



# US Economic Perspectives

## Mind the gaps: Why November core CPI should get a lift

- The seemingly mundane October CPI report was littered with outliers on both sides. Can information about these outliers help to predict core CPI the following month? We take a granular and more general look at this question.
- The gaps between the monthly core CPI print and several measures of trend inflation can help to predict the following month's change in core CPI inflation. Importantly, the accuracy of this signal – both in terms of whether core CPI moves in the direction predicted and the size of the move – tends to rise as the gap increases.
- Signals from these individual trend inflation measures and a model-based assessment suggest that the month-over-month core CPI print should rise by 6-13bps for November, consistent with monthly core CPI between 0.22% and 0.29%. Our official forecast of 0.26% lies in the middle of this range.
- While many CPI components demonstrate mean reversion, they are typically not useful in predicting next month's change in the core CPI. This is even true for the larger shelter components.

Matthew Luzzetti, Ph.D.

Chief US Economist  
+1-212-250-6161

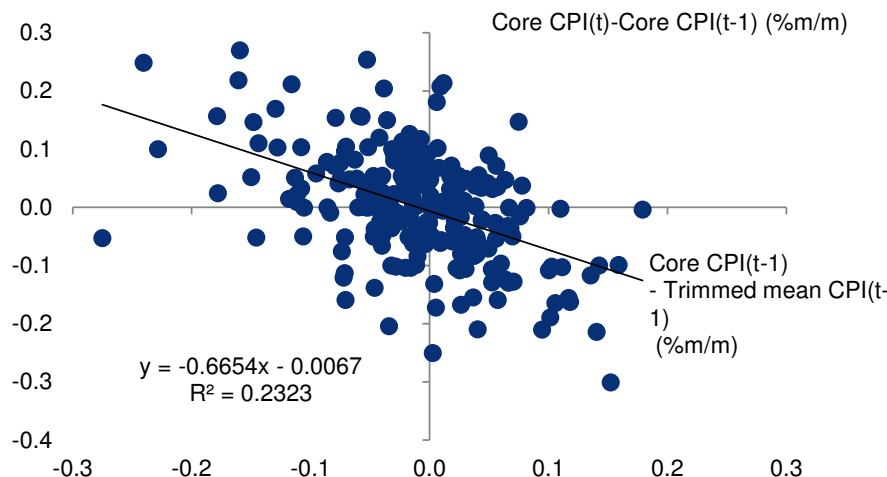
Justin Weidner

Economist  
+1-212-469-1679

Brett Ryan

Senior US Economist  
+1-212-250-6294

Figure 1: Gap between core CPI and alternative trend inflation gauges (e.g., trimmed mean) help to predict next month's core CPI change



Source : BLS, Cleveland Fed, Haver Analytics, Deutsche Bank



## Introduction

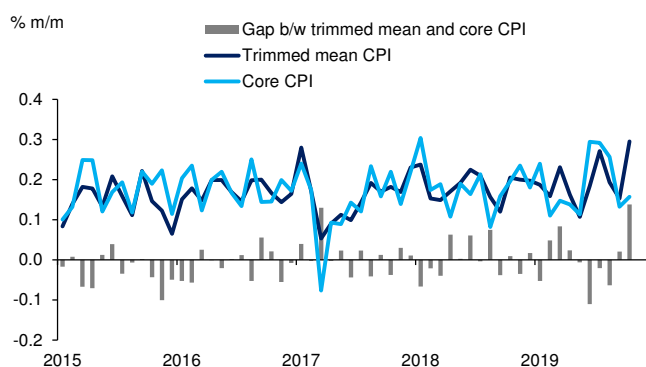
The seemingly mundane October CPI report was littered with outliers on both sides. Depending on how you disaggregate the data, there were about a half dozen categories that experienced a monthly increase in the price level that was more than two standard deviations of the historical average, while on the downside there were two such categories. Constructing the contributions from these outliers in last month's data, we find that they were critical drivers of the print. The five top outliers to the upside based on the Z-score added nearly 13bps to the monthly print, while the five most significant outliers to the downside subtracted nearly 12bps (Figure 2). Reflecting the importance of these outliers, the gap between the monthly changes in the trimmed mean CPI – which excludes outliers on both sides – and core CPI was 14bps, the highest since January 2010 (Figure 3).

