NBER WORKING PAPER SERIES

DOES IT MATTER IF STATISTICAL AGENCIES FRAME THE MONTH'S CPI REPORTON A 1-MONTH OR 12-MONTH BASIS?

Jeffrey A. Frankel
Ayako Saiki

Working Paper 23754
http://www.nber.org/papers/w23754

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 2017

The authors would like to thank Katharine Abraham, David Levin, and Richard Thaler for useful comments on an earlier draft. This research was undertaken while Saiki was working at De Nederlandsche Bank (DNB). She would like to thank Zion Gorgi and Martin Admiraal of DNB for valuable help. The views expressed here are solely those of the authors and do not necessarily reflect the views of DNB or the National Bureau of Economic Research.

At least one co-author has disclosed a financial relationship of potential relevance for this research. Further information is available online at http://www.nber.org/papers/w23754.ack

Does It Matter If Statistical Agencies Frame the Month's CPI Reporton a 1-Month or 12-month Basis?

Jeffrey A. Frankel and Ayako Saiki

NBER Working Paper No. 23754
August 2017
JEL No. E44,E7,F3,G15,G4

ABSTRACT

When the US Bureau of Labor Statistics releases new numbers, in theory it should make no difference whether the press release emphasizes the most recent 1-month number, which is what it always does, or the 12-month number, as many other countries' statistical agencies do. This paper offers the hypothesis that it does matter: Markets react to CPI inflation news via whichever framing the agency has adopted.

Jeffrey A. Frankel
Harvard Kennedy School
Harvard University
79 JFK Street
Cambridge, MA 02138
and NBER
jeffrey_frankel@harvard.edu

Ayako Saiki
Tokyo International University
Institute of International Strategy
1-31-1 Matobakita
Kawagabe, Saitama
Japan
ayako@brandeis.edu

Official statistical agencies report GDP numbers every quarter and industrial production, inflation, and various employment measures every month. The complete statistical report that is released and posted on agency websites contains a lot of information. But in the United States, the agency's website and the headline and/or lead sentence of the agency's press release clearly and consistently emphasize the figure for the most recent period: the most recent quarter for the rate of growth in GDP and the most recent month for the CPI, Industrial Production, or employment (change from the previous month). In many other countries, the website and the headline or lead sentence of the press release emphasize instead the change over the preceding one-year interval – such as Canada and most European countries for CPI inflation, China and Taiwan for the GDP growth rate, Switzerland for industrial production, or Japan and Korea for change in employment.[1]

Economists' logic would say that it cannot make any difference what the agency chooses to emphasize in the website or press release that it gives to journalists and the public, so long as all the information is made available at the same time (including the estimate for the most recent period, revised numbers for one or more preceding periods, and the number for the preceding 12-months or 4 quarters). A standard criterion for the efficiency of financial markets is that they process all available government statistics. But the hypothesis explored in this paper is that it does make a difference, that financial markets tend to react relatively more strongly to the most recent number in countries such as the United States and to react relatively more strongly to the 12-month number in countries where that is the one emphasized in the press release.

Macroeconomists steeped in the literature on statistical effects of government announcements may find the proposed outlook unfamiliar.[2] The hypothesis will be less

[1] There are also other systematic differences in the way that governments report statistics in different countries. In the United States, quarterly GDP growth rates are compounded to express them at annual rates, approximately equal to multiplying the quarterly numbers by four. Europeans and others do not compound or multiply by four. The US Bureau of Labor Statistics (BLS), on the other hand, does not compound the percentage change in the CPI or PPI nor multiply by 12 in its press releases; as a result, inflation news reports usually headline an uninformative 0.1% number, for everything between 0.6% p.a. and 1.8% p.a. (i.e., between 0.05% and 0.15% per month). There are also international reporting differences with respect to headline versus core, seasonally adjusted versus not, etc. This paper is concerned only with the question of whether the releases emphasize the most recent period versus the last year.

[2] The necessary mental adjustment is perhaps analogous to what was needed 30 years ago to get macroeconomists interested in real-time government announcement effects in the first place. Some reactions were along the lines "why should we be interested in original announcements in dusty

surprising to those familiar with the evidence on psychological biases of framing and anchoring that has made its way into behavioral economics.[3] It may also be less surprising to market traders themselves, who do not feel they have the time to read the entire statistical release before rushing to participate in the market reaction. Given that the United States is the country that seems consistently to emphasize the most recent period in its statistical releases, the hypothesis considered here may also be of interest to those who believe that US financial markets suffer from "short-termism."[4]

Others have noted possible evidence of over-reaction to short-term noise, for example the fact that markets react strongly to the preliminary estimate of GDP but not to subsequent revisions. Well-targeted tests are hard to construct, however.

Bartolini, Goldberg and Sacarny (2008) are among those noting that the markets react to the advanced estimate of GDP but not noticeably to the revisions. This is important because Mankiw and Shapiro (1986), Faust, Rogers and Wright (2005), and others have documented that changes from the US flash estimate to the preliminary estimate, and from preliminary to revised, are usually large in magnitude. The market reactions don't necessarily prove irrationality or over-reaction, however, because the incremental value in each of the revisions might still be too small, when the first advanced number (even though highly imperfect) is already known. But it is highly suggestive that the Bureau of Economic Analysis stopped altogether reporting the preliminary flash estimate after 1985.[5] Whatever useful information there had been in the early estimate was apparently considered to be of less value than the danger that the public would read too much into a measure that BEA considered very noisy.

---

archives, when we have the correct revised numbers?" (A particular version of the rational expectations hypothesis had in effect held that economic agents intuit the true state of the economy, so that real time releases regarding economic statistics subject to subsequent revision would not be of interest.)

[3] E.g., Kahneman and Tversky (1984), Benartzi and Thaler (1995), De Bondt and Thaler (1996), Thaler, Tversky, Kahneman and Schwartz (1997), Daniel, Hirshleifer and Subrahmanyam (1998), Barberis, Shleifer and Vishny (1998), Barberis, Huang and Santos (2001), Daniel, Hirshleifer and Teoh (2002), Barberis and Thaler (2003), and Thaler (2005), among others.

