US ECONOMIC DATA AND THE AUSTRALIAN DOLLAR[1]

Introduction

News about the US economy can affect the Australian dollar exchange rate against the US dollar (AUD/USD) through a number of channels. First, stronger-than-expected data on the US economy might exert downward pressure on the AUD/USD exchange rate, due to an anticipated narrowing of the Australia–US yield differential. More broadly, investors may be more likely to invest in an economy where stronger-than-expected data are taken as a signal of stronger growth prospects. This can be referred to as the 'bilateral' channel. Second, there are 'global' channels through which stronger-than-expected US data can lead to *upward* pressure on the AUD/USD exchange rate. For example, news of an improvement in US economic conditions may prompt upward revisions to forecasts of global growth and commodity prices, which have traditionally been closely correlated with the Australian dollar due to the importance of commodities in Australian exports. Further, the prospect of higher global growth may lead to an increase in market risk appetite, and with the Australian dollar typically viewed as a risk asset by portfolio managers, increases in risk appetite have been associated with upward pressure on the Australian dollar.[2]

This article provides evidence to suggest that the relative importance of the bilateral and global channels is contingent upon the prevailing level of market volatility and uncertainty about the global economic outlook. In periods of elevated market volatility and uncertainty, the global channels tend to dominate the bilateral channel, such that the net effect of positive news on the US economy tends to be an appreciation of the AUD/USD exchange rate. This is consistent with market commentary since the onset of the global financial crisis. Under more normal market conditions, the bilateral channel tends to dominate, so that the net effect of positive news on the US economy is more likely to be a depreciation of the AUD/USD exchange rate. Empirical evidence suggests that these effects are most evident for US data releases pertaining to growth, employment and production.

Data and Methodology

The methodology adopted in this article builds on that used by Clifton and Plumb (2008)[3], who examine the effects of US economic data 'surprises' on the AUD/USD exchange rate. A data surprise is defined as an outcome that was not in line with market expectations, so that weaker-(stronger)-than-expected data constitute a negative (positive) surprise. The focus on

1 *This article was written by Kim Edwards of International Department and Michael Plumb of Economic Analysis Department. The authors thank Sam Nightingale for assistance.*

2 *See P D'Arcy and E Poole (2009), 'Fundamentals, Portfolio Adjustments and the Australian Dollar',* RBA Bulletin, *May, pp 1–9.*

3 *See K Clifton and M Plumb (2008), 'Economic Data Releases and the Australian Dollar',* RBA Bulletin, *April, pp 1–9.*

'surprises' assumes that investors only respond to unexpected news, as their expectations are already incorporated into the market price. This methodology is extended here to test whether the effect of a particular data release (or group of releases) changes in an environment of high market volatility and uncertainty. The key variables in the analysis are therefore the change in the AUD/USD exchange rate, the surprise component of US economic data releases, and the measure of market volatility.

Exchange rate data at 10-minute intervals are sourced from the Reuters electronic broking system. For each US data release in the sample, the change in the exchange rate is calculated from 10 minutes before the release to 50 minutes after. This captures the effects on the exchange rate of any last-minute positioning by foreign exchange traders in the lead-up to the release.

The US data releases considered in this analysis include: GDP (the advance reading); non-farm payrolls; initial jobless claims; existing, new and pending home sales; housing starts; industrial production; manufacturing and non-manufacturing ISM; durable goods orders; retail sales; personal income and spending; Conference Board consumer confidence; and the University of Michigan consumer confidence index. Information on US data releases, including the date and time of release, the actual result and revisions to previous releases, is obtained from Bloomberg. The data sample spans more than 10 years, from March 1998 to February 2009. The surprise component for any given release is calculated as the difference between the actual published outcome and the expected outcome, with the latter proxied by the median forecast of economists surveyed by Bloomberg. Revisions to the previous period's outcome are also taken into account.[4] The surprise component is scaled (by its sample standard deviation) to facilitate comparison across data releases.

To distinguish periods of elevated market volatility from periods of relative stability, the VIX index is used, although the results are robust to alternative measures of volatility.[5] This index is constructed using the implied volatilities of a range of S&P500 index options, and incorporates both the price of risk and the quantity of risk associated with the US equity market. It is often used by investors to proxy the uncertainty associated with the US economy and, by extension, the global economy, as measures of volatility across markets are highly correlated.

To determine whether the VIX series is 'high' at the time of a given data release, a benchmark is constructed that is equal to the sum of the two-year moving historical average of the VIX and the two-year moving historical standard deviation of the VIX at each time period. The moving average approach to calculating the benchmark VIX allows for the fact that markets adapt over time. For example, a VIX reading of 30 in 2006 would have been regarded as relatively high, but the same reading in late 2008 would have been regarded as more moderate (Graph 1).