Figure 2: Significant outliers in the October CPI report

Categories with the largest upside Z-scores				
Category	Monthly Inflation (%)	Z-score	Relative Importance In Core CPI	Contribution to Core CPI (bps)
Recreation	0.74	3.50	7.09	5.21
Health Insurance	2.24	3.00	1.58	3.47
Medical Care Commodities	1.22	2.85	2.13	2.57
Car and Truck Rental	5.58	2.72	0.15	0.82
Miscellaneous Personal Goods	2.27	2.71	0.27	0.59
Total			11.23	12.66
Categories with the largest downside Z-scores				
Category	Monthly Inflation (%)	Z-score	Relative Importance In Core CPI	Contribution to Core CPI (bps)
Lodging Away From Home	-3.84	-3.55	1.18	-4.84
Apparel	-1.77	-3.42	3.82	-6.76
Alcoholic Beverages	-0.25	-1.96	1.21	-0.31
Other Intercity Transportation	-1.71	-1.93	0.20	-0.36
Education	0.15	-1.21	3.85	0.57
Total			10.26	-11.70

Notes: Categories in blue (red) have monthly prints greater than 1(2) standard deviation(s) away from the category's average print since January 2006. Source: BLS, Haver Analytics, Deutsche Bank

Figure 3: Importance of outliers in October evident in large gap between trimmed mean and core CPI



Source: FRB Cleveland, BLS, Haver Analytics, Deutsche Bank

What does the distribution of outliers tell us about the likely evolution of core CPI in the coming months? We take two approaches to this question, first asking whether the relationships between core CPI and alternative gauges of trend inflation are able to predict subsequent developments in the former. We then investigate whether individual price components mean revert and can, in turn, help to predict a subsequent change in core CPI. Our analysis reveals several key conclusions:

1. The gaps between the monthly core CPI print and several measures of trend inflation can help to predict next month's change in core CPI inflation. Importantly, the accuracy of this signal – both in terms of whether core CPI moves in the direction predicted and the size of the move – tends to rise as the gap increases.
2. A model based on the gaps between core CPI and the median and sticky price ex-shelter CPIs tends to be most accurate. Signals from these individual trend inflation measures and the model-based assessment suggest that the monthly core CPI print should rise by 6-13bps for November, consistent with month-over-month core CPI inflation rising to 0.22-0.29%. Our official forecast of 0.26% lies in the middle of this range.
3. While many CPI components demonstrate mean reversion, they are typically not useful in predicting next month's change in the core CPI. This is even true for the larger shelter components.

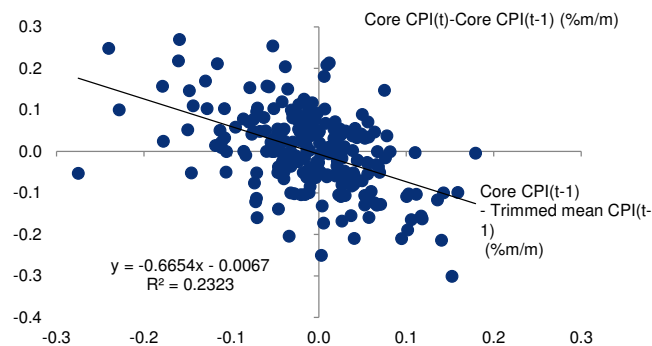


## Mind the gaps: Using alternative trend inflation rates to predict future core inflation

We begin by asking whether the lagged gap between the month-over-month growth in core CPI and alternative measures of trend inflation can help to predict the change in core CPI the following month. While we consider a variety of alternative gauges for CPI inflation, our analysis suggests that several measures of trend inflation are useful in this respect. The gaps between core CPI and (1) trimmed mean CPI, (2) median CPI, and (3) sticky price CPI excluding shelter, are all able to help predict the subsequent change in core CPI inflation.

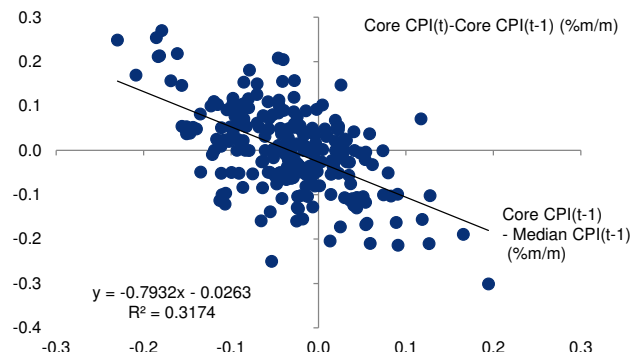
The direction of the relationship accords with intuition – core CPI tends to fall (rise) in a particular month if it was above (below) a measure of trend inflation the prior month – and is significant. For example, the estimated relationship suggests that a 10 basis point gap between the core CPI and trimmed mean inflation, where the former outperforms the latter, should result in a 6.7bp decline in core CPI inflation the following month (Figure 4). Analogous calculations using median CPI and sticky price CPI excluding shelter imply 7.9bps and 5.8bps reversals, respectively (Figures 5 and 6). Based on these average experiences, trimmed mean, median, and sticky price ex shelter would predict 9.2bps, 2.6bps, and 10.9bps increases in core CPI inflation for the November data, consistent with a monthly print ranging from 0.18% to 0.27%.

