ECONOMIC DATA RELEASES AND THE AUSTRALIAN DOLLAR[1]

Introduction

Analysis of the intraday volatility of the Australian dollar shows spikes in volatility around the times of major economic data releases in Australia and the US.[2] These spikes reflect the arrival and processing of new information contained in the data by the market.

This article examines the impact on the Australian dollar of the release of major Australian and US economic data. These releases include inflation, GDP, employment, Reserve Bank of Australia (RBA) and Federal Open Market Committee (FOMC) monetary policy announcements and the RBA's *Statement on Monetary Policy* (*SMP*). As foreign exchange markets tend to react to new information very quickly, the exchange rate response is measured within the hour following a given data release. The efficient markets hypothesis suggests that the exchange rate should react only to unexpected information, so the impact on the Australian dollar of an average 'surprise' in each of the data releases is also assessed, with the surprise defined as the difference between the actual and expected outcomes.

The results suggest that, on average, AUD/USD volatility is most affected by Australian GDP and employment data releases and the US employment data release. The AUD/USD generally appreciates following a positive surprise in Australian economic data, and depreciates following a positive surprise in US economic data.[3] The AUD/EUR and AUD/JPY tend to appreciate following positive surprises in data measuring US economic activity, but depreciate on average following a higher-than-expected US inflation outcome. This may be explained by the fact that Australia is assessed by the market to be more sensitive to changes in expectations of global growth, of which the US economy is an important driver.

Data

Data on the major economic data releases were obtained from Bloomberg, including the date, time, outcome, revisions to previously published results and the median forecast of surveyed economists. The data set spans nine and a half years from 1 March 1998 to 31 August 2007.

In Australia, most economic data are released at 11.30 am, as is the RBA's *Statement on Monetary Policy*. The major US economic data are released at three different times: 8.30 am, 9.15 am and 10 am New York time, which correspond to Australian Eastern Standard Times

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1 *This article was prepared by Kristina Clifton and Michael Plumb of International Department.*

2 *For further details please see Clifton and Plumb (2007).*

3 *This is not always the case. For example, a weaker-than-expected US employment report might be expected to lead to an appreciation in the AUD/USD. However, in recent times there have been occasions when such an outcome has been viewed as negative for global growth, which has led to heightened risk aversion and a depreciation in the AUD/USD. This issue is discussed further below.*

(AEST) of 10.30 pm, 11.15 pm and midnight respectively.[4] Until recently, RBA monetary policy announcements were made at 9.30 am.[5] FOMC announcements occur at 2.15 am AEST.

The measure of volatility used in this paper is the absolute percentage change in the exchange rate, although results are not sensitive to the use of alternative volatility measures, such as the standard deviation. Volatility is measured over a one-hour window, commencing ten minutes before the data release, rather than at the time of its release, to capture any increased volatility arising from last minute positioning by foreign exchange traders in the lead-up to the release.

Impact on Australian Dollar Volatility of Individual Data Releases

The analysis begins by testing whether there is a difference in AUD/USD volatility around the time of each major economic data release, compared with the same time on non-release days. AUD/USD volatility is regressed on a set of dummy variables representing the K different data releases, which equal 1 when k is released and 0 otherwise. That is:

$$\left|Z_n\right| = \alpha + \sum_{k=1}^{K} \beta_k D_{kn} + u_n \tag{1}$$

where $\left|Z_n\right|$ is the absolute percentage change in the exchange rate from 10 minutes before the release time to 50 minutes after on day n, K is the number of data releases, and D_{kn} is a set of dummy variables that equals 1 if release k is made on day n and 0 otherwise.

A separate regression is estimated for each time period in which major Australian and US economic data are released or monetary policy announcements are made (i.e. 9.30 am, 11.30 am, 10.30 pm, 11.15 pm, midnight and 4.15 am, AEST). For example, to test the impact of the various Australian economic data releases, volatility is measured between 11.20 am and 12.20 pm for each day in the sample. If volatility is higher between 11.20 am and 12.20 pm on those days when, say, the Australian labour force data are released (at 11.30 am), this will be reflected by a positive and significant coefficient on the labour force dummy variable in Equation (1).

The results in Table 1 show that on days when the RBA makes a monetary policy announcement, there is a 0.09 percentage point increase in volatility in the hour of the announcement compared with days when there is no RBA announcement. On days when the FOMC announces interest rates (at 4.15 am AEST), volatility over the hour around the announcement is on average 0.15 percentage points higher than days when there is no rate announcement.

