

# Foreign Exchange Market Intervention

Vicki Newman, Chris Potter and Michelle Wright\*

The Reserve Bank's approach to foreign exchange market intervention has evolved since the float of the Australian dollar in 1983, as the Australian foreign exchange market has developed and market participants have become better equipped to manage their foreign exchange risk. Over time, foreign exchange market intervention has become much less frequent and more targeted towards addressing periods of market dysfunction. This article presents a new dataset and summarises the key characteristics of major intervention episodes since the late 1980s. Some simple regression analysis is undertaken to gauge the effectiveness of these interventions, but the results mainly illustrate the inherent limitations of such exercises.

## Introduction

The Reserve Bank of Australia (RBA) transacts in the foreign exchange market on an almost daily basis. However, only a small subset of these transactions can be characterised as foreign exchange market 'interventions' – where interventions are defined as transactions undertaken with the sole objective of influencing market conditions. Instead, the bulk of the RBA's foreign exchange transactions are carried out as a result of the Bank's function as the provider of foreign exchange services for the Australian Government. In contrast to intervention, these routine transactions are expressly designed to avoid influencing broader market conditions.<sup>1</sup>

This article provides an overview of how the RBA's approach to foreign exchange market intervention has evolved since the float of the Australian dollar in 1983. To this end, it presents some summary statistics that characterise the RBA's major intervention

episodes since the late 1980s, using new data that are being made available to the public for the first time.<sup>2</sup> These data provide a considerably more accurate series on intervention than that available previously. These data are also used to conduct some simple regression analysis which seeks to gauge the effect of these interventions on conditions in the foreign exchange market. Notwithstanding the improvement to the data, the regression analysis illustrates the limitations in empirically assessing the effects of interventions on exchange rates. Nevertheless, the results do provide some support for the conclusion that the RBA's intervention transactions have had a stabilising effect on conditions in the foreign exchange market, which is corroborated by the Bank's real-time observations of the influence of individual transactions on broader trading conditions.

The infrequency of foreign exchange market intervention by the RBA reflects the Bank's views of the benefits of a freely floating exchange rate: exchange rate adjustments play an important role in the economy adapting to external shocks. This

\* The authors are from International Department.

1 Most studies define intervention as central bank foreign exchange transactions intended to influence foreign exchange market conditions (Vitale 2007). However, there is a lack of consensus over whether transactions for reserve accumulation or reserve reduction meet this definition (Adler and Tovar 2011). The RBA's reserve rebuilding and reduction transactions have been designed to avoid influencing market conditions and so are excluded from the intervention series presented here.

2 These data are now available on the RBA's website in Statistical Table A5 at <<http://www.rba.gov.au/statistics/tables/xls/a05hist.xls>>. These data will be updated annually with the release of the RBA *Annual Report*.

benefit relies upon market participants being able to effectively manage their exchange rate risk, which is enhanced by the presence of well-developed hedging markets.

The Bank's approach to intervention has evolved over the past 30 years. In the period immediately following the floating of the exchange rate, the market was at an early stage of development and the exchange rate was relatively volatile as a result. As market participants were not always well-equipped to cope with this volatility, the Bank sought to mitigate some of this volatility to lessen its effect on the economy. However, as the market developed and participants became better at managing their exchange rate risk, the costs of volatility have reduced. Accordingly, the Bank's interventions have become less frequent and more targeted towards addressing infrequent periods of disorderly market conditions.

## How the RBA Intervenes

When the RBA intervenes in the foreign exchange market, it creates demand or supply for the Australian dollar by buying or selling Australian dollars against another currency. The RBA almost always conducts its intervention in the Australian dollar/US dollar exchange market, owing to the fact that liquidity and turnover are greatest in that market. The RBA has the capacity to deal in markets for the Australian dollar around the world in all time zones. Most of the RBA's foreign exchange intervention transactions occur in the spot market. If the RBA chooses to neutralise any resulting effects on domestic liquidity conditions, foreign exchange intervention transactions can be 'sterilised' through offsetting transactions in the domestic money market or, as has been typically the case, through the use of foreign exchange swaps.<sup>3</sup>