Figure 4: Core CPI and trimmed mean gap predicts next month's core CPI change...



Source : FRB Cleveland, BLS, Haver Analytics, Deutsche Bank

Figure 5: ...Same is true for median CPI...

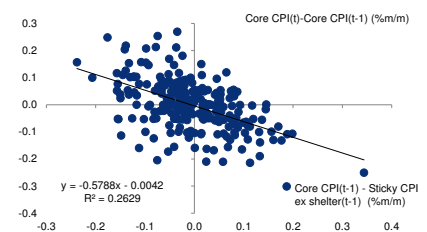


Source : FRB Cleveland, BLS, Haver Analytics, Deutsche Bank

These average results are encouraging, but we are also interested in whether the accuracy of the signal from these gaps improves as core CPI diverges more sharply from the alternative measure of trend inflation. To test this, we compute the “hit rates” – the percentage of time that the sign of the gap correctly predicts the direction of the change in core CPI in the following month – for the most significant outliers. That is, we ask whether the gap between core CPI and the trend measure of inflation becomes a more accurate predictor of a core CPI reversal as the gap widens. We then ask whether larger gaps are associated with sharper reversals.

There is supportive evidence for both of these questions. First, the signal from the gap between core CPI and these alternative measures does tend to become more accurate as the gap widens. For example, the gap between core CPI and trimmed mean CPI correctly predicts the direction of change in the subsequent monthly core

Figure 6: ...and sticky CPI ex shelter



Source : FRB Atlanta, BLS, Haver Analytics, Deutsche Bank



CPI print 79%, 85% and 91% of the time when the prior months gap was in the top 30%, 20% and 10% of historical outliers (Figure 7). As the table shows, hit rates for the median and sticky price CPI ex shelter are similarly high and in general rise as the gap widens.

Figure 7: Hit rate: % of time core CPI moves in predicted direction following top x% outlier

	Top 30%	Top 20%	Top 10%
Trimmed mean	79%	85%	91%
Median	79%	79%	96%
Sticky CPI ex shelter	80%	85%	82%

Note: Top x% is the largest outliers for core CPI minus alternative measure of trend inflation. Source : FRB Cleveland, FRB Atlanta, BLS, Haver Analytics, Deutsche Bank

Figure 8: Average change (bps) in core CPI when gap between core CPI and trend inflation is large negative outlier

	Top 30%	Top 20%	Top 10%
Trimmed mean	6	9	12
Median	7	7	13
Sticky CPI ex shelter	6	7	6

Note: Top x% is the largest negative (i.e., core CPI less than trend inflation) outliers for core CPI minus alternative measure of trend inflation. Source : FRB Cleveland, FRB Atlanta, BLS, Haver Analytics, Deutsche Bank

The average change in core CPI inflation also tends to vary as expected with the size of the gap in the prior month. Figure 8 shows the average change in the month-over-month core CPI inflation rate in basis points in a given month when core CPI was well below a given gauge of trend inflation in the previous month. The fact that the average change in monthly core inflation is large and tends to rise as the extent of the outlier increases is consistent with this gap providing an important signal about the subsequent change in core CPI inflation.

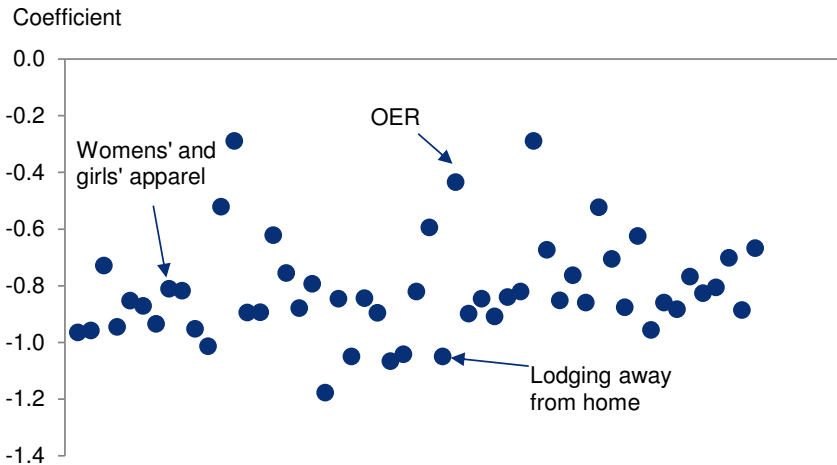
Having shown that the gaps between core CPI and several measures of trend inflation are useful in predicting subsequent movements in the former, we next investigate whether mean reversion is evident in individual components and whether this behavior can help to predict movements in core CPI.