For the Australian economic data, released at 11.30 am AEST, the results show that the release of GDP, the labour force report, the RBA's *Statement on Monetary Policy*, the CPI, the trade balance, retail sales and building approvals all result in a statistically significant increase in AUD/USD volatility on average.[6] The GDP release has the largest impact, with around a

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4 *The Australian times of US economic data releases are two hours later during Australian daylight saving time. We exclude from the sample the first week of April when Sydney has moved to standard time but New York is yet to move to daylight saving time.*

5 *As of December 2007, RBA monetary policy announcements were changed to 2.30 pm on the day of the RBA Board meeting. In this sample, RBA monetary policy announcements occurred at 9.30 am AEST on the day after the RBA Board meeting.*

6 *The first three CPI releases in 2007 were associated with a much larger exchange rate response than was the case for previous years in the sample. If we exclude data from 2007, the CPI coefficient is no longer significant.*

Table 1: AUD/USD Volatility Regressions
Coefficient estimates for individual data releases

Australia		US	
9.30 am		**4.15 am**[a]	
Data release	*Coefficient*	*Data release*	*Coefficient*
Constant	0.10 ***	Constant	0.09 ***
RBA[b]	0.09 ***	FOMC	0.15 ***
11.30 am		**10.30 pm**[a]	
Data release	*Coefficient*	*Data release*	*Coefficient*
Constant	0.11 ***	Constant	0.13 ***
GDP	0.18 ***	Labour market	0.16 ***
Labour force	0.15 ***	GDP (advance)	0.07 **
SMP	0.10 ***	Trade balance	0.06 ***
CPI	0.08 **	Retail sales	0.04 **
Trade balance	0.04 ***	Durable goods	0.03
Retail sales	0.04 ***	PPI	0.02
Building approvals	0.03 *	CPI	0.02
Wage cost index	0.01	Housing starts	0.01
Housing finance	0.01	Initial jobless claims	0.01
Average weekly earnings	0.00	Personal income and spending	–0.02
PPI[c]	–0.00		
		11.15 pm[a]	
		Data release	*Coefficient*
		Constant	0.15 ***
		Industrial production and capacity utilisation	–0.01
		Midnight[a]	
		Data release	*Coefficient*
		Constant	0.15 ***
		ISM manufacturing	0.04 ***
		ISM non-manufacturing	–0.01
		Consumer confidence	–0.02 *

Notes: White's heteroskedasticity-consistent standard errors are used to calculate the *t*-ratios.
       ***, ** and * indicate significance at the 1, 5 and 10 per cent levels respectively.
(a)   Australian Eastern Standard Time (AEST). During Australian daylight saving time, the time in Sydney of US economic data releases is two hours later.
(b)   As of December 2007, RBA monetary policy announcements were changed to 2.30 pm on the day of the RBA Board meeting, rather than 9.30 am on the day after the meeting.
(c)   Included from June quarter 2001.
Sources: Bloomberg; RBA; Reuters

0.18 percentage point increase in volatility compared with the same time on days with no GDP release.

Of the US economic data releases occurring at 10.30 pm AEST, the monthly labour market report, GDP, the trade balance and retail sales all result in a statistically significant increase in AUD/USD volatility. The monthly US labour market data have the largest impact on volatility, with an average increase of around 0.16 percentage points. There is no significant increase in

AUD/USD volatility around the time of the release of the US CPI. Furthermore, the release of the personal consumption expenditures (PCE) deflator (released with the personal income and spending data), another closely watched measure of inflation, has no significant impact on volatility.[7] Of the US data released at other times, the only major release that generates a significant increase in volatility is the ISM manufacturing index. The coefficient on the US consumer confidence dummy variable is significant at the 10 per cent level, but contrary to expectations has a negative sign.

While it has been shown that several US economic data releases have a significant impact on AUD/USD volatility around the time of their release, this analysis does not determine whether it is a general US dollar reaction to the data that causes the change, or if the AUD/USD is reacting more or less than other Australian dollar exchange rates. In an attempt to address this issue, the above analysis is repeated using volatility in first the AUD/EUR, and then the AUD/JPY, as the independent variable in Equation (1). This will help determine whether US economic data releases have a differential impact on the currencies of other countries.

This analysis shows that both the AUD/EUR and AUD/JPY are affected by US economic data releases. Specifically there is a statistically significant increase in the volatility of:[8]

- both the AUD/EUR and AUD/JPY around the time of FOMC interest rate announcements and US labour market data releases;

- the AUD/EUR, around the time of the US producer price index (PPI), trade balance and initial jobless claims releases; and

- the AUD/JPY, around the time of the release of the ISM manufacturing index.