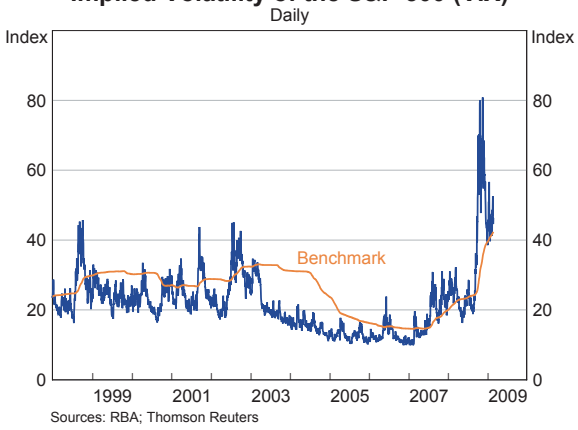
4 *See Clifton and Plumb (2008). While the median forecast of economists surveyed by Bloomberg may not always accurately represent market expectations, it is assumed that it provides an unbiased indication of market expectations.*

5 *Using a composite measure of global volatility based on the implied volatilities of different market segments across countries does not affect the results.*

Volatility is said to be 'high' in a given time period if the actual VIX is above the benchmark, while volatility is said to be 'normal' if the actual VIX is below the benchmark. A risk dummy variable is constructed, $\overline{VIX}_t$, that equals 1 if volatility is 'high' (the blue line is above the orange line in Graph 1) and zero if volatility is 'normal'. The volatility variable is constructed such that 'high' volatility identifies those periods when volatility is significantly higher than average, thereby capturing episodes where the market outlook can be quite clearly regarded as uncertain.

Graph 1

Implied Volatility of the S&P 500 (VIX)



Sources: RBA; Thomson Reuters

The primary aim is to examine whether the relationship between the AUD/USD exchange rate and US data surprises changes when volatility and uncertainty are 'high'. To do this, the following equation is estimated over the entire sample:[6]

$$\%\Delta AUD/USD_t = \alpha + \beta_1 Surprise_{kt} + \beta_2 Surprise_{kt}\overline{VIX}_t + u_t \quad (1)$$

In particular, the hypotheses tested are that:

- in periods of 'normal' market volatility, the bilateral channel dominates, and a positive surprise in the United States leads to a *depreciation* of the Australian dollar relative to the US dollar ($\beta_1 < 0$); and
- in periods of elevated market volatility and uncertainty about the global growth outlook, global channels dominate, and a positive US surprise leads to an *appreciation* of the Australian dollar relative to the US dollar ($\beta_1 + \beta_2 > 0$).[7]

These hypotheses are first tested assuming that the exchange rate response is the same across various pieces of news. This assumption is then relaxed, and the response is allowed to vary depending upon the type of data release.

6 *$\%\Delta AUD/USD_t$ is the percentage change in the exchange rate from 10 minutes before data release times to 50 minutes after on day t; $Surprise_{kt}$ is the signed (scaled) surprise component of data release k in period t; β_1 measures the effect of a US data surprise on the exchange rate in periods of 'normal' market volatility ($\overline{VIX}_t = 0$); $\beta_1 + \beta_2$ measures the effect of a US data surprise on the exchange rate in periods of 'high' market volatility ($\overline{VIX}_t = 1$); and u_t is the random error term in the regression.*

7 *This methodology does not preclude* changes *in volatility due to US data surprises from directly affecting the AUD/USD exchange rate (e.g. via portfolio rebalancing effects; see D'Arcy and Poole (2009)), as Equation (1) captures the average effect of all the channels through which US data surprises affect the AUD/USD exchange rate. However, the methodology allows the importance of all the channels to vary, depending on the* level *of volatility and uncertainty.*

Results

Making no distinction between the various types of data releases and estimating over the entire sample, the results are consistent with the hypotheses outlined above. In periods of 'normal' financial market volatility, a US data release that surprises on the upside tends to lead to a *depreciation* of the AUD/USD. More specifically, on average across all releases, a positive data surprise of one standard deviation causes a statistically significant AUD/USD depreciation of 0.037 per cent (which is equivalent to around 2½ basis points) in periods of 'normal' financial market volatility (Table 1).[8] However, in periods of 'high' volatility, a stronger-than-expected US data release tends to lead to an *appreciation* of the AUD/USD. On average, in times of 'high' volatility, a positive US data surprise of one standard deviation is associated with a statistically significant AUD/USD appreciation of 0.024 per cent (around 1½ basis points). Stated alternatively, the results suggest that there is a positive relationship between the AUD/USD and US data surprises in periods of 'high' volatility, but a negative relationship otherwise.