## A component-level investigation

This section assesses whether individual categories within the CPI demonstrate some degree of mean reversion. That is to say, if we notice an out-of-the-ordinary monthly inflation print in a particular category, should we expect to see some reversal from that category in the next month's data. To do this, we regress the change in a given category's monthly inflation print on the lagged difference between the category's inflation print and its trailing six-month average. The latter is intended to capture a deviation from the recent trend. If the category's coefficient is negative and significant, then any outlier prints would be expected to be unwound to a degree. In particular, a coefficient of -1 would imply we should expect an equal and opposite deviation in next month's data.



Figure 9: CPI categories demonstrate mean reversion

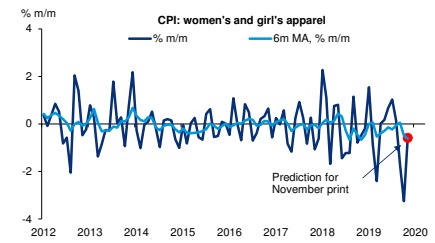


Source : BLS, Haver Analytics, Deutsche Bank

Figure 9 shows these coefficients for 53 relatively disaggregated categories within core CPI. All categories are negative and highly significant, indicating that at least some degree of payback is to be expected for all categories. For example, about 80% of an outlier inflation print in women's and girls' apparel gets unwound the next month, which is roughly the (unweighted) average across the categories. Figure 10 illustrates this particularly well: large deviations from the six-month trailing average tend to see a large swing in the other direction. Other categories that demonstrate significant mean reversion are mostly related to relatively small items in the goods category, including books, tobacco, personal care products, and furniture, among others.

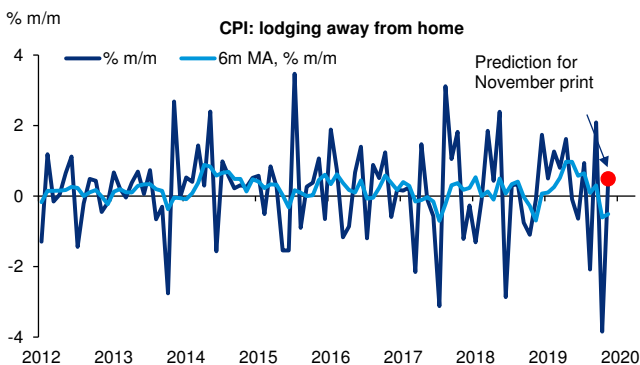
However, there is a wide degree of payback across categories. In comparison, an outlier in lodging away from home tends to be more than fully offset in the next month's data, while the degree of payback in owners' equivalent rent (OER) is relatively small, -0.4. Figures 11 and 12 show these tendencies that lodging away demonstrates a larger tendency to post paybacks, while oscillations for OER are more muted (note the difference of scale).

Figure 10: Women's and girl's apparel should rebound in November after October plunge



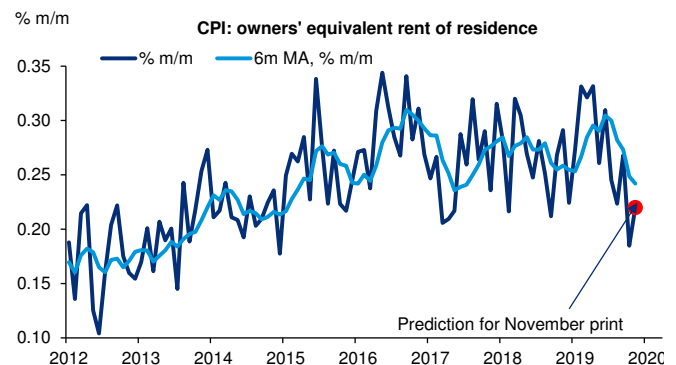
Source : BLS, Haver Analytics, Deutsche Bank