These results are discussed further in the following section.

Impact on the Australian Dollar of the Surprise Component of Data Releases

The efficient markets hypothesis suggests that the exchange rate should respond only to unexpected information, as expectations about the economic outlook should already be incorporated in asset prices. Therefore, the estimated impact of data releases on Australian dollar volatility in the previous section may be biased downward, to the extent that outcomes of data releases were well anticipated by the market on some occasions. Stated alternatively, a larger coefficient in Table 1 does not necessarily imply that the market gives more weight to that particular release. It may just be that a given series is difficult to forecast, and, on average, has a larger surprise component than do other releases.

In this section, the impact of the surprise component of economic data releases on the AUD/USD is examined.[9] The surprise component is defined as the difference between the actual published outcome and the expected outcome, with the latter proxied by the median forecast of

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7 *In its Monetary Policy Report to the Congress in February 2000, the Fed announced it was changing its primary measure of inflation from the CPI to the 'chain-type price index for PCE'.*

8 *Results not reported here.*

9 *The remainder of the analysis excludes interest rate announcements, as this issue has been examined by Kearns and Manners (2006). This study finds that a 25 basis point interest rate surprise leads to an appreciation in the AUD/USD of around ¼ per cent.*

economists surveyed by Bloomberg.[10] Revisions to the previous month's outcome are also taken into account. That is, the surprise component of a data release is calculated as:

$$S_{kn} = A_{kn} - F_{kn} + R_{kn} - A_{k,n-1} \tag{2}$$

where S_{kn} is the signed surprise component of data release k in period n;

A_{kn} is the published outcome for release k in period n;

F_{kn} is the median forecast for release k in period n;

$A_{k,n-1}$ is the published outcome for release k in period n–1; and

R_{kn} is the revised outcome for $A_{k,n-1}$ announced in period n.

As some economic data releases contain a range of information, analysis is limited to the statistic in each release considered to be of most interest to the market. For the Australian labour force report, the chosen statistic is employment. For the Australian CPI release, the headline figure is used. Analysis using other inflation measures such as the 'weighted median' and 'trimmed mean' cannot be performed, as surveys of economists' forecasts for these measures lack a sufficient history.[11]

Similar to Campbell and Lewis (1998),[12] the surprise variable is scaled by the average absolute surprise for the relevant series. This facilitates comparison of the estimated coefficients on the surprise component across data releases. A separate regression is undertaken for each time period in which major Australian and US economic data are released (i.e. 11.30 am, 10.30 pm, 11.15 pm, and midnight, AEST) and takes the following form:

$$Z_n = \delta + \sum_{k=1}^{K} \lambda_k \frac{S_{kn}}{\overline{S}_k} + v_n \tag{3}$$

where Z_n is the percentage change in the exchange rate from 10 minutes before the announcement time to 50 minutes after on day n;

S_{kn} is the signed surprise component of data release k on day n, as defined above. S_{kn} equals 0 on days when there is no release;

$\overline{S}_k$ is the average absolute surprise over the sample for release k; and

λ_k measures the effect of an average surprise in release k on the exchange rate.

If there were no additional events or news releases relevant for the exchange rate occurring during the hour surrounding the release time, the constant term, δ, should equal zero. This says that if all economic data releases on day n were in line with market expectations, the exchange rate should remain unchanged on average.

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10 *While the median forecast of economists surveyed by Bloomberg may not always accurately represent market expectations, we assume that it provides an unbiased indication of market expectations on average.*

11 *There has been market interest in 'underlying' inflation indices, published by the RBA up to the March quarter 2007 and by the ABS from the June quarter 2007 onwards. However, the Bloomberg survey of economists' forecasts for these measures commenced only in the September quarter 2007, which covers the last CPI release in our sample. Given the market interest in these underlying measures as well as the headline CPI, future research would likely benefit from analysing these measures when assessing the 'surprise' impact of the CPI release.*

12 *Campbell and Lewis (1998).*

In general, positive coefficients on the Australian data releases are expected, as stronger-than-expected outcomes (or 'positive surprises') in Australian economic data should lead to an appreciation in the Australian dollar.[13] On the other hand, the US economic data releases are usually expected to have negative coefficients, as positive surprises in US economic data should lead to a depreciation in the AUD/USD.[14] One exception is US initial jobless claims, where a positive coefficient is expected, as a positive surprise in jobless claims suggests a weaker US labour market.