In large part, the approach taken by the Bank will depend on the precise objective of the intervention and, in particular, the type of signal the Bank wishes to send to the market. By using its discretion in

deciding when to transact, the size of the transaction and how the transaction will be conducted, the RBA is potentially able to elicit different responses from the foreign exchange market. Generally speaking, transactions that are relatively large in size and signalled clearly are expected to have the largest effect on market conditions, with these effects further amplified if trading conditions are relatively illiquid. This is in stark contrast to the routine foreign exchange transactions undertaken by the RBA on behalf of the Government, where the express intention is to have a minimal influence on the exchange rate.<sup>4</sup>

Historically, the RBA has generally chosen to intervene by transacting in the foreign exchange market in its own name, in order to inform participants of its presence in the market. This 'announcement effect' can itself have a significant impact on the exchange rate, as it conveys information to the market about the RBA's views on the exchange rate from a policy perspective. The intervention transactions are typically executed through the broker market, either voice or electronic, or through direct deals with banks. Intervention in the broker market could involve the RBA placing a 'bid' or 'offer' but, if it wishes to send a stronger signal, the RBA would either 'give the bid' or 'pay the offer' of the broker. Direct deals with banks are similar whereby the RBA would request a 'two way' quote for a fixed amount and either 'give the bank's bid' or 'pay the bank's offer'. The effects of direct transactions with banks are realised over two stages. First, after receiving a direct quote request from the RBA, banks will adjust their quotes as compensation for holding the currency the RBA is trying to sell and for bearing the potential risk that the RBA is simultaneously dealing with other banks (who would also be adjusting their quotes). For example, if the RBA wants to sell US dollars and purchase Australian dollars, banks will increase their

<sup>3</sup> For further information on the use of foreign exchange swaps for sterilisation purposes, see Becker and Sinclair (2004).

<sup>4</sup> The RBA typically aims to minimise the effect of its routine transactions by executing trades at times when the market is liquid and, if necessary, breaking up the required purchases/sales into a series of smaller transactions so as to minimise the price impact of individual trades.

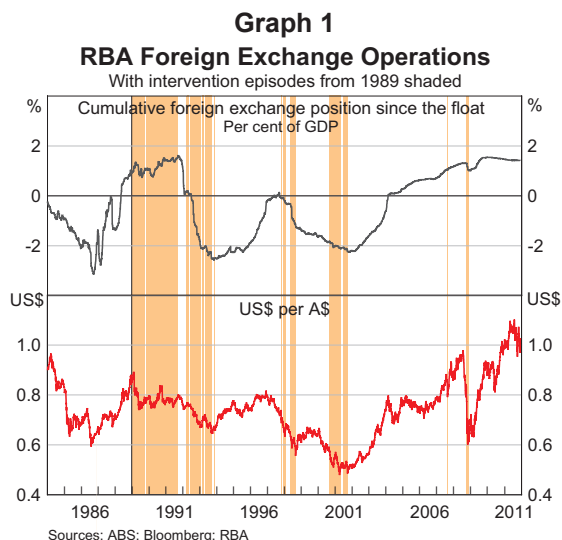
Australian dollar offer quotes. Second, after banks have traded with the RBA, this can trigger additional price adjustments among market makers in the spot foreign exchange market.

## The Evolution of RBA Intervention

Since the float of the Australian dollar in December 1983, the RBA's approach to foreign exchange market intervention has evolved through a number of phases as the Australian foreign exchange market has matured.

In Becker and Sinclair (2004), the RBA's intervention transactions are described as occurring over three cycles – cycle 1 from December 1983 to September 1991, cycle 2 from September 1991 to September 1997, and cycle 3 from September 1997 onward. This characterisation was based on cycles in the RBA's cumulative net foreign exchange reserves position, which was a particularly relevant metric for their study (Graph 1).<sup>5</sup> This article focuses instead on individual intervention 'episodes', where episodes are defined as a set of intervention transactions. New episodes begin after conditions in the foreign exchange market have stabilised – at least temporarily – since the previous intervention episode, or when previous interventions were on the other side of the market.