Figure 11: Lodging away from home has tendency to mean revert



Source : BLS, Haver Analytics, Deutsche Bank

Figure 12: OER payback is more muted

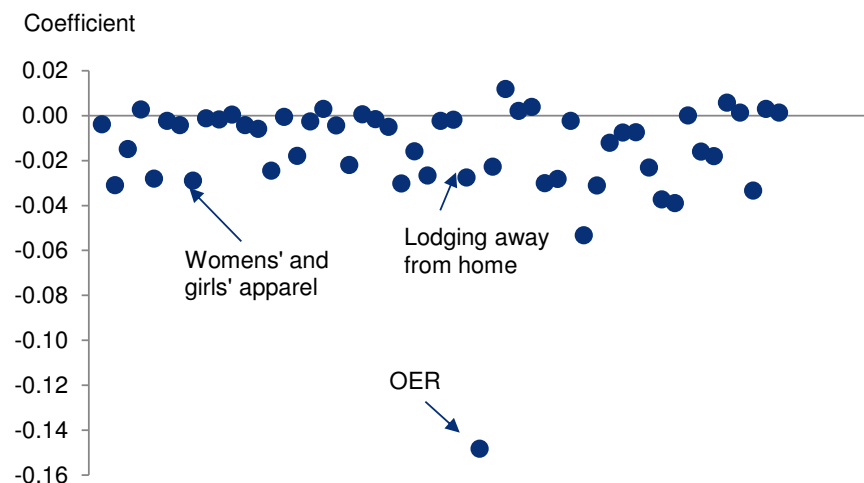


Source : BLS, Haver Analytics, Deutsche Bank



Knowing the degree of mean-reversion for each category is important for constructing a bottom-up forecast. However, we now examine if there are categories that we should pay particular attention to when they post outlier prints. That is, are there any categories whose outlier prints can systematically predict how next month's core CPI will evolve? Given that it represents about a quarter of the core CPI basket, OER is a prime candidate. To do this, we run the same regressions as above, except we replace the change in the category's monthly inflation print with the change in the monthly print of core CPI.

Figure 13: Impact on core CPI from a 1pp deviation from trend in each category



Source : BLS, Haver Analytics, Deutsche Bank

Figure 13 shows the coefficients from that regression for each category. The (unweighted) average coefficient is about -0.015, meaning that it would take a one percentage point outlier in most categories to move the core CPI print by only 1.5 basis points in the other way. To systematically influence how core CPI evolves on a month-by-month basis, a category must either have a large weight or have particularly volatile moves, which does not seem to be the case for most of the categories. Only nine out of the 53 categories have a significant (at the 5% level) coefficient vis-a-vis predicting next month's core inflation. Though OER stands out in terms of the size of its coefficient, it is not one of those nine, presumably in part because of the limited mean reversion discussed above. Consistent with this finding, larger historical outliers for OER do not consistently predict the direction of change in the monthly core CPI print in the subsequent month.

While there are a few categories, such as women's and girls' apparel and lodging away discussed above, that regularly see large enough magnitude prints to influence the overall core print for the next month, most are not. As such, we would expect significant changes in core CPI only if there were a large mass of outliers moving in one particular direction, which, given the mean reversion results discussed above, would all need to be unwound at once.

## What's the signal for the November CPI?

The above analysis could have important implications for the month-over-month core CPI inflation print for November, given that core CPI was well below trimmed mean and sticky price ex shelter CPI in October. Indeed, the gaps of 14bps and



19bps are in the top 8% and 3% of historical experience, respectively. The average historical rise in core CPI in the subsequent month when outliers have been this large during the prior month is 12-13bps. With the October core CPI printing 0.16% month-over-month, this points to significant risks of a print that rounds to 0.3% in November.

Taking a more structured approach to this question, we model the change in the month-over-month core CPI inflation rate in a given month as a function of the lagged gaps between core CPI and the trend measures of inflation noted in previous sections. We also add a lag of the change in the monthly core CPI inflation rate.

We find that the best fit to predict the change in the monthly core CPI inflation rate comes from a model that includes (1) lagged change in monthly core CPI, (2) the lagged gap between core CPI and sticky price CPI ex-shelter, and (3) the lagged gap between core CPI and median CPI. Once we control for the median and sticky price CPI ex-shelter gaps, trimmed mean is no longer a statistically significant factor (Figure 14).

