is that central bank credibility is crucial to inflation regardless whether regime shifts are endogenously estimated or chosen based on historical evidence. The main difference between the two styles of regime shift selection is the size of the inflation response to a credibility shock. Therefore, if it does take a regime shift to change inflation, but this must come from increased central bank credibility.[41] An announcement may not be enough. Moreover, it is not the case that all regime shifts are associated with dramatic policy shifts.

While deviations from the Taylor rule recommendation provide some insights about the conduct of monetary policy, the picture is incomplete. As noted previously, another common assessment tool of monetary policy consists in tracing out the impact over time of shocks on economic variables of interest such as inflation and real economic growth. Hence, I next examine as the average response to a credibility shock by obtaining impulse responses from factor-augmented local projections (FALP) of the form

$$\pi_{t+h}=\boldsymbol{\mu}_h+\boldsymbol{\beta}_h\mathbf{X}_{\mathbf{t}-i}+\boldsymbol{\alpha}_h\mathbf{D}_t+\boldsymbol{\varepsilon}_t \tag{7}$$

where $h=0,\ldots,10$ is the horizons for the linear projection and $\mathbf{X}$ was previously defined. The local projection impulse responses of inflation (π) with respect to $\mathbf{X}$ is $\{\boldsymbol{\beta}\}_{h\geq 0}$. The vector, $\mathbf{D}_{t,}$ captures regime shifts, assumed exogenous, defined according to whether they are, respectively, estimated or historically chosen relying on the same dates as ones used to estimate Eq. (6). Since, as above, the signs (but not necessarily the sizes) of the responses are the same regardless of how regime shifts are estimated Fig. 7 displays the results for the endogenously selected regime changes only. Also, given foregoing discussion, I will focus on the nexus linking credibility, inflation, the (median) output gap, and financial conditions.

Recall that regime shifts, as defined above, are accounted for. The selected impulse responses shown in Fig. 7 suggest[42] that lower central bank credibility raises the output gap, that is, creates conditions wherein there is an excess in observed versus trend output. Otherwise, a few differences emerge. Higher credibility reduces inflation in Japan and the Eurozone. Credibility seems to have, on average no significant impact on inflation in the U.S. Of course, it is well known that the Fed has a dual mandate that considers more than inflation. Note that, the credibility proxy used here does contain some information from real GDP forecasts (see Eq. (2)). Alternatively, it may be that the credibility effect is dominated by the result reported above, namely that credibility and inflation are unrelated in the U.S. since the GFC.

Tighter financial conditions impact credibility at all three central banks and this is indicative that central banks are responsive to financial stability concerns. Nevertheless, whereas tighter financial conditions reduce credibility in Japan and the U.S., the same stance produces an improvement in credibility in the Eurozone. In the case of the Eurozone the previous result may be explained by the association of lower credibility with looser financial conditions. Similarly, the link between changes in financial conditions and credibility is seen as due to the reduction of credibility that follows a loosening of financial conditions in both Japan and the U.S. Hence, there is an element of LAW after all in the U.S. and the Eurozone but not so in Japan which appears not to LAW. All the re-

[40] Other variables such as a lag in inflation (domestic and/or U.S. inflation) did not alter the conclusions discussed below (not shown).

[41] Adding a lagged U.S. inflation term, to account for potential spillover effects, does not change the conclusions.

[42] I tried estimating quantile FALP, but the results are unlikely to be very informative since there is considerable heterogeneity in the relationship between credibility and inflation across the three economies and regimes considered.