[4] E.g., Bolton, Scheinkman and Xiong (2006) and Froot, Scharfstein and Stein (1992).

[5] "Terminology for the Quarterly Estimates," BEA (www.bea.gov/scb/account_articles/national/1093od/box1.htm).

Reporting practices in different countries

Table 1 shows the CPI reporting practices of different countries, as between most-recent-period versus 12-month change, and the corresponding reporting tendencies across countries of the important financial wire services (Bloomberg and Reuters). The United States is the country where the news clearly and consistently focuses on CPI inflation for the most recent month. The statistical agencies in Korea also give it emphasis. Correspondingly, the news services Bloomberg/World Process and Reuters tend to give greater emphasis to the month's number from the US, and somewhat less to the 12-month inflation rate. Most other countries do this differently. Canada and most European countries emphasize CPI changes on a 12-month basis in the official statistical reports. Bloomberg and Reuters follow suit in most of these countries.

Appendix Tables 1A and 1B report the corresponding information for GDP nd employment reporting practices. For GDP growth, the US has a lot more company in its short-termism. A majority of countries, including the UK, Canada, Japan, and the Eurozone, emphasize growth in the most recent quarter. The news outlets tend to do the same for these countries, reporting the most recent quarter. China and Taiwan, on the other hand, report GDP growth with an emphasis on the 4-quarter basis. In these two countries the media outlets again follow suit (Bloomberg and Reuters).[6]

[6] Baum, Kurov and Wolfe (2015) find that announcements of GDP and 11 other Chinese variables move stock markets worldwide.

Table 1: Reporting patterns for CPI statistics released by official agencies and financial news services across countries

Sept 19, 2014

	Countries and release agencies	Gov't agency	Bloomberg	Reuters
Americas	United States (BLS)	5	5	3
	Canada (Stat Canada)	1	1	1
	Mexico (National Statistic Institution)	2	3	3
	Brazil (Central Bank)	3	3	3
Eurozone	Belgium (Directorate-general Statistics)	5	2	2
	Finland (Stat Finland)	1	2	1
	France (INSEE)	2	1	3
	Germany (Statistisches Bundesamt)	1	1	1
	Ireland (Central Statistics Office)	2	1	1
	Italy (Istituto Nazionale di Statistica)	4	1	1
	NL (Centraal Bureau voor de Statistiek)	1	1	1
	Spain (Instituto Nacional de Estadistica)	2	1	1
	Eurozone (Eurostat)	1	1	1
Non-EZ Europe	Denmark (Denmark Statistik)	1	1	1
	Sweden (Statistics Sweden)	1	3*	3*
	UK (Office for National Statistics)	1	1	1
	Switzerland (Swiss Statistics)	5	1	3
Asia	Japan (Stat Bureau)	3	1	1
	Korea (Korea Statistics)	5	3†	3†

* English-language media tend to focus on MoM, while the local news services focus on YoY, consistent with the government release.
†English media tend to focus on YoY, while the local news services focus on MoM, consistent with the government release.

1 = Emphasis (e.g., headlines) is clearly and consistently on the 12-month version, even though the monthly basis is also contained somewhere in the announcement.
2 = Some emphasis on the 12-month version, but not consistently, relative to the shorter-term basis.
3 = Precisely equal emphasis on both versions.
4= Some emphasis on the shorter term basis, but not consistently, relative to the 12-month basis.
5 = Emphasis (e.g., headline or first sentence) is clearly and consistently on the monthly (or quarterly) version, even though the 12-month basis is also contained in the announcement.

Note: Each country reports monthly, except for Denmark which reports quarterly.

Source: (Bernford (2012) and authors' investigations from press releases and news services.
Appendix table 3a documents in more detail the basis for the classification of each country.

Reactions in bond markets

Statistical findings of jumps in interest rates in response to inflationary news, with a highly significant positive correlation, go back to the early 1980s, a time when Federal Reserve announcements of money supply numbers were important: Grossman (1981), Roley (1983), Urich and Wachtel (1981), Urich (1982), Naylor (1982), Cornell (1982), Engel and Frankel (1982, 1984), and Campbell, Schoenholtz and Shiller (1983). More recent papers, able to take advantage of larger and higher-frequency datasets, have similarly found interest rates rising or bond prices falling in reaction to news of higher inflation or stronger economic growth. They include Fleming and Remolona (1999), Goldberg and Leonard (2003), Ehrmann and Fratscher (2005), Gurkaynak, Sack and Swanson (2005), Andersen, Bollerslev, Diebold and Vega (2007), Faust, Rogers, Wang and Wright (2007), Paiardini (2014), Gilbert, Scotti, Strasser and Vega (2016) and Strasser (2017), among others.

We now examine the patterns of reaction in the bond markets of different countries. In this study, we focus on the effects of CPI announcements on the one-day change in 10-year bond prices, comparing them before and after the announcement. One could also look at the reactions in stock markets and foreign exchange markets.[7] But theory is ambiguous as to the predicted direction of reaction in those two markets: on the one hand, higher inflation itself should be bad news for the foreign exchange value of the domestic currency but, on the other hand, the likelihood that the monetary authority will react to the news by tightening is good news for the value of the currency. The same ambiguity applies to stock market reactions.

We could also look at the financial market reactions to official announcements of GDP, employment, or other measures of economic activity. But, again, there is a theoretical ambiguity. To the extent that news of strong growth raises interest rates, it should have a negative effect on bond prices, stock prices, and the exchange rate (price of foreign currency). But in each case there are also effects that go the other way (respectively: default risk, earnings growth, and the demand for money). Sure enough, others' studies of the effect of inflation and other economic announcements tend to find weaker effects on equity and foreign exchange markets than on bond markets and to explain this in terms of the ambiguous theoretical effect. To quote Bartolini, Goldberg and Sacarny (2008, p.2): "…the strongest effects are seen on interest-bearing assets…The effects of economic news on stock prices are

[7] E.g., Andersen, Bollerslev, Diebold and Vega (2007), Evans and Lyons (2005), Galati and Ho (2003), Love and Payne (2008), Koch and Yung (2016), and Caporale, Guglielmo, Spagnolo and Spagnolo (2016). It is a large literature. Studies of short-term reactions to monetary releases, for example, go back at least to Pearce and Roley (1985) in the stock market and to Engel and Frankel (1982, 1984) in the foreign exchange market. Neely and Dey (2010) survey the latter literature.

harder to predict…The consequences of economic news for exchange rates are also somewhat ambiguous."