Broadly speaking, in the years immediately following the float, the goal was to smooth out day-to-day volatility in the value of the Australian dollar. In the first few years after the float (end 1983 to around mid 1986), interventions were small, frequent, and often involved switches from purchases to sales of foreign exchange in quick succession. This period has previously been described as the 'testing and smoothing' phase of intervention, reflecting the RBA's dual purposes of: (i) maintaining a presence in the market in order to gain a better understanding of how it operated under the new floating exchange

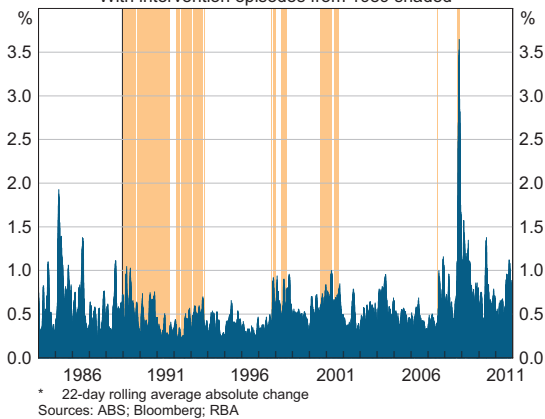


rate regime; and (ii) moderating the substantial day-to-day volatility in the exchange rate, given the limited capacity of some market participants to manage this volatility.

Even before the end of the 1980s, the foreign exchange market had developed significantly, with the average daily turnover of Australian dollars in the Australian market having risen more than eightfold since the time of the float. By the early 1990s, volatility was also much reduced (Graph 2). With the need to 'test and smooth' now much diminished, the focus of intervention evolved towards responding to episodes where the exchange rate was judged to have 'overshot' the level implied by economic fundamentals and/or when speculative forces appeared to have been dominating the market. This shift resulted in less frequent, but typically larger, transactions. Reflecting the focus on redressing instances of exchange rate misalignment, switches between sales and purchases of foreign exchange were also somewhat less frequent than during the 'testing and smoothing' period. Periods where the exchange rate was judged to have 'undershot' were typically countered by a series of sales of foreign exchange reserves (purchases of Australian dollars), and periods where the exchange rate was judged to have 'overshot' were typically addressed

<sup>5</sup> Becker and Sinclair (2004) use the 'profit test' to assess whether interventions have exerted a stabilising influence on the exchange rate, with the rationale being that if central bank intervention has been profitable, it must have 'bought low and sold high'.

**Graph 2**  
**Australian Dollar Volatility\***  
 With intervention episodes from 1989 shaded



through a series of foreign exchange purchases (sales of Australian dollars). This approach to foreign exchange intervention continued through to the early 1990s.

While data limitations make it difficult to identify a comprehensive series of intervention transactions prior to 1989, there were nevertheless some notable instances of intervention during this period. These include episodes in July 1986, January 1987 and October 1987, which involved large sales of RBA foreign exchange reserves in order to support the Australian dollar in response to major domestic and international developments (following the 'Banana Republic' comments, a European Monetary System exchange rate realignment<sup>6</sup> and the October 1987 stock market crash, respectively).

However, starting from 1989, it is possible to obtain a more reliable series by applying a filter to daily transactions data, and overlaying this with institutional knowledge (Table 1). The data are illustrative but not definitive, as the method used to identify the transactions is necessarily somewhat imprecise. Nevertheless, this new dataset indicates that the RBA intervened on almost half of the trading days between January 1989 and late 1991.

<sup>6</sup> Four of the ten currencies in the European Currency Unit were revalued (the German mark, Dutch guilder and Belgian and Luxembourg francs).

This period consisted of a series of relatively lengthy foreign exchange purchase (Australian dollar sale) episodes to resist appreciation pressures on the Australian dollar, punctuated by shorter episodes of foreign exchange sales (Australian dollar purchases) to support the Australian dollar. Overall, the RBA undertook cumulative net purchases of foreign exchange (sales of Australian dollars) of around A\$12½ billion through this period to place downward pressure on the relatively high Australian dollar. The daily intervention transactions that took place throughout this period were, on average, equivalent to around A\$60 million, or 0.3 per cent of daily turnover in the Australian foreign exchange market, and as large as A\$461 million, or 2.7 per cent of daily average turnover.

From the early 1990s, the threshold for what constituted an 'overshooting' in the exchange rate became much higher: a moderate misalignment was no longer considered sufficient to justify an intervention. This gradual change in the RBA's approach occurred as the foreign exchange market became increasingly developed and much less volatile than it had been in the late 1980s. But, more importantly, market participants had become better equipped to manage volatility, particularly through hedging. Accordingly, the main focus of intervention shifted to episodes that could be characterised by evidence of significant market disorder – that is, instances where market functioning was impaired to such a degree that it was clear that the observed volatility was excessive. Reflecting this, the previous pattern of alternating foreign exchange sales and purchases was replaced by a series of less frequent sales of foreign exchange (with no interventions in the form of foreign exchange purchases recorded after mid 1992, Graph 3). The one-sided nature of these interventions reflected concerns regarding market conditions when the exchange rate had been facing depreciation pressures.