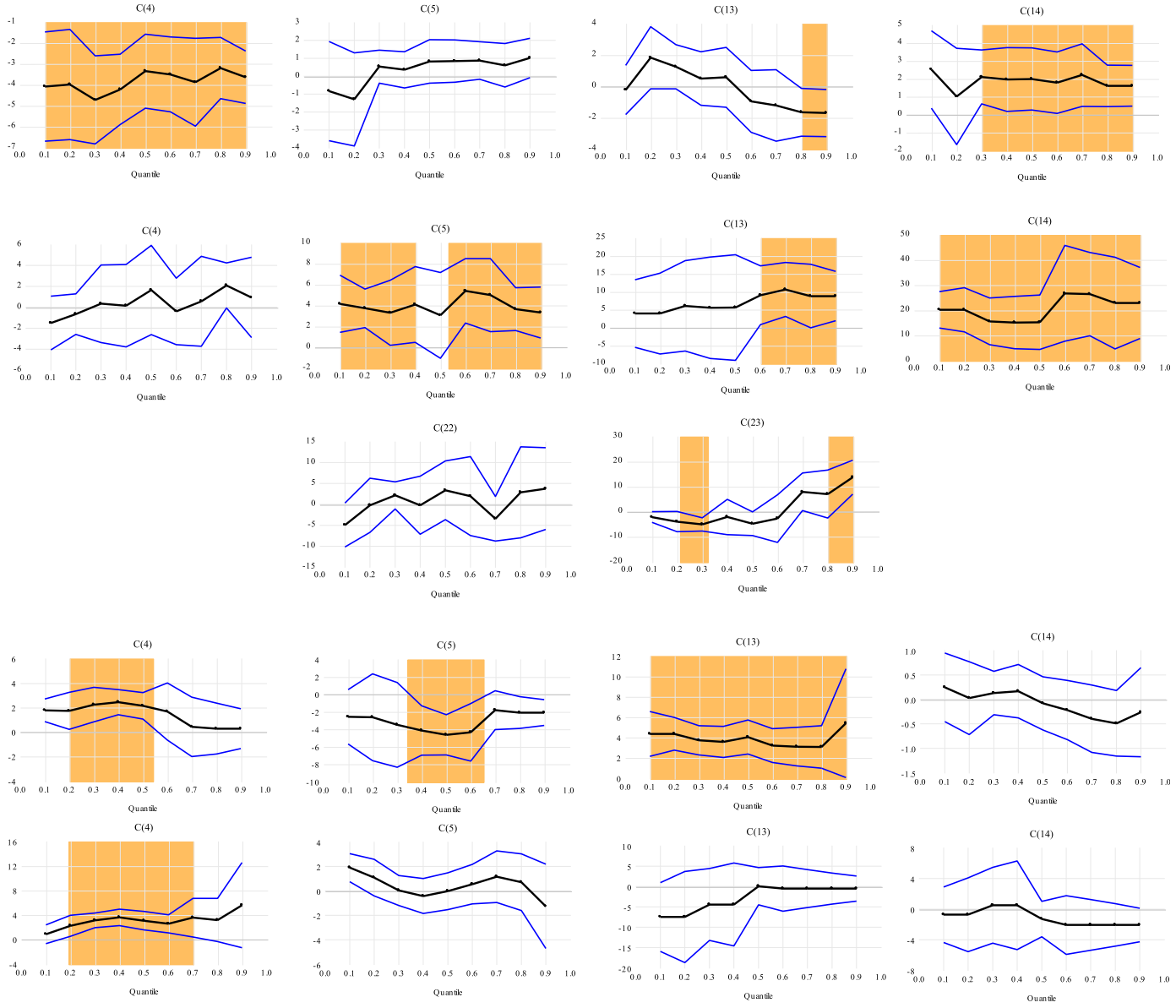


Fig. 6. JAPAN

Note: C(4), C(5), C(13), C(14), C(22), C(23) are coefficient estimates of the impact of credibility (CREDN4B) on inflation based on the factor -augmented quantile regression given by Eq. (6). The first two (C(4), C(5)) estimates are for the first regime, the second two (C(13), C(14)) estimates for the second regime, the last two (C(22),C(23)) estimates for the third regime. C(4), C(13), C(22) are the contemporaneous coefficients; C(5), C(14), and C(23) are coefficients lagged on period. Estimates in the first row are based on narrative breaks; estimates in the second (and third) row are based on endogenously estimated. Endogenously estimated breaks are: 1990Q2, 1998Q2 (Japan); 1987Q2, 2008Q4 (USA); 2008Q4 (Eurozone). Narrative breaks are: 2013Q1 (Japan), 2008Q3, 2012Q1 (USA), 2008Q3 (Eurozone). See Table 1 for descriptions. Shaded areas indicate statistically significant coefficients at the 10% level of significance.