Table 2: Reactions to CPI releases in countries that emphasize 12-month vs. 1-month news

Panel regression (with country fixed effects)

Dependent Variable: % change in 10-year government bond prices (from the day before the announcement to the day following)		
	(1)	(2)
Emphasis of Inflation Announcement	**12-month emphasis group**	**Month-on-month emphasis group**
Countries	**UK and Canada**	**US and Korea**
MoM Surprise†	0.002	**-0.019**
	[1.09]	**[-1.48]**
YoY Surprise†	**-0.006*****	0.002
	[-2.76]	[1.46]
Constant	-0.0003	0.0002
	[-1.28]	[0.61]
Number of observations	267	259
R^2	0.06	0.01
F-value	7.4	1.1
Prob > F	0.0007	0.33

*** Statistically significant at 1% level. (t-statistics are in parentheses.)

† Surprise =announcement minus forecast. The forecast is from an average of analysts' forecasts of that number (MoM or YoY) before the announcement (source: Bloomberg).

Sample period (by month of release)
Canada: February 2003 - August 2014
Korea: Feb 2004 - Dec 2013
UK: Dec 2003 - August 2014
US: February 2003 - August 2014

Table 2 above reports the results of regressions of the reactions to CPI releases of prices of 10-year bonds in four countries (% change of 10-year government bond price). The new CPI number is expressed as the difference from the forecast made immediately before the release. The forecast is measured as the average of analysts' forecasts compiled by Bloomberg. In line with much research on announcement effects ("news" or "event studies"), what should matter is the announcement relative to what the market had been expecting. The first right-hand side variable is the newly released CPI number for the most recent month. The other variable is the newly released inflation rate over the preceding 12-months.

The first regression, in column 1, applies to data from two countries that emphasize the 12-month inflation rate in the headlines of their press releases: Canada and the United Kingdom. The second regression, in column 2, applies to data from two countries that give more emphasis to the most recent month's CPI inflation: the US and Korea. Recall that all these countries make all the information available, both 1-month and 12-month; we are distinguishing the countries according to the headline habits of the statistical agencies in their press releases.

This table offers some preliminary support for the hypothesis. In Canada and the UK the expected reaction – the bond market falls when inflation is higher than expected – comes entirely with respect to the change over the preceding 12 months, which is the one that these authorities headline. The coefficient is negative and significant. But given that, as hypothesized they pay no attention to the month-on-month number. Its coefficient is insignificant and the sign is wrong. In the US and Korea, the signs are the other way around, as hypothesized: the negative reaction of bond markets to inflation news comes in the form of the reaction to the information about the latest month, though it narrowly misses being statistically significant (the P-value is 0.14).

We have also estimated the equation for each country individually (Appendix Table 2B). The findings are qualitatively similar. In the UK, it is again the 12-month number that has a statistically significant negative effect, with higher significance now that the country is considered on its own. But the significance of this coefficient in the case of Canada diminishes, compared to Table 2 where the data were grouped together with the UK. In the US and Korea it is again the month-on-month number that has the negative effect on bond prices, as hypothesized. The significance level goes up (becoming almost statistically significant at the 10% level for Korea, with aP-value of 0.11) but down slightly for the US, compared to Table 2 where the two were grouped together. Higher-frequency data would allow a test with higher power. Recall that studies with intra-daily data have found highly significant reactions to the statistical releases; we are just trying to pin down what form the reaction takes.

These results are preliminary. Further research could extend the tests to other statistical releases (measures of economic activity such as growth in GDP, industrial production, trade balance, and employment) and to reactions in other markets (equities and foreign exchange).

The highest priority should be to obtain data observed at a higher frequency: over an hour or half-hour interval, before and after each announcement. So far we only have data observed from one day to the next. But we know from the existing literature that reactions that are strong over a short interval can get swallowed up over a one-day interval, because a lot

of other things happen in the course of the day in addition to the statistical release.[8] Bartolini, Goldberg and Sacarny (2008), for example, find that the size and significance of the effect diminishes as one moves from the half-hour reaction, to a mid-day observation, to end-of-trading day, let alone over a 24-hour window: "the immediate effect can generally be measured more precisely than the full-day impact" and "…the immediate effects of economic news on asset prices are easier to assess than the full-day effects, because the accumulation of other shocks to asset prices through the business day makes the identification of persistent effects more difficult" (p.5).

Implications

No doubt these results require qualification. One theoretical possibility is that the most recent observation could carry relatively more genuine information about the economy in some countries than in others, and the statistical agencies could tailor their reporting tendencies in response to this.[9] But at this stage, the biggest qualification is that the data used here do not allow a sufficiently powerful test. The hypothesis needs to be tested more extensively, especially on higher-frequency datasets. It is also important to test the difference in impacts of GDP and Industrial Production announcements.

If the results in Table 2 do turn out to hold up, then the implications will be striking. As positive social science, the hypothesis is consistent with theories of framing and anchoring that are familiar in behavioral economics.

But it also might be relevant in a very practical way for the choice of reporting practices on the part of the US Bureau of Labor Statistics and Bureau of Economic Analysis and other official statistical agencies around the world. The limited word space in a media headline and limited cognitive space in human mental capacities are presumably the reasons for the observed tendency for agencies and news services to choose to focus on one measure above others: either the latest period or the 12-month average. Which focus is "best practice"?