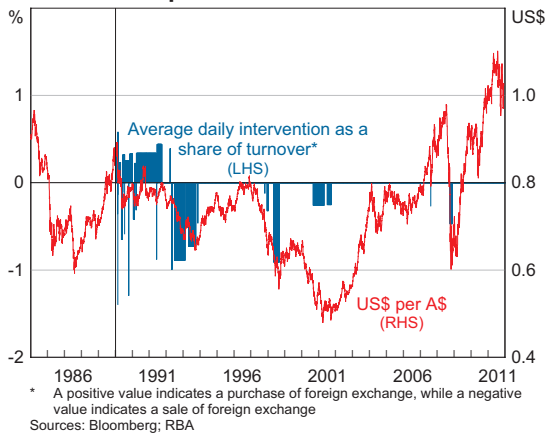
**Table 1: RBA Foreign Exchange Intervention Episodes – 1989–2011**

Dates	Number of days with intervention transactions Number	Range of Australian dollar during episode US\$ per A\$	Total size of interventions during episode <sup>(a)</sup> A\$ million	Average size of daily interventions Share of average daily turnover over intervention months Per cent
<b>Period 1: January 1989–September 1991</b>				
Jan–Feb 89	20	0.86–0.90	1 033	0.36
Feb 89 (1)	2	0.82–0.87	–128	0.36
Feb 89 (2)	1	0.82–0.83	47	0.26
Feb 89 (3)	1	0.81–0.81	–250	1.40
Feb 89 (4)	4	0.80–0.83	414	0.58
Feb 89 (5)	1	0.80–0.80	–25	0.14
Mar–Apr 89	21	0.80–0.83	956	0.23
May 89	9	0.74–0.79	–1 215	0.65
Jun 89 (1)	3	0.75–0.76	140	0.25
Jun 89 (2)	1	0.74–0.75	–20	0.11
Jun–Jul 89	21	0.74–0.78	1 161	0.32
Jul 89	1	0.74–0.75	–95	0.59
Jul–Oct 89	48	0.75–0.79	1 927	0.25
Oct 89	1	0.76–0.77	–210	1.29
Nov 89–Jan 90	17	0.77–0.80	877	0.33
Jan–Feb 90	9	0.74–0.80	–746	0.42
Feb–Mar 90	16	0.75–0.77	682	0.22
Mar 90	2	0.75–0.76	–115	0.31
Mar 90–May 91	116	0.75–0.84	7 151	0.34
Jun 91	3	0.75–0.76	–445	0.88
Jun–Sep 91	22	0.76–0.80	1401	0.44
<b>Period 2: March 1992–November 1993</b>				
Mar–Apr 92	4	0.76–0.77	228	0.39
Apr–May 92	3	0.75–0.76	–455	0.99
Jun 92–Feb 93	59	0.66–0.75	–9 071	0.89
Mar–Apr 93	2	0.70–0.72	–200	0.50
Apr–Sep 93	23	0.64–0.72	–3 284	0.73
Nov 93	1	0.66–0.66	–90	0.46
<b>Period 3: October 1997–September 2001</b>				
Oct 97	1	0.68–0.72	–50	0.12
Dec 97–Jan 98	3	0.63–0.66	–350	0.32
May–Aug 98	10	0.55–0.64	–3 870	0.91
Sep 00–Apr 01	29	0.48–0.57	–2 906	0.26
Jul–Sep 01	9	0.48–0.54	–1 098	0.25
<b>Period 4: August 2007–November 2008</b>				
Aug 07	1	0.78–0.82	–318	0.27
Oct–Nov 08	9	0.60–0.77	–3 759	0.47

(a) A positive value indicates a purchase of foreign exchange, while a negative value indicates a sale of foreign exchange.