Fig. 6 (cont'd) U.S.A.

Note: C(22) and C(23) all highly insignificant at all quantiles for both the endogenously estimated and narrative breaks and are not shown to conserve space.

Fig. 6 (cont'd) Eurozone.

sults, except for the LAW result for Japan, are generally consistent with the quantile and Taylor rule methodologies reported above.[43]

4. Conclusions: whither 'Japanification'?

For over a decade, the view that policy making in Japan differs markedly from that implemented in other large, systemically important, economies such as the U.S. and the Eurozone brought comfort and succor to observers who felt that they could escape the threat of

[43] I note that the estimated or historical dummies are not statistically significant (at least at the 10% level of significance) in all equations in the VARs. For the endogenously estimated breaks, the dummies for Japan are significant for the real exchange rate equation and financial conditions for the historically determined break. For the U.S. estimated breaks impact inflation, financial conditions, the real exchange rate and output gaps equations; historical break dates impact the output and real exchange rate gaps equations. In the Eurozone case, estimated breaks are significant in the inflation, output gap, and financial conditions equations; only the inflation equation is significantly impacted by the addition of breaks. I also tried alternatives to the Choleski ordering discussed above by placing the real exchange rate and financial conditions ahead of central bank credibility. None of the conclusions in Figs. 6 and 7 are impacted.