There are reasons to deem the 12-month average more informative. It contains the information in the latest month or quarter and more beyond that. Even in a world of full rationality, the announcement of a 4-quarter average of GDP growth or a 12-month average of

[8] Preliminary tests of GDP and employment releases, and reactions in other markets, have not yielded very edifying results so far. This may be because of the coarseness of the one-day interval. Or it may be because of the theoretical ambiguities mentioned above, which take hold when we move away from the effect of inflation announcements on bond prices.

[9] This point was made to the author by Larry Summers.

employment growth contains important new information in addition to the latest period's number: revisions in the preceding quarters or months, which are often substantial. Of course these revisions are available elsewhere in the statistical release. But the hypothesis, and the supporting evidence in Table 2, suggests that a single headline number receives far more attention than other numbers in the release.

In addition, once we admit the likelihood of departures from full rationality, we must recognize that even if figures from previous months or quarters have not been revised, they may fade from people's awareness more quickly than is rational. We must consider that a focus on the most recent month or quarter may lead financial market participants and others to put too much weight on highly noisy short-term numbers, and to lose sight of the more meaningful medium-term trend. A 12-month or 4-quarter average is an efficient way to convey the recent trend. That much of the information in it was already available in the previous period's announcement of the one-year trend at that time does not necessarily mean that observers do not need to be reminded of it, in order to gain a good fact-based perspective. A 12-month or 4-quarter change also carries the extra advantage of avoiding problems of seasonal adjustment, which can sometimes be problematic.

If government statistical announcements could be made more informative, that could have implications well beyond the financial markets studies in this paper. Firms' hiring and investment decisions depend on their perceptions of the current state of the economy. There is even evidence that such decisions may respond more to the initial GDP releases, for example, than to the "true" state of economic activity as captured by the final GDP numbers.

Making it easier for the public to gain perspective on the state of the economy could have benefits as well for the participation of ordinary citizens in the political process. It is possible that most people do not even bother to follow economic statistics because the short-term noise is so great in what they hear or read that there is not much value in trying. Polls indicated that four years after the end of the great recession in mid-2009, a heavy majority of Americans thought that the country was still in recession.[10] One could give other examples of unawareness of economic statistics, from other stages in the business cycle and from other

[10] From 74% to nearly 80%. (Sources: Douglas McIntyre,"74% Believe U.S. Still in Recession," Jan. 23, 2014, 247Wallst.com; and Kenneth Walsh, "Poll: Nearly 80 Percent Thinks Economy Still in Recession" *US News and World Report*, Dec.17, 2013; and Polling Report, "Economic Outlook," 2014).

presidents' terms.[11] But what looks like ignorance may be a result of "rational inattention."[12] If it were made easier for the public to get a genuine reading on the state of the economy, it might help them in their lives as individual decision-makers in the economy and as voters in a well-functioning democracy.

References

Andersen, Torben, Tim Bollerslev, Francis Diebold, and Clara Vega (2007), "Real-Time Price Discovery in Global Stock, Bond and Foreign Exchange Markets," *Journal of International Economics,* 73(2), pp. 251 – 277.

Barberis, Nicholas, Ming Huang, and Tano Santos (2001), "Prospect Theory and Asset Prices," *The Quarterly Journal of Economics,* 116(1), pp.1-53.

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny (1998), "A Model of Investor Sentiment," *Journal of Financial Economics* 49(3), pp.307-343.

Barberis, Nicholas, and Richard Thaler (2003) , "A Survey of Behavioral Finance," in M. Constantinides & M. Harris & R. Stulz (ed.), *Handbook of the Economics of Finance*, Edition 1, volume 1, Chapter 18, pp. 1053-1128.

Bartolini, Leonardo, Linda Goldberg, and Adam Sacarny (2008), "How Economic News Moves Markets," *Current Issues in Economics and Finance* (Federal Reserve Bank of New York), 4(6).

Baum, Christopher F., Alexander Kurov, and Marketa Halova Wolfe (2015), "What do Chinese Macro Announcements Tell Us About the World Economy?" *Journal of International Money and Finance* 59, pp.100-122.

Baumohl, Bernard (2012), *The Secrets of Economic Indicators: Hidden Clues to Future Economic Trends and Investment Opportunities* (3rd Edition), FT Press.

Benartzi, Shlomo, and Richard Thaler (1995), "Myopic Loss Aversion and the Equity Premium Puzzle," *Quarterly Journal of Economics,* 110(1), February, pp. 73-92. Also NBER WP 4369.

Bolton, Patrick, José Scheinkman, and Wei Xiong (2006), "Executive Compensation and Short-Termist Behavior in Speculative Markets," *Review of Economic Studies*, 73(3), pp. 577-610.

Campbell, John, Kermit Schoenholtz and Robert Shiller (1983), "Forward Rates and Future Policy: Interpreting the Term Structure of Interest Rates," *Brookings Papers on Economic Activity*, 1, pp.173-217.

Caporale, Guglielmo Maria, Fabio Spagnolo, and Nicola Spagnolo (2016), "Exchange Rates and Macro News in

[11] Any change in procedure would be decided and announced during one president's term to take effect during the next.

[12] E.g., Mankiw, Reis and Wolfers (2003).

Emerging Markets," *Discussion Papers of DIW Berlin* No 1558, German Institute for Economic Research.

Cornell, Bradford (1982), "Money Supply Announcements, Interest Rates, and Foreign Exchange," *Journal of International Money and Finance* 1, pp. 201-208.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam (1998), "Investor Psychology and Security Market Under-and Overreactions," *The Journal of Finance* 53(6), pp. 1839-1885.

Daniel, Kent, David Hirshleifer, and Siew Hong Teoh (2002), "Investor Psychology in Capital Markets: Evidence and Policy Implications," *Journal of Monetary Economics,* 49(1), pp. 139-209.

De Bondt, Werner, and Richard Thaler (1996), "Financial Decision-making in Markets and Firms: A Behavioral Perspective," *Handbook in Operations Research and Management Science*, Vol. 9, Finance. NBER WP no. 4777.

Ehrmann, Michael, and Marcel Fratzscher (2005), "Equal Size, Equal Role? Interest Rate Interdependence between the Euro Area and the United States," *Economic Journal*, 115(506), pp. 930-950.