Table 1: Estimated Effect of a US Data Surprise on AUD/USD
Per cent, sample 1998–2009

Volatility	Effect of a positive US data surprise (one standard deviation) on AUD/USD (*p*-value)[(a)]
Normal	–0.037 (0.00)
High	+0.024 (0.01)

(a) The *p*-values for these effects are those associated with the appropriate Wald test.

The results are statistically significant, but the estimated average effect of a US data surprise of one standard deviation on the AUD/USD exchange rate is quite small. For example, the 'normal volatility' effect of 2½ basis points estimated above implies a depreciation of the AUD/USD from US68.00 cents to US67.97 cents from such a surprise. This is partly explained by the bilateral and global channels working in the opposite direction, such that the overall effect tends to be small. In practice, however, surprises can be much larger than one standard deviation, with the largest surprise in the sample being seven standard deviations.

Further, as demonstrated in Clifton and Plumb (2008), certain types of US data releases, such as employment and GDP, have considerably larger effects on the AUD/USD exchange rate than other releases. Thus, while the average effect over all release types of a one-standard-deviation surprise is quite small, larger surprises in certain US data releases can have a considerable effect on the AUD/USD exchange rate – and in both directions, depending on the prevailing level of uncertainty in the market. For example, the 10 largest positive US employment data surprises that occurred during periods of 'normal' volatility have been associated with an average AUD/USD *depreciation* of 30 basis points in the hour interval used in this article. In contrast, the 10 largest positive US employment data surprises that occurred during 'high' volatility periods have been associated with an average AUD/USD *appreciation* of 20 basis points. In the former

8 *–2½ basis points ≈ 0.68* x *–0.037 per cent, where 0.68 is the sample average level of the AUD/USD and* $\hat{\beta}_1 = -0.037$.

case, the bilateral channel dominated the global channels, as market volatility was low and market participants were relatively confident about the global economic outlook. In the latter case the global channels dominated, as volatility was high and market participants focused on the ramifications of new data for the global economy and commodity prices.

To further examine how the exchange rate responds to different pieces of news, each of the US data releases were treated separately. For example, in periods of 'high' volatility, is the positive relationship between the AUD/USD exchange rate and US data surprises more pronounced for a US GDP surprise than a retail sales surprise? Due to the limited number of data releases each year, the individual releases are first grouped into four 'types' of broadly similar information: growth/employment; production; consumption; and housing (Table 2). The effect of each 'type' of US data release on the AUD/USD exchange rate is then allowed to differ (compared with the base case, where no distinction was made between different types of data releases).

Table 2: Categorisation of US Data Releases

Growth/ Employment	Production	Consumption	Housing
GDP (advance reading)	Industrial production	Retail sales	Existing home sales
Non-farm payrolls	ISM manufacturing	Personal income and spending (average surprise)	Housing starts
Initial jobless claims	ISM non-manufacturing	Conference Board consumer confidence	New home sales
	Durable goods orders	University of Michigan consumer confidence	Pending home sales

Source: RBA

Results for the full sample and a sample starting in 2005 are presented in Table 3. They show that US growth/employment and production-related releases have the largest impact on the AUD/USD exchange rate, with positive data surprises in these releases exhibiting a negative relationship with the AUD/USD in periods of 'normal' volatility, and a positive relationship in periods of 'high' volatility. For example, when volatility is 'normal', a positive (one-standard-deviation) surprise in US production data will, on average, lead to an AUD/USD depreciation of 0.028 per cent (2 basis points). However, when volatility is 'high', a similar surprise will, on average, lead to an AUD/USD appreciation of 0.071 per cent (5 basis points). On the other hand, for US housing and consumption-related releases there are no clear effects on the AUD/USD, irrespective of the state of volatility – all parameter estimates are insignificant, and don't have the expected sign when volatility is 'high'. This exercise was also carried out by analysing each of the 15 individual data releases separately, rather than the four different 'types' of release. While these results were not as well determined due to the smaller amount of data being used to estimate the results, they broadly confirm the results in Table 3. Results for US employment releases were estimated more precisely, due to their higher frequency of release, and were similar to the results for the growth/employment category in Table 3.

Table 3: Estimated Effect of a US Data Surprise on AUD/USD

Per cent

Type of US data release	Volatility	Effect of a positive US data surprise (one standard deviation) on AUD/USD (*p*-value)	
		Sample 1998–2009	Sample 2005–2009
Growth/employment	Normal	–0.071 (0.000)	–0.067 (0.003)
Growth/employment	High	+0.030 (0.073)	+0.072 (0.001)
Production	Normal	–0.028 (0.026)	–0.067 (0.005)
Production	High	+0.071 (0.000)	+0.093 (0.000)
Housing	Normal	–0.004 (0.739)	–0.026 (0.251)
Housing	High	–0.026 (0.289)	–0.038 (0.281)
Consumption	Normal	–0.021 (0.109)	–0.015 (0.574)
Consumption	High	–0.011 (0.570)	–0.001 (0.961)

Further, the positive relationship between the AUD/USD exchange rate and US data surprises in periods of heightened market volatility has become more pronounced in recent years, as shown by the results for the 2005–2009 sample. Since 2005, the results suggest that a one-standard-deviation positive surprise in US production data has, on average, led to an AUD/USD *depreciation* of 0.067 per cent (4½ basis points) when volatility is 'normal', but an AUD/USD *appreciation* of 0.093 per cent (6½ basis points) when volatility is 'high'.