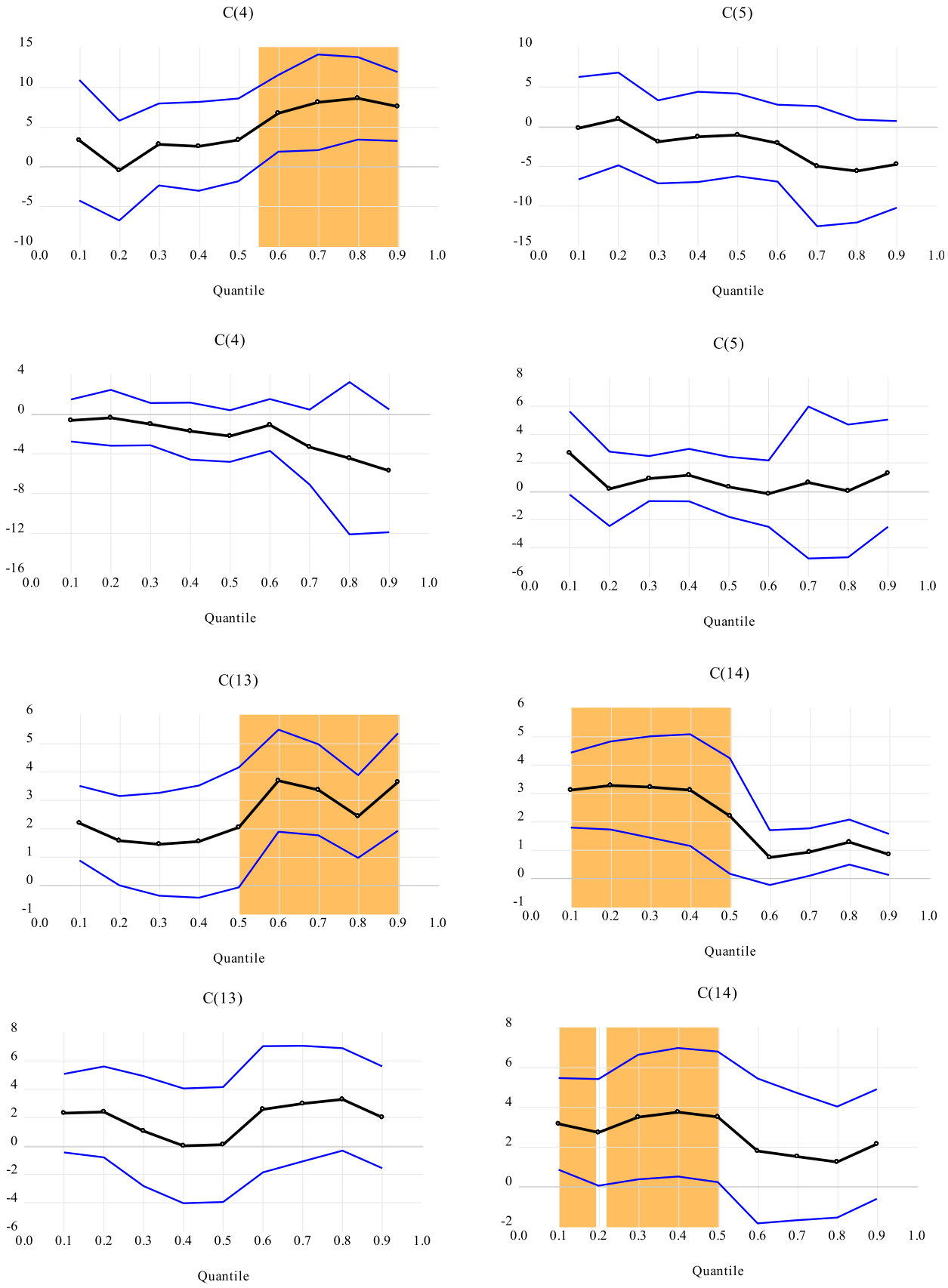


Fig. 6. Continued

Table 3
Searching for common breaks.

(i) Inflation: observed vs. median forecast

Japan		United States		Eurozone	
80Q1–19Q2 [observed]	85Q3–19Q4 [forecast]	81Q1–19Q2 [observed]	80Q1–19Q4 [forecast]	97Q1–18Q4 [observed]	89Q4–19Q4 [forecast]
2016Q2	2014Q4	2014Q3	2014Q3	2013Q2	*2013Q3*
2008Q4	2008Q4	2008Q3	2008Q3		2008Q4
1998Q4	1998Q3	*1991Q3*	*1997Q4*		1997Q2
1993Q3	**1994Q2**	**1982Q2**	*1991Q2*		**1996Q1**
1981Q4	1992Q3		*1997Q4*		
	1986Q4		**1981Q3**		

(ii) Real GDP (log)

Japan: 80Q1–19Q1	United States: 80Q4–19Q2	Eurozone: 95Q1–19Q2
2014Q1	2012Q2	2012Q2
2008Q3	2012Q4	2012Q4
1998Q4	**2008Q4**	**2008Q4**
1993Q2	2007Q4	2002Q4
1992Q1	1990Q3	
1982Q2	1981Q3	

(iii) Real GDP growth forecasts and the output gap

Japan: 90Q13–19Q2		United States: 80Q1–19Q2		Eurozone: 95Q1–19Q2	
FORECAST	OUTPUT GAP	FORECAST	OUTPOUT GAP	FORECAST	OUTPUT GAP
2014Q2	2001Q1	2008Q3	2016Q2	2001Q1	2018Q3
2005Q1	2009Q3	2006Q1	2009Q3	**2004Q1**	2009Q3
2008Q1	**2008Q1**	**2001Q4**	2006Q3	2002Q1	**2008Q2**
1994Q4	2000Q1	1996Q4	**1999Q2**		2002Q1
	1995Q2	1984Q3	1998Q4		
			1984Q3		

Note: in bold the first estimated break. Subsequently breaks are estimated from the beginning of the sample to the first break; then from the quarter following the first estimated break to the end of the sample. Highlighted are breaks that are common across two or more economies. All tests conclude that (log) real GDP are I(1) with the estimated breaks shown. Breaks are listed from most recent to earliest. Also see notes to Table 2. Bai's (2010) test is used to search for common breaks between inflation or real GDP growth and expected inflation or the (median) output gap.