Engel, Charles, and Jeffrey Frankel (1982), "Why Money Announcements Move Interest Rates: an Answer From the Foreign Exchange Market," *Proceedings*, Federal Reserve Bank of San Francisco, Nov. 1982, pp.1-36. NBER WP 1049.

Engel, Charles, and Jeffrey Frankel (1984), "Why Interest Rates React to Money Announcements: An Explanation From the Foreign Exchange Market," *Journal of Monetary Economics*, 13(1), pp. 31-39.

Evans, Martin, and Richard Lyons (2005), "Do Currency Markets Absorb News Quickly?." *Journal of International Money and Finance* 24 (2), pp. 197-217.

Faust, Jon, John Rogers, Shing-Yi Wang, and Jonathan Wright (2007), "The High-Frequency Response of Exchange Rates and Interest Rates to Macroeconomic Announcements," *Journal of Monetary Economics* 54(4), pp. 1051-1068.

Faust, Jon, John Rogers, and Jonathan Wright (2005), "News and Noise in G-7 GDP Announcements," *Journal of Money, Credit and Banking*, 37(3), pp. 403-419.

Fleming, Michael, and Eli Remolona (1999), "Price Formation and Liquidity in the U.S. Treasury Market: The Response to Public Information," *Journal of Finance*, 54(5), pp. 1901-1915.

Froot, Kenneth, David Scharfstein, and Jeremy Stein (1992), "Herd on the Street: Informational Inefficiencies in a Market with Short-Term Speculation," *The Journal of Finance*, 47(4), pp.1461–1484.

Galati, Gabriele, and Corrinne Ho (2003), "Macroeconomic News and the Euro/Dollar Exchange Rate," *Economic Notes* 32(3), pp. 371-398.

Gilbert, Thomas, Chiara Scotti, Georg Strasser, and Clara Vega (2016), "Is the Intrinsic Value of Macroeconomic News Announcements Related to Their Asset Price Impact? " *Working Paper Series* 1882, European Central Bank.

Goldberg, Linda, and Deborah Leonard (2003), "What Moves Sovereign Bond Markets? The Effects of Economic News on U.S. and German Yields," *Current Issues in Economics and Finance*, no.9 (Federal Reserve Bank of New York).

Grossman, Jakob (1981), "The 'Rationality' of Money Supply Expectations and the Short-Run Response of Interest Rates to Monetary Surprises," *Journal of Money, Credit, and Banking*, 13, pp. 409-424.

Gurkaynak, Refet, Brian Sack, and Eric Swanson (2005), "The Sensitivity of Long-Term Interest Rates to Economic News: Evidence and Implications for Macroeconomic Models," *American Economic Review* 95(1), pp. 425-436.

Kahneman, Daniel, and Amos Tversky (1984), "Choices, Values, and Frames," *American Psychologist* 39(4), pp.341-350.

Koch, Christoffer, and Julieta Yung (2016), "Macroeconomic News and Asset Prices Before and after the Zero Lower Bound." *Globalization and Monetary Policy Institute Working Paper No. 287*, Federal Reserve Bank of Dallas, Oct. 1. http://dx.doi.org/10.24149/gwp287

Love, Ryan, and Richard Payne (2008), "Macroeconomic News, Order Flows, and Exchange Rates," *Journal of Financial and Quantitative Analysis* (Cambridge University Press), vol. 43(02), pp.467-488, June.

Mankiw, N. Gregory; Ricardo Reis, and Justin Wolfers (2003), "Disagreement About Inflation Expectations," *NBER Macroeconomics Annual 2003*, ed. by M. Gertler and K. Rogoff.

Mankiw, N. Gregory, and Matthew Shapiro (1986), "News or Noise: An Analysis of GNP Revisions," *Survey of Current Business*, 66, pp.20-25.

Mora, José V. Rodríguez, and Paul Schulstad (2007), "The Effect of GNP Announcements on Fluctuations of GNP Growth," *European Economic Review* 51.8, pp. 1922-1940.

Naylor, John A (1982), "Do Short-Term Interest Rate Expectations Respond to New Information on Monetary Growth?" *Southern Economic Journal*, 48(3), pp. 754-763.

Neely, Christopher J., and S. Rubun Dey (2010), "A Survey of Announcement Effects on Foreign Exchange Returns." *Federal Reserve Bank of St. Louis Review* 92.5, pp.417-463.

Paiardini, Paola (2014), "The Impact of Economic News on Bond Prices: Evidence from the MTS Platform," *Journal of Banking and Finance*, vol. 49(C), pp. 302-322.

Pearce, Douglas, and Vance Roley (1985), "Stock Prices and Economic News," *The Journal of Business*, University of Chicago Press, 58(1), pp. 49-67. Also NBER WP 958, 1982.

Rigobon, Roberto, and Brian Sack 2008), "Noisy Macroeconomic Announcements, Monetary Policy, and asset prices." *Asset Prices and Monetary Policy* (University of Chicago Press), pp. 335-370.

Roley, Vance (1983), "The Response of Short-Term Interest Rates to Weekly Money Announcements," *Journal of Money, Credit and Banking*, 15(3), pp.344-354.

Strasser, Georg (2017), "What Determines the Impact of Macroeconomic News on Asset Markets?" *Research Bulletin No. 37*, European Central Bank.

Thaler, Richard (2005), ed., *Advances in Behavioral Finance*, Volume 2 (Princeton University Press).

Thaler, Richard, Amos Tversky, Daniel Kahneman, and Alan Schwartz (1997), "The Effect of Myopia and Loss Aversion on Risk Raking: An Experimental Test," *The Quarterly Journal of Economics* Vol. 112 (2), May, pp.647-661

Urich, Thomas, and Paul Wachtel (1981), “Market Response to the Weekly Money Supply Announcements in the 1970s,” *Journal of Finance*, 36(5), pp.1063-1072.

Urich, Thomas (1982), “The Information Content of Weekly Money Supply Announcements,” *Journal of Monetary Economics*, 10(1), pp.73-88.