Sources: Bloomberg; RBA

**Graph 3**  
**RBA Foreign Exchange Intervention**  
**Episodes from 1989**



There were six major intervention episodes in 1992 and 1993. With the exception of the first of these episodes, all intervention transactions during this period involved sales of foreign exchange (purchases of Australian dollars) to resist downward pressure on the Australian dollar, with cumulative net sales totalling around A\$13 billion. Intervention transactions took place on around 20 per cent of trading days during this period but were much larger, on average, than those in the earlier period. The largest one-day intervention during this period was a A\$1.3 billion sale of foreign exchange, equal to 7.5 per cent of daily average turnover; on average, the daily intervention transactions that took place during this period were equivalent to around A\$145 million, or 0.8 per cent of daily average turnover in the Australian foreign exchange market.

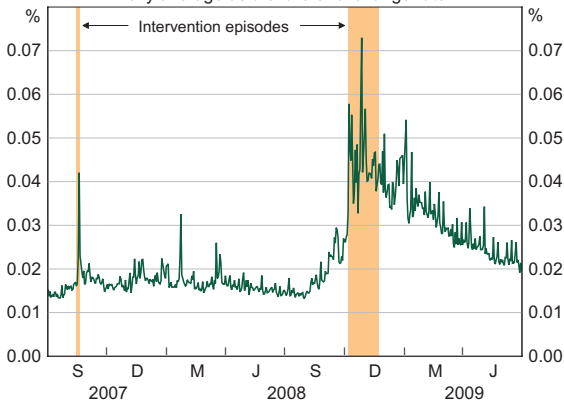
Between 1997 and 2001, there were five intervention episodes, with around A\$8.3 billion in cumulative foreign exchange sales (purchases of Australian dollars) undertaken. The frequency of interventions fell even further, to just 5 per cent of trading days

throughout this period. These episodes coincided with periods of significant market volatility – in particular, the 1997–1998 Asian financial crisis and the tech bubble in 2000–2001. During the tech bubble, the Australian dollar was under downward pressure as investors shunned commodity-based currencies in favour of those with exposure to new-economy technology assets. However, the RBA intervened as the Australian dollar became increasingly undervalued in one-sided market conditions.

The primary objective of interventions that occurred during the financial crisis beginning in 2007 was to address market dysfunction. In each of these particular episodes, the RBA had identified that trading conditions had become disorderly, with liquidity deteriorating rapidly in the spot market even though there did not appear to be any new public information. As discussed in Poole and D'Arcy (2008), the market became one-sided as large numbers of investors attempted to simultaneously unwind similar positions. At the same time, those participants with a natural interest on the other side of the market withheld liquidity, both in anticipation of better levels and because of uncertainty about whether transactions could be executed. As a result, there were increasingly sharp price movements between trades.<sup>7</sup> Accordingly, on each of these occasions, the interventions – which took place when liquidity was poor as indicated, for example, by widening bid-ask spreads (Graph 4) – were designed to improve liquidity in the market and thereby limit disruptive price adjustments.

Since these episodes, the RBA has not intervened in the foreign exchange market as liquidity in the Australian dollar has been acceptable, notwithstanding the fact that the Australian dollar exchange rate has traded in a wide range.

<sup>7</sup> See also DeBelle, D'Arcy and Ossolinski (2009) for more detail on these episodes.

**Graph 4****AUD/USD Interbank Bid-ask Spread**  
Daily average as a share of exchange rate\*

\* Calculated from hourly average using tick data; excludes public holidays  
Sources: RBA; Securities Industry Research Centre of Asia-Pacific (SIRCA) on behalf of Reuters

## Gauging the Effectiveness of RBA Interventions

Typically, studies of the effectiveness of foreign exchange market intervention attempt to quantify the effect of intervention transactions on the exchange rate. This is an inherently difficult exercise for three key reasons:<sup>8</sup>

- (i) Interventions usually take place when the exchange rate is moving in the opposite direction to the expected effect of the intervention (the 'endogeneity' or 'reverse causation' problem), and it is virtually impossible to know what would have happened to the exchange rate in the absence of the intervention.
- (ii) It may not always be appropriate to measure the success or failure of interventions using a simple metric such as the daily exchange rate return (a 'dependent variable' problem), nor may it be feasible to develop alternatives.

<sup>8</sup> See Neely (2005) and Vitale (2007) for an overview of results of previous studies in Australia and elsewhere.

- (iii) Data which accurately identify the magnitude of genuine intervention transactions have been scarce, with researchers often resorting to the use of imperfect proxies (an 'independent variable' problem).