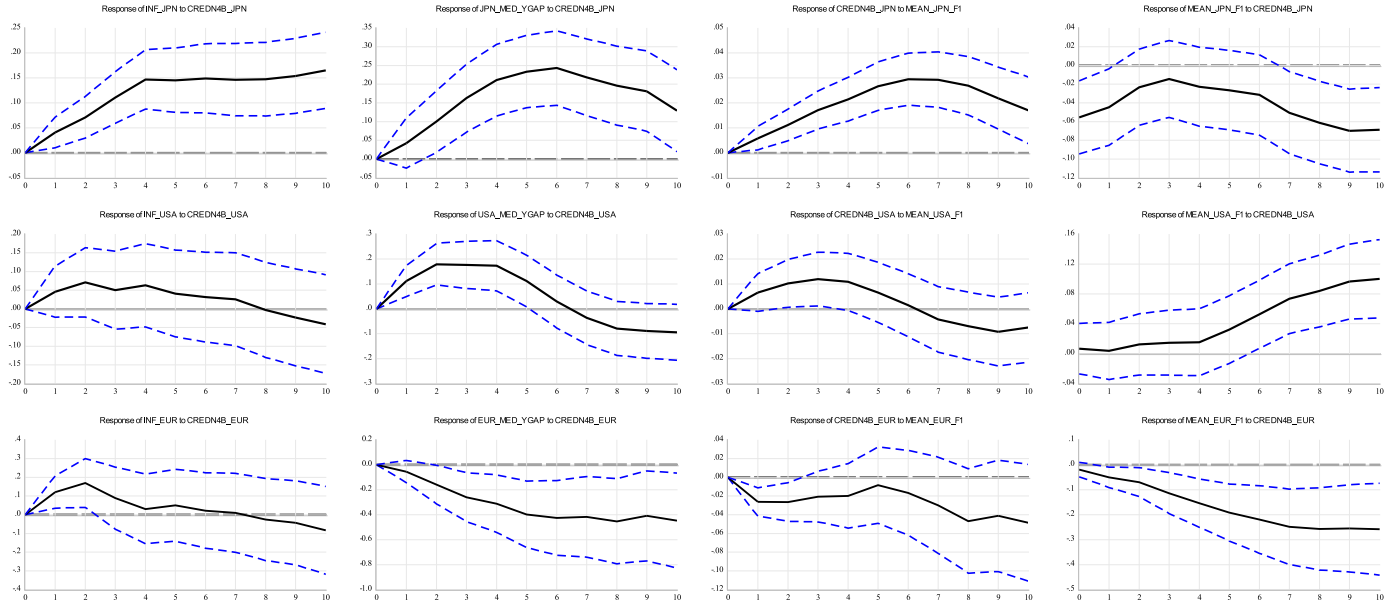


Fig. 7. Factor Augmented Local Projection Impulse Responses
Note: impulse responses are based on estimates of Eq. (7). One lag is used for Japan and the U.S., 2 lags for the Eurozone. JPN, USA, and EUR are respectively: Japan, the U.S., and the Eurozone. MED indicates that a median estimate is used. CREDN4B is the credibility estimate described in the main body of the paper based on the lagged observed inflation version of the credibility proxy since other versions were not very different but provide fewer observations. F1s the PCA generated proxy for financial conditions. YGAP is the (median) estimate of the output gap as described in the main body of the text. Dashed lines are 90% confidence intervals.

Table 4
Explaining deviations from the Taylor rule.