Appendix Table 1a: Reporting patterns for GDP statistics released by official agencies and financial news services across countries

		Focus of release (see below for definition)		
	Country and Release Agency	Government agency release	Bloomberg	Reuters
America	USA (BLS)	5†	5†	5†
	Canada (Stat Canada)	5#	5†	5†
	Mexico (INEIG)	1	5	4
	Brazil (Statistics Portal Brazil)	2	3	5
Eurozone	Belgium (Bank of Belgium)	1	5	4
	Finland (Stat Finland)	2	5	4
	France (INSEE)	5	5	5
	Germany (Statistisches Bundesamt)	5	5	5
	Ireland (Central Statistics Office)	5	5	5
	Italy (Istituto Nazionale di Statistica)	4	5	5
	NL (Centraal Bureau voor de Statistiek)	4*	5	5
	Spain (Instituto Nacional de Estadistica)	2	5	5
	Eurozone (Eurostat)	5	5	5
Non-Euro Europe	Denmark (Danmarks Statistik)	5	5	4
	Sweden (Statistics Sweden)	1	3	5
	UK (Office for National Statistics)	4	5	4
	Swiss (Statistics Swiss)	5	5	4
Asia	Japan (Cabinet Office)	5	5†	5†
	Korea (Bank of Korea)	5	5	4
	China	1	1	1
	Taiwan	1	1	1

Note regarding press statement accompanying the release of statistics:

1 = Emphasis is clearly on an annual basis.
2 = Some emphasis on the annual version, but not consistently, relative to the shorter-term basis.
3 = Precisely equal emphasis on both versions.
4 = Some emphasis on the quarterly basis, but not consistently, relative to the 12-month basis.
5 = Emphasis is clearly and consistently on the quarterly version.

Appendix Table 3b documents the basis for the classification of each country.

† Annualized Quarter-on-Quarter.
# Canada also reports *monthly* growth figures as a reference.
* The Netherlands Statistics Bureau (CBS) recently changed its focus from annual to quarterly (in 2012).

Appendix Table 1b Change in employment

	Definition	Focus of release		
		Government	Reuters	Bloomberg
Canada	People in Employment	MoM	MoM	MoM
Japan	People at Work	YoY	N/A*	N/A
US	Payroll Non-Farm Employment	MoM	MoM	MoM
Korea	Number of Employed	YoY	N/A	N/A

*In Japan and Korea, the news services almost exclusively report the unemployment *rates*, not changes in employment.

Appendix Table 2B: Reactions to CPI releases by individual country

Dependent Variable: % change in 10-year government bond prices (between the days before the announcement and the day following)				
Emphasis of Inflation Announcement	12-month inflation		Month-on-month	
Country	Canada	UK	Korea	US
MoM Surprise†	-0.0006	0.01	**-0.065**	**-0.02**
	[-0.21]	[0.03]	**[-1.61]**	**[-1.03]**
YoY Surprise†	**-0.002**	**-0.02*****	0.005	0.001
	[-0.70]	**[-3.56]**	[1.60]	[1.01]
Constant	-0.0002	-0.002	-0.0006	0.0008
	[-0.58]	[0.57]	[-1.37]	[1.55]
Number of observations	139	128	120	139
R^2	0.02	0.13	0.02	0.01
F-value	1.28	6.66	1.3	0.59
Prob > F	0.28	0.002	0.28	0.56

*** Statistically significant at 1% level. (t-statistics are in parentheses.)
Regressions use heteroscedasticity-consistent standard errors.
† Surprise ≡ announcement minus forecast. The Forecasts are the average of analysts' forecasts of that number (MoM or YoY) before the announcement. The source is Bloomberg.

Sample period (by month of release):

Canada: February 2003 - August 2014

Korea: Feb 2004 - Dec 2013

UK: Dec 2003 - August 2014

US: February 2003 - August 2014

Appendix Table 3 (a): Examples documenting Table 1: CPI -Wording of the latest release by authorities and Bloomberg, as of 2014