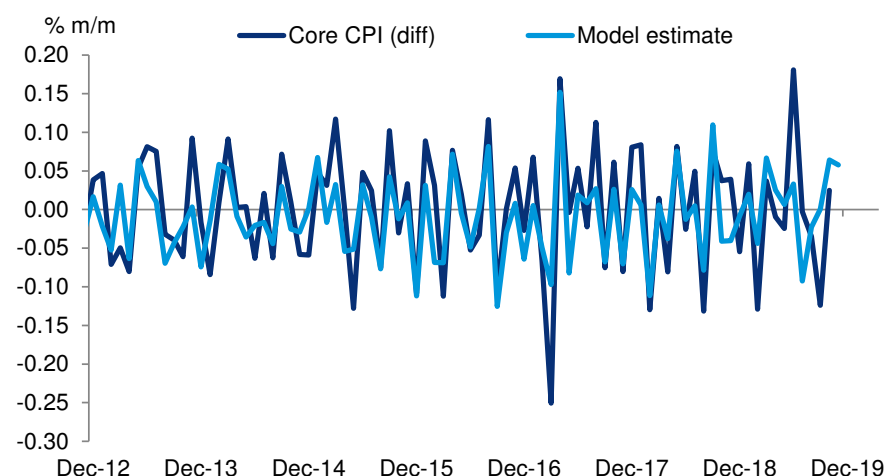
This model does a reasonably satisfactory job in explaining a very volatile series, with an r-squared of 45% (correlation of 67%). As expected given the preceding analysis, it also tends to capture the directionality of particularly large swings in the change, with core CPI demonstrating mean reversion and core CPI monthly inflation tending to move in the direction of the median CPI and sticky price CPI ex-shelter. Based on the gaps from the October data, this model predicts a 6bps rise in the month-over-month core CPI inflation rate to 0.22% (Figure 15).

Figure 14: Regression model for change in monthly core CPI inflation rate

	Coefficient	Standard Error
Constant	-0.02	0.01
Lagged Core CPI diff	-0.22	0.06
Median CPI	-0.46	0.06
Sticky CPI ex shelter	-0.35	0.09
R-squared	0.45	

Source : Deutsche Bank

Figure 15: Model predicts firmer core CPI in November



Source : FRB Cleveland, FRB Atlanta, BLS, Haver Analytics, Deutsche Bank

Based on the above, the historical experience with months when core CPI was as far below trimmed mean and sticky price CPI ex shelter as it was in October suggests that a more than 10bp increase in the month-over-month core inflation rate is quite possible. Such a development would produce a core CPI print that rounds up to 0.3% in November, in line with our official forecast. The predicted change based on our model is consistent with a somewhat smaller (roughly 6bps) rise in monthly inflation in November. Either way, it seems very likely that the November monthly core CPI data should bounce back from a somewhat weak print in October.



# Appendix 1

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## David Folkerts-Landau

Group Chief Economist and Global Head of Research

Pam Finelli  
Global Chief Operating Officer  
Research

Anthony Klarman  
Global Head of  
Debt Research

Michael Spencer  
Head of APAC Research

Steve Pollard  
Head of Americas Research  
Global Head of Company  
Research

Gerry Gallagher  
Head of European  
Company Research

Andreas Neubauer  
Head of Research - Germany

Peter Milliken  
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Research, APAC

Jim Reid  
Global Head of  
Thematic Research

Francis Yared  
Global Head of Rates Research

George Saravelos  
Head of FX Research

Peter Hooper  
Global Head of  
Economic Research

## International Production Locations

### Deutsche Bank AG

Deutsche Bank Place  
Level 16  
Corner of Hunter & Phillip Streets  
Sydney, NSW 2000  
Australia  
Tel: (61) 2 8258 1234

### Deutsche Bank AG

Equity Research  
Mainzer Landstrasse 11-17  
60329 Frankfurt am Main  
Germany  
Tel: (49) 69 910 00

### Deutsche Bank AG

Filiale Hongkong  
International Commerce Centre,  
1 Austin Road West, Kowloon,  
Hong Kong  
Tel: (852) 2203 8888

### Deutsche Securities Inc.

2-11-1 Nagatacho  
Sanno Park Tower  
Chiyoda-ku, Tokyo 100-6171  
Japan  
Tel: (81) 3 5156 6000

### Deutsche Bank AG London

1 Great Winchester Street  
London EC2N 2EQ  
United Kingdom  
Tel: (44) 20 7545 8000

### Deutsche Bank Securities Inc.

60 Wall Street  
New York, NY 10005  
United States of America  
Tel: (1) 212 250 2500