(a) Smallest Deviations: Eq. (5)				
Dependent Variable: Minimum deviations from Taylor Rule - JAPAN				
Sample (adjusted): 1990Q3 2017Q4				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	–4.03	0.74	–5.48	0.00
Real exchange rate GAP	0.07	0.02	3.68	0.00
Monetary Policy Credibility	*–7.16*	*1.72*	*–4.17*	*0.00*
Economic Policy Uncertainty	0.03	0.00	5.45	0.00
Lagged (1 period) DEV from US Taylor rule	0.34	0.08	4.42	0.00
1st Principal Comp. of inflation forecast	–1.00	0.26	–3.89	0.00
R-squared	0.49			–3.44
Adjusted R-squared	0.46			1.98
Dependent Variable: Minimum deviations from Taylor Rule- USA				
Sample (adjusted): 1985Q1 2017Q4				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	–3.41	0.92	–3.73	0.00
Real exchange rate GAP	–0.01	0.04	–0.25	0.80
Monetary Policy Credibility	*6.16*	*1.57*	*3.92*	*0.00*
Economic Policy Uncertainty	–0.02	0.01	–1.86	0.07
1st Principal Comp. of inflation forecast	–0.93	0.39	–2.40	0.02
R-squared	0.14	Mean dependent var –3.68		
Adjusted R-squared	0.11	S.D. dependent var 2.61		
Dependent variable: minimum deviations from Taylor rule - Eurozone				
Sample (adjusted): 2003Q1 2017Q4				
Included observations: 60 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	–0.90	0.63	–1.42	0.16
Real exchange rate GAP	–0.02	0.02	–0.79	0.43
Monetary Policy Credibility	*–1.60*	*0.59*	*–2.71*	*0.01*
Economic Policy Uncertainty	0.00	0.00	0.80	0.43
Lagged (1 period) DEV from US Taylor rule	0.28	0.05	5.32	0.00
Long versus Short-term rate spread	0.17	0.32	0.55	0.58
1st Principal Comp. of inflation forecast	–1.53	0.14	–11.13	0.00
R-squared	0.79	Mean dependent var –2.47		
Adjusted R-squared	0.77	S.D. dependent var 1.44		
(b) Median Deviations				
Dependent variable: median deviations from taylor rule - Japan				
Included observations: 110 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.34	0.66	2.01	0.05
Real exchange rate GAP	0.13	0.02	7.74	0.00
Monetary Policy Credibility	*–1.94*	*1.55*	*–1.25*	*0.21*
Economic Policy Uncertainty	0.00	0.00	0.53	0.60
Lagged (1 period) DEV from US Taylor rule	0.41	0.07	5.88	0.00
1st Principal Comp. of inflation forecast	–1.37	0.23	–5.90	0.00
R-squared	0.53	Mean dependent var –0.32		
Adjusted R-squared	0.51	S.D. dependent var 1.87		
Dependent variable: median deviations from Taylor rule - USA				
Method: Least Squares				
Sample (adjusted): 1985Q1 2017Q4				
Included observations: 132 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.10	0.69	1.60	0.11
Real exchange rate GAP	–0.01	0.03	–0.16	0.87
Monetary Policy Credibility	*5.01*	*1.18*	*4.24*	*0.00*
Economic Policy Uncertainty	–0.02	0.01	–2.49	0.01
1st Principal Comp. of inflation forecast	–0.54	0.29	–1.87	0.06
R-squared	0.15	Mean dependent var 0.56		
Adjusted R-squared	0.13	S.D. dependent var 1.98		
Dependent variable: median deviations from Taylor rule - Eurozone				
Method: Least Squares				
Sample (adjusted): 2003Q1 2017Q4				
Included observations: 60 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.59	0.79	3.29	0.00
Real exchange rate GAP	0.04	0.03	1.41	0.17
Monetary Policy Credibility	*–0.36*	*0.73*	*–0.49*	*0.63*
Economic Policy Uncertainty	–0.01	0.00	–2.54	0.01
Lagged (1 period) DEV from US Taylor rule	0.15	0.06	2.31	0.02
Long versus Short-term rate spread	–0.33	0.39	–0.84	0.40
1st Principal Comp. of inflation forecast	–1.25	0.17	–7.31	0.00
R-squared	0.64	Mean dependent var 0.06		
Adjusted R-squared	0.60	S.D. dependent var 1.35		

Note: Estimated via least squares. Inflation forecasts are mean of available inflation forecasts. The text contains more details.

a 'lost decade'. Fast forward to today and worries that 'Japanification' can spread have become real.