Country (manner of release by the government)*	Government Agency	Manner of announcement (and category)*	*Quotes from government releases and the Bloomberg*	
United States	BLS	Monthly	Official release(Sep 17, 2014)	Bloomberg (Sep 17, 2014)
5		(5)	The Consumer Price Index for All Urban Consumers (CPI-U) decreased 0.2 percent in August on a seasonally adjusted basis, the U.S. Bureau of Labor Statistics reported today. Over the last 12 months, the all items index increased 1.7 percent before seasonal adjustment.	The consumer-price index declined 0.2 percent, the first decrease since April 2013, a Labor Department report showed today in Washington. Excluding volatile food and fuel, the so-called core measure was unchanged, the first time it failed to increase in almost four years.
Sweden	Stat Sweden	Annual	Official release (Aug 12, 2014)	Reuters (Aug 12, 2014)
1		Govt (2) Media (5 for English, 2 for Swedish)	**Inflation rate 0.0 percent** The inflation rate was 0.0 percent in July 2014, down from 0.2 percent in June 2014. The Swedish Consumer Price Index (CPI) decreased by 0.3 percent from June to July 2014, while the CPI decreased by 0.1 percent from June to July 2013.	Swedish consumer prices fell slightly less than expected in July from the month before, official data showed on Tuesday, following a half-point rate cut early in July aimed at breathing life into falling consumer prices. The consumer price index fell 0.3 percent against a median forecast in a Reuters poll of economists for a 0.4 percent drop.
Canada	StatCan	Annual	Official release (Sep 19, 2014)	Bloomberg (Sep 19, 2014)
1		(1)	The Consumer Price Index (CPI) rose 2.1% in the 12 months to August, matching the increase in July.	The 12-month core inflation rate accelerated to 2.1 percent in August from July's 1.7 percent, faster than all 21 economist estimates in a Bloomberg survey. The total consumer price index rose at a 2.1 percent rate for a second month, matching economist forecasts.
UK	ONS	Annual	Official release (Sep 16, 2014)	Bloomberg (Sep 16, 2014)
1		(1)	The Consumer Prices Index (CPI) grew by 1.5% in the year to August 2014, down from 1.6% in July.	The rate of consumer-price growth fell to 1.5 percent from 1.6 percent in July, in line with the median forecast of economists and marking an eighth month below the Bank of England's 2 percent target.
Japan	Stat Japan	Annual	Official release (August 29, 2014)	Bloomberg (Aug 29, 2014)
3		(3)	The consumer price index for Japan in July 2014 was 103.4 (2010=100), the same level as the previous month, and up 3.4% over the year. The consumer price index for Ku-area of Tokyo in August 2014 (preliminary) was 102.0 (2010=100), up 0.2% from the previous month, and up 2.8% over the year.	Consumer prices excluding fresh food rose 3.3 percent from a year earlier, the same pace as June, the statistics bureau said today in Tokyo. Overall inflation was 3.4 percent and 2.3 percent excluding perishable food and energy.
Eurozone Total	Eurostat	Annual	Official release (Sep 17, 2014)	Wall Street Journal (Sep 17, 2014)
1		(1)	Euro area annual inflation stable at 0.4% Euro area annual inflation was 0.4% in August 2014, unchanged compared to July.	The annual rate of inflation in the 18 countries that use the euro was unchanged at 0.4% in August, as the European Union's statistics agency revised a previous estimate that recorded a decline to 0.3%
Germany	Destatis	Annual	Official release (August 28, 2014)	Bloomberg (Aug 28, 2014)
1		(1)	The inflation rate in Germany – measured by the change in the consumer price index on the same month a year earlier– is expected to stand at 0.8% in August 2014. Based on the results available so far, the Federal Statistical Office (Destatis) also reports that the consumer prices are expected to remain unchanged from July 2014.	In a separate release, the Federal Statistics Office said Germany's inflation rate stayed at 0.8 percent in August, in line with the median of 23 estimates in a Bloomberg News survey. Prices were unchanged on the month.
Korea	Stat Korea	Monthly	Official release (Sep 2, 2014)	Bloomberg (Sep 2, 2014)
5		Gov't (3) Media (1)	The Consumer Price Index was 109.45(2010=100) in August 2014. The index increased 0.2 percent from the preceding month and rose 1.4 percent from August 2013.	South Korea's three-year bonds advanced after data showed consumer prices rose in August by 1.4 percent from a year earlier, less than the 1.6 percent forecast by economists in a Bloomberg survey.

* Manner of emphasis

1 = Emphasis (e.g., headlines) is clearly and consistently on the 12-month version, even though monthly is also contained somewhere in the announcement.

2 = Some emphasis on the 12-month version, but not consistently, relative to the shorter-term basis.

3 = precisely equal emphasis on both versions.

4= Some emphasis on the shorter term basis (monthly), but not consistently, relative to the 12-month basis.

5 = Emphasis (e.g., headlines) is clearly and consistently on the monthly version, even though 12-month basis is also contained in the announcement.

Last updated Sep 24, 2014

Appendix 3(b): Examples documenting Appendix Table 1(a): GDP - Wording of the latest release by authorities and Bloomberg

Country (manner of release by the government)	Government Agency	Manner of announcement (and category)*	*Quotes from government releases and the Bloomberg*	
United States	BEA	Annualized Quarterly	Official release (July 30, 2014) Advanced estimate	Bloomberg (July 30, 2014)
5		(5)	Real gross domestic product -- the output of goods and services produced by labor and property located in the United States -- increased at an annual rate of 4.0 percent in the second quarter of 2014, according to the "advance" estimate released by the Bureau of Economic Analysis. In the first quarter, real GDP decreased 2.1 percent (revised).	Real gross domestic product -- the output of goods and services produced by labor and property located in the United States -- increased at an annual rate of 4.0 percent in the second quarter of 2014, according to the "advance" estimate released by the Bureau of Economic Analysis. In the first quarter, real GDP decreased 2.1 percent (revised).
Sweden	Stat Sweden	Annual (gov't)	Official release (July 30, 2014) Flash estimate	Bloomberg (July 30, 2014)
1		(1) Media: Quarterly	Sweden's GDP increased by 1.9 percent in the second quarter of 2014 compared with the same quarter in 2013	Gross domestic product grew a quarterly 0.2 percent in the three months through June after contracting 0.1 percent in the first quarter, Statistics Sweden said today, citing preliminary data. GDP was seen expanding 0.6 percent in a Bloomberg survey of 11 economists. The economy grew an annual 1.9 percent, compared with an estimate for 2.4 percent.
Canada	Stat Canada	quarterly and monthly	Official release (August 29, 2014)	Bloomberg (August 29, 2014)
5		(5) Media: Annualized quarterly	Real gross domestic product (GDP) rose 0.8% in the second quarter, following a 0.2% increase in the first quarter. This was the largest quarterly gain since the third quarter of 2011. On a monthly basis, real GDP by industry increased 0.3% in June.	Canada's gross domestic product rose at a 3.1 percent annualized pace from April to June, Statistics Canada said today in Ottawa, faster than the 2.7 percent economists forecast in a Bloomberg survey.
UK	ONS	Quarterly	Official release (August 15, 2014)	Bloomberg (August 15, 2014)
4		(4)	GDP increased by 0.8% in Q2 2014, the second consecutive quarter-on-quarter increase of 0.8%. This figure is unrevised from the preliminary estimate of GDP published on 25 July 2014.	Gross domestic product grew an unrevised 0.8 percent between April and June, the same as in the previous three months, the Office for National Statistics said in London today.
Japan	Cabinet	(Annualized) quarterly	Official release (Sep 8, 2014)	Bloomberg (Sep 8, 2014)
5		(5)	The figures are shown at http://www.esri.cao.go.jp/en/sna/data/sokuhou/files/2014/qe142/pdf/main_1e.pdf (No description available)	Gross domestic product shrank an annualized 7.1 percent in the three months through June, the most since the first quarter of 2009, the Cabinet Office said today in Tokyo.
Eurozone Total	Eurostat	Annual and Quarterly	Official release (Sep 5, 2014)	Bloomberg (Sep 5, 2014)
5		(4) Media: Quarterly	GDP stable in the euro area and up by 0.2% in the EU28: 0.7 and 1.2 respectively compared with the second quarter of 2013	Gross domestic product in the three months through June was unchanged from the first quarter, when it increased 0.2 percent, the European Union's statistics office in Luxembourg said.
Germany	Destatis	Quarterly	Official release (Sep 1, 2014)	Bloomberg (Sep 1, 2014)
5		(5)	The German economy is losing momentum. The gross domestic product (GDP) decreased 0.2% – upon price, seasonal and calendar adjustment – in the second quarter of 2014 compared with the previous quarter.	Gross domestic product in the Germany (...) fell 0.2 percent from the first quarter, when it rose a revised 0.7 percent, the Federal Statistics Office in Wiesbaden said today.
Korea	Kosis	Quarterly	Official release (April 24, 2014)	Bloomberg (April 24, 2014)
5		(5)	Real gross domestic product (chained volume measure of GDP) grew by 0.9 percent in the first quarter of 2014 compared to the previous quarter.	Gross domestic product grew 0.9 percent in January-March period from the previous quarter, the Bank of Korea said today in a statement in Seoul. From a year earlier, GDP increased 3.9 percent, the most in three years.