The more pronounced effect in recent years is likely to reflect the abnormally high level of market volatility during the global financial crisis. Given the extent of uncertainty surrounding the global economic outlook, market participants have been extremely sensitive to new economic information. Other possible factors include: the prevalence of the Australian dollar carry trade though this period and the resulting sensitivity of the local currency to changes in the price of risk;[9] and the composition of market participants, which may have shifted in recent years towards more active or speculative accounts (such as hedge funds) that are more sensitive to changes in the risk environment.

The Effect of US Data on Other Australian Dollar Exchange Rates

While new information on the US economy can affect the AUD/USD exchange rate through bilateral and global channels, it is also possible that other Australian dollar exchange rates, such as the exchange rate against the Japanese yen (AUD/JPY) and the euro (AUD/EUR), could be

9 *See A Zurawski and P D'Arcy (2009), 'Japanese Retail Investors and the Carry Trade', RBA* Bulletin, *March, pp 1–8.*

affected by US data surprises. Because the US dollar does not figure in these exchange rates, the standard yield differential (that is, bilateral) channel by which positive US data surprise tend to lead to an AUD/USD depreciation would not be expected to apply in the cases of the AUD/JPY or AUD/EUR exchange rates. On the other hand, we might expect that the global channels would still exert a *positive* influence on the Australian dollar. In particular, the AUD/JPY 'carry trade' is a risky strategy that is likely to be especially sensitive to any general repricing of risk which occurs as a result of developments in the US economy. This was examined by conducting the previous analysis using changes in the AUD/JPY and AUD/EUR exchange rates, instead of the AUD/USD exchange rate.

The results (not reported here) support these priors. When volatility is 'normal', the effect of a positive US data surprise on the AUD/JPY and the AUD/EUR exchange rates is positive (but statistically insignificant in the case of the AUD/JPY). When volatility is 'high', a positive US data surprise leads to a larger and statistically significant appreciation of both the AUD/JPY and the AUD/EUR exchange rates. The magnitude of the effect is greatest for the AUD/JPY exchange rate, and in both cases is larger than for the AUD/USD exchange rate. This is to be expected, as the bilateral channel is not acting against the global channels for the non-US exchange rates.

Treating different types of releases separately and comparing results over time suggests that the effect of heightened uncertainty on the relationship between US data surprises and the AUD/JPY exchange rate is strongest in the period from 2005, and for the growth/employment and production-related releases.

Summary and Assessment

There are a number of channels through which economic news about the US economy can affect the AUD/USD exchange rate. In addition to the bilateral channel relating to interest rate differentials, the effects of US economic news on the outlook for global growth and market risk appetite are also important, and these effects work in the opposite direction to the interest rate differential channel.

Results presented in this article suggest that the extent to which the conventional interest rate differential (or bilateral) effects on the AUD/USD exchange rate are offset by these global channels depends on the extent of volatility and uncertainty in financial markets. Specifically, stronger-than-expected US data are more likely to be associated with an appreciation of the AUD/USD exchange rate in an environment of high market volatility and uncertainty about the global economy (as proxied by the level of the VIX index). In these periods, the Australian dollar is likely to be more sensitive to the effect of new US data on the outlook for global growth and commodity prices, as well as the price of other risk assets. On the other hand, in more normal conditions the impact of economic news on interest rate differentials is likely to be the primary influence and US data surprises are more likely to be negatively correlated with the AUD/USD exchange rate.

This result appears to be strongest for US data relating to growth/employment and production, particularly over the past few years. For housing and consumption indicators, on the other hand, there is little sign of the hypothesised volatility effect. One reason why growth and production-oriented releases exhibit this effect more clearly may be because these releases

are more directly tied to the outlook for global growth and commodity prices, which in turn are viewed as fundamental drivers of Australian dollar movements.

There are a number of possible reasons why these effects have been more pronounced in recent years. The most likely factor is the abnormally high level of market volatility during the global financial crisis. Given the extent of uncertainty surrounding the global economic outlook, market participants have been extremely sensitive to new economic information. Other possible factors include the rise of the so-called Australian dollar carry trade and the resulting sensitivity of the local currency to changes in the price of risk, and the changing composition of market participants towards more active or speculative accounts (such as hedge funds) that are more sensitive to changes in the risk environment. ✠