The estimation results are shown in Table 2. Three out of four regression equations have a constant term that is not significantly different from zero: the Australian data released at 11.30 am, US data released at 11.15 pm and US data released at midnight, AEST. This suggests

Table 2: AUD/USD Regressions
Coefficient estimates for individual data surprises

Australia		US	
11.30 am		**10.30 pm[a]**	
Data release	*Coefficient*	*Data release*	*Coefficient*
Constant	−0.00	Constant	0.01 **
GDP	0.23 ***	Non-farm payrolls	−0.17 ***
Employment	0.15 ***	GDP (advance)	−0.08 **
Retail sales	0.10 ***	Core CPI	−0.07 **
CPI	0.10 **	Trade balance	−0.06 **
Building approvals	0.03 *	PPI	−0.04 ***
Trade balance	0.03 *	Retail sales	−0.04 *
Average weekly earnings	0.03	Personal income	−0.01
Wage cost index	0.00	Housing starts	0.00
Housing finance	−0.03 *	Durable goods	0.00
PPI[b]	na	Personal spending	0.00
		Initial jobless claims	0.03 ***
		11.15 pm[a]	
		Data release	*Coefficient*
		Constant	0.00
		Capacity utilisation	−0.01
		Industrial production	0.02
		US: midnight[a]	
		Data release	*Coefficient*
		Constant	−0.00
		ISM manufacturing	−0.05 ***
		Consumer confidence	−0.02
		ISM non-manufacturing	−0.01

Notes: White's heteroskedasticity-consistent standard errors are used to calculate the *t*-ratios.
***, ** and * indicate significance at the 1, 5 and 10 per cent levels respectively.
(a)   Australian Eastern Standard Time (AEST). During Australian daylight saving time, the time in Sydney of US economic data releases is two hours later.
(b)   The PPI is excluded from the analysis as regular forecasts are not available over our sample.
Sources: Bloomberg; RBA; Reuters

13 *A positive surprise occurs when $S_{kn}>0$, while a negative surprise is defined as $S_{kn}<0$. When $S_{kn}=0$ there is no surprise.*

14 *This is not always the case. See Footnote 3 and discussion below.*

that, on average, economic data releases are the main determinants of movements in the Australian dollar at these times of day. For US data released at 10.30 pm AEST, there is a small but significant positive coefficient. This may suggest that over the sample, variables other than the economic data releases considered here have affected the exchange rate at this time of day.

For Australian data released at 11.30 am, the data for GDP, employment, retail sales, the CPI, building approvals and the trade balance that are above market expectations lead to a statistically significant appreciation of the exchange rate. Similar to the results presented in Table 1, GDP has the largest coefficient. This suggests that a GDP outcome of 0.3 percentage points above the median forecast – the average forecasting error in the sample – would lead to a 0.23 percentage point increase in the AUD/USD. This equates to an increase of 15 basis points when the Australian dollar is trading at US66 cents, the average exchange rate over the sample. The result for housing finance suggests that a larger-than-expected outcome would cause a decline in the Australian dollar, albeit very small. This result is not in line with expectations and is difficult to explain.

Turning to the results for US data releases, positive surprises for non-farm payrolls, GDP, core CPI, the trade balance, PPI, retail sales and the ISM manufacturing index tend to be associated with a statistically significant depreciation in the AUD/USD exchange rate. In addition, a higher-than-expected outcome for initial jobless claims leads to a statistically significant appreciation. The fact that the core CPI, PPI and initial jobless claims contain a relatively small surprise component compared with some data releases may explain why the coefficient estimates on these releases are insignificant in regression Equation (1), but significant in Equation (3) (Table 2). That is, if the market is better at anticipating the outcomes of these releases, there is less likely to be a significant exchange rate response when the data are released.[15]

The release of US non-farm payrolls has the largest impact on the AUD/USD exchange rate, reflecting its timeliness and its importance in market forecasts for the US economy. An average surprise in non-farm payrolls – which over the sample was 82 000 – will, on average, lead to a 0.17 percentage point fall in the AUD/USD within the hour following the release. This equates to around 11 basis points when the Australian dollar is trading at US66 cents.

These findings are in line with a wide body of work on the US dollar exchange rate and US economic data releases. Much of this research examines the impact of data releases on the EUR/USD (or Deutsche mark prior to 1999) and finds that the release of US economic data results in a statistically significant increase in the volatility of the exchange rate.[16] The release of US non-farm payrolls is generally found to have the largest impact on the volatility of the EUR/USD, as is found to be the case for the AUD/USD here. Research examining the impact of the surprise component of US economic data releases on the EUR/USD has found that the US dollar tends to appreciate versus the euro (or Deutsche mark) following a positive surprise in US economic activity.[17] There is less evidence of a statistically significant impact on the exchange rate following a surprise in US inflation data.