* Manner of emphasis

1 = Emphasis (e.g., headlines) is clearly and consistently on the 12-month version, even though quarterly is also contained somewhere in the announcement.

2 = Some emphasis on the 12-month version, but not consistently, relative to the shorter-term basis.

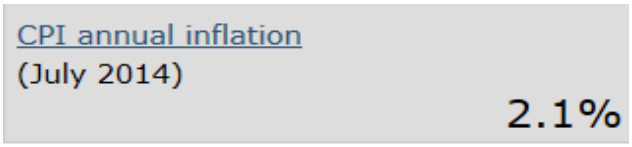
3 = precisely equal emphasis on both versions.

4= Some emphasis on the shorter term basis (quarterly), but not consistently, relative to the 12-month basis.

5 = Emphasis (e.g., headlines) is clearly and consistently on the quarterly version, even though 12-month basis is also contained in the announcement.

Last updated Sep 24, 2014

Appendix Table 4(a): CPI change reported on the top page of relevant stat agencies' websites

	Start Page	What is stated in the start and related page
US	 More detailed explanation CONSUMER PRICE INDEX – JULY 2014 The Consumer Price Index for All Urban Consumers (CPI-U) increased 0.1 percent in July on a seasonally adjusted basis, the U.S. Bureau of Labor Statistics reported today. Over the last 12 months, the all items index increased 2.0 percent before seasonal adjustment.	**Monthly** In neadline of CPI release, There seems to be an equal emphasis. but there is a focus on MoM in sub-component
Sweden	**Inflation rate** **0.0%** July 2014 compared to July 2013 More detailed explanation Inflation rate 0.0 percent The inflation rate was 0.0 percent in July 2014, down from 0.2 percent in June 2014. The Swedish Consumer Price Index (CPI) decreased by 0.3 percent from June to July 2014, while the CPI decreased by 0.1 percent from June to July 2013.	**Annual** However, the actual explanations in the release inflation release report both.
Canada		**Annual**

UK

Consumer Prices Index 1.6%

Annual

Japan

- **Consumer Price Index: 3.4% (July 2014/ change over the year))**

Detailed explanation

Summary

The consumer price index for Japan in July 2014 was 103.4 (2010=100), the same level as the previous month, and up 3.4% over the year.

The consumer price index for Ku-area of Tokyo in August 2014 (preliminary) was 102.0 (2010=100), up 0.2% from the previous month, and up 2.8% over the year.

Annual
However, in CPI section's explanation, equal emphasis is placed on both monthly and annual (see below)

Eurozone

€	29.08.2014	Euro area annual inflation down to 0.3%

Annual

Germany

Inflation rate	2013	1.5%

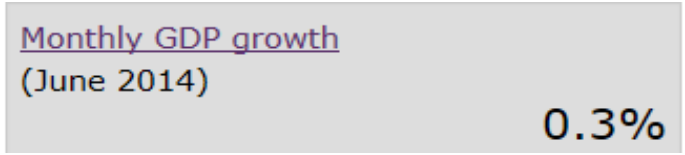
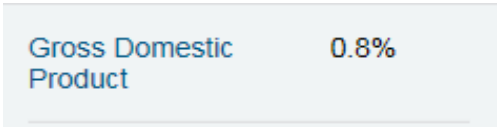
Average YoY Change in 2013 (updated each month)

Korea

▪ **Consumer Prices** 0.2%(Month-on-Month, Aug. 2014)	**Monthly**

As of September 2014.

Appendix Table 4(b): GDP change reported on the top page of relevant stat agencies' websites

	Start Page	What is stated in the start and related page
US		Annualized Quarterly
Sweden		Annualized Quarterly
Canada		Monthly
UK		Quarterly

Japan

Quarterly

"2014年4－6月" denote the second quarter (April to June of 2014). 実質and 名目 denotes "real and "nominal" respectively.

Eurozone

Quarterly

Germany

Economic growth	2013	0.1%

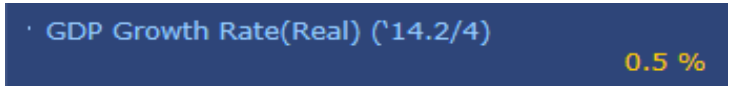
Average YoY growth in 2013

More detailed explanation

Detailed gross domestic product results for the 2nd quarter of 2014

The German economy is losing momentum. The gross domestic product (GDP) decreased 0.2% – upon price, seasonal and calendar adjustment – in the second quarter of 2014 compared with the previous quarter. However, one of the reasons probably was the extremely mild weather leading to high growth rates at the beginning of the year. According to the most recent calculations, the German economy had grown 0.7% in the first quarter of 2014. The increase in the entire first half of 2014, when adjusted for price, seasonal and calendar effects, was as much as 0.8% on the second half of 2013. All results are based on the new concepts of ESA 2010.

Korea



Quarterly

As of September 2014.