This paper has attempted to marshal both narrative and econometric evidence to suggest that, at least in the case of monetary policy, the Bank of Japan's performance does not always stand out from the Fed and the ECB as much as many previously cited observers believe. That is not to say, of course, that differences between the three economies studied here do not exist. Clearly, inflation and inflationary expectations have been relatively lower in Japan than in either the U.S. or the Eurozone for well over a decade. Nevertheless, and despite the fact that the 'mass' of inflation performance includes a substantial amount of deflation, there is far less evidence of this phenomenon spreading to inflationary expectations. Even when inflation performance is negative it is usually in the zero to −1 percent interval, hardly evidence of a deflationary spiral.

Central bank credibility is a critical ingredient in influencing inflation performance and changes substantially over time unlike most models where it is assumed to be perfect. Indeed, changes in credibility are often associated with key events such as financial crises or changes in policy strategy. Nevertheless, while the Fed and the ECB lost considerable credibility in the run-up to the GFC and the Eurozone's sovereign debt crisis the BoJ did not suffer a comparable loss. Perhaps this is one reason why the introduction of QQE in 2013 does not show up as a dramatic event. If this is the case then it is unclear why a regime shift, that is, a change in policy strategy, that aims to raise inflation will suffice when there is an unchanged risk that inflation target misses will be just as likely at higher inflation rates. Stated differently, higher monetary policy uncertainty may well be the price paid for an attempted regime shift.

Another complication is that all three central banks evince a concern for financial conditions. Tighter financial conditions reduce central bank credibility in Japan and the U.S. but not the Eurozone. However, a reduction of credibility is also associated with tighter financial conditions in Japan and the Eurozone but looser financial conditions in the U.S. There is a potential unpleasant loop wherein, for Japan and the Eurozone, a fall in credibility leads to tighter financial conditions which, in turn, leads to additional credibility losses. Only for the U.S. is the reduction in credibility stemming from tighter financial conditions reversed by raising central bank credibility.

Several extensions to the foregoing analysis follow. First, asymmetries between rising and falling inflation were not considered. After all, between the end of 1998 until the end of 2017, inflation has been below zero considerably more often than it has been positive though, as noted above, rarely below −1%. However, it may well be that the link between credibility and inflation differs between periods of rising versus falling inflation. Next, there is no consensus yet on how to definitively measure financial conditions. Once we have a clear idea of how these evolve over time the relationship between credibility, financial conditions and inflation needs to be reconsidered. Perhaps more importantly, data limitations prevent conditioning the results presented here on the stop-go nature of fiscal policy and how this may have spilled over into inflation and growth expectations. Finally, it would be helpful if additional evidence were brought to bear on the question whether the myth of Japan's 'failure' is the new narrative that ought to replace the current one.

Perhaps another lesson is that we need to be careful not to conflate great events, such as the GFC, with many other events that can also give rise to structural breaks as defined by econometricians. A narrative approach suggests potentially many more candidates for regime shifts than does econometric testing. However, the narrative approach also potentially leaves too few observations between regimes to provide useful assessments of reactions to policy changes. Indeed, another possibility is that regime shifts that need to concern policy makers most result from the slow build-up of shocks over time until a tipping point is reached.

Unfortunately, the results presented here do not point to obvious ways Japan, or any other economy, can escape its current predicament. While it is reasonable to suggest that passive monetary policy may well have prevented much worse outcomes the experience of the past three decades also suggest that a return to an era of higher growth and higher inflation will not be found in the conduct of monetary policy alone. Whether the appropriate response is even more aggressive policies is another matter since the wisdom of this kind of reaction is based on very few observations. Clearly, there are dangers in looking at policy solely from the rear-view mirror.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.aglobe.2021.100003.

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