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15 *For example, there is no surprise in the core US CPI 40 per cent of the time during our sample. That is, the core US CPI comes out in line with expectations in four out of every ten months, on average.*

16 *See Ederington and Lee (1993) and Andersen and Bollerslev (1998), among others.*

17 *See Almeida, Goodhart and Payne (1998), among others.*

Comparing Australian and US GDP releases shows that the impact on the AUD/USD of an average surprise in Australian GDP is larger (in absolute value) than the impact of an average surprise in US GDP, with coefficients of 0.23 and –0.08 respectively. One explanation is that a positive surprise in US GDP can be interpreted in different ways by the market. The traditional interpretation is that a positive surprise affects growth differentials in favour of the US, and leads to a depreciation of the AUD/USD. A second interpretation is that a positive US growth surprise is considered good for global growth, which can lead to a reduction in risk aversion. Demand for Australian dollar assets tends to increase in such an environment, which places upward pressure on the Australian dollar. This latter effect may offset the former to some extent, which might explain the smaller magnitude of the coefficient on the US GDP variable. This argument holds for other releases, but not for the employment releases where the coefficients are similar in magnitude.

Once again, the regression analysis is repeated using the AUD/EUR and AUD/JPY as independent variables in Equation (3), to determine whether surprises in US economic data releases have a differential impact on the currencies of other countries. In general, the Australian dollar appreciates against the euro and, to a lesser extent, the yen, when there is a positive surprise in data measuring US economic activity. Specifically, a positive surprise in:[18]

- US GDP, non-farm payrolls, the trade balance, retail sales, the ISM manufacturing index and consumer confidence result in a statistically significant appreciation in the AUD/EUR following their release;

- US industrial production leads to an appreciation of the AUD/JPY; and

- US CPI, capacity utilisation and personal income result in a statistically significant depreciation in the AUD/EUR and the AUD/JPY.

The coefficient estimates for the US economic data releases are generally smaller in magnitude for the AUD/EUR and AUD/JPY compared with the AUD/USD.

Hence, a positive surprise in data measuring US economic growth tends to result in a depreciation of the AUD/USD, but an appreciation of the Australian dollar against the euro and the yen. There are two effects at work here. Firstly, a positive surprise in data measuring US economic growth results in a widening of growth differentials in favour of the US, which tends to result in a depreciation of other currencies against the US dollar. However, a positive US growth surprise is also considered good for global growth. This provides some support for the Australian dollar, reflecting the market's assessment that the Australian dollar is more sensitive to global growth than the euro or yen.[19] Combining these two effects, the Australian dollar will tend to depreciate against the US dollar, but appreciate against the euro and the yen.

A positive surprise in US inflation data tends to result in a depreciation of the Australian dollar against the US dollar, euro and yen. Once again, there are two effects at work. First, higher-than-expected US inflation may signal an increased likelihood of an official interest rate rise in the US. This would affect interest rate differentials in favour of the US, resulting in a depreciation of currencies against the US dollar. Second, higher US interest rates may be

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18 *Results not reported here.*

19 *See Cairns, Ho and McCauley (2007).*

expected to slow US growth, and therefore global economic growth. Given that the Australian dollar is assessed by the market to be more sensitive to the global outlook than the euro and yen, the AUD/EUR and AUD/JPY will tend to depreciate.

Conclusion

Volatility of the Australian dollar is found to increase around the time of regular Australian and US economic data releases. Of the Australian economic data releases, GDP and the labour force data have the largest influence on the volatility of the AUD/USD around the time of their release, while the release of the CPI, the RBA's *Statement on Monetary Policy* (which outlines the RBA's forecasts for inflation), the trade balance and retail sales also result in an increase in volatility.

Of the US economic data releases, the labour market data have the largest impact on AUD/USD volatility. The release of US GDP, the trade balance, retail sales and the ISM manufacturing index also cause a statistically significant increase in volatility around the time of their release.

US economic data releases are also found to have a differential impact on the currencies of other countries. In general, the Australian dollar appreciates versus the euro and, to a lesser extent, the yen, when there is a positive surprise in data measuring US economic activity. A likely explanation is that news about US economic growth will affect expectations of current and future global growth prospects, which are relatively more important for the Australian dollar.

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