Previous studies in Australia and elsewhere have employed various empirical methods that attempt to resolve the first problem, but with mixed and generally limited success. The second problem has generally received relatively little attention in the literature. The third problem has been an issue for previous studies of RBA interventions as they have all used some measure of 'net market transactions', which also includes the RBA's routine foreign exchange market transactions, to proxy for interventions.<sup>9</sup>

The econometric exercises presented in this article resolve this third problem by using the interventions series summarised in Table 1 as the independent variable. This new data series, which is being made available to all researchers, provides a considerably more accurate representation of the RBA's interventions in the foreign exchange market. But as these exercises demonstrate, despite efforts to reduce the impact of endogeneity and 'dependent variable' problems, these econometric issues cannot be overcome altogether, even with the benefit of a much-improved dataset.

In the first instance, the results of Equation 1 (Table 2) illustrate the pervasive problem of endogeneity. A standard GARCH (1,1) model of the relationship between the daily percentage change in the Australian dollar (exchange rate return) and contemporaneous RBA intervention transactions is estimated over the January 1989–December 2010

<sup>9</sup> Using an econometric approach that attempts to control for endogeneity, Kearns and Rigobon (2005) found that RBA interventions had successfully influenced the Australian dollar with most of the effect occurring on the day of intervention. Using an approach combining an event study and an econometric study, Edison, Cashin and Liang (2003) found that although the RBA has had modest success in moderating a depreciating Australian dollar, interventions may have modestly added to uncertainty in the market at these times.

**Table 2: Estimates of the Effects of RBA Intervention on the Australian Dollar**  
January 1989–December 2010, daily data

Dependent variable	Equation 1	Equation 2	Equation 3	Equation 4
	Exchange rate return (per cent)			Difference in exchange rate return (ppt)
<b>Explanatory variables</b>				
$I_t$	-0.146***	—	—	—
$I_{t-1}$	—	-0.012	-0.075***	—
$D_{t-1}I_{t-1}$	—	—	0.122***	—
$\Delta I_{t-1}$	—	—	—	0.063***

**Where:**

$I_t$  = contemporaneous intervention transactions

$I_{t-1}$  = intervention transactions, lagged by one day

$D_{t-1}I_{t-1}$  = intervention transactions, lagged by one day, when there was also an intervention transaction on the previous day; in all other cases this variable is set equal to zero

$\Delta I_{t-1}$  = difference in intervention transactions, lagged by one day

Notes: \*\*\*, \*\*, \* indicate significance at the 1, 5 and 10 per cent levels respectively, based on a normal distribution; intervention transactions are measured in A\$100 million blocks, with FX sales expressed as a positive value, and FX purchases expressed as a negative value

Eqn 1:  $\Delta \ln(ER_t) = 0.011 - 0.146I_t + \varepsilon_t$ ; Variance:  $h_t = 0.004 + 0.054(\varepsilon_{t-1})^2 + 0.938h_{t-1}$ ;  $R^2 = 0.02$ ; DW = 2.09

Eqn 2:  $\Delta \ln(ER_t) = 0.009 - 0.012I_{t-1} + \varepsilon_t$ ; Variance:  $h_t = 0.004 + 0.053(\varepsilon_{t-1})^2 + 0.939h_{t-1}$ ;  $R^2 = 0.00$ ; DW = 2.09

Eqn 3:  $\Delta \ln(ER_t) = 0.009 - 0.075I_{t-1} + 0.122D_{t-1}I_{t-1} + \varepsilon_t$ ; Variance:  $h_t = 0.004 + 0.052(\varepsilon_{t-1})^2 + 0.940h_{t-1}$ ;  $R^2 = 0.00$ ; DW = 2.10

Eqn 4:  $\Delta \ln(ER_t) - \Delta \ln(ER_{t-1}) = 0.000 + 0.063\Delta I_{t-1} + \varepsilon_t - 0.999\varepsilon_{t-1}$ ;  $R^2 = 0.52$ ; DW = 2.07

Where:  $ER_t$  = US dollar per Australian dollar exchange rate;  $\varepsilon_t$  = residual from mean equation;  $h_t$  = conditional variance of  $\varepsilon_t$

Sources: Bloomberg; RBA

sample period.<sup>10</sup> The negative coefficient estimate on the intervention variable suggests that sales of Australian dollars (purchases of foreign exchange) are usually associated with an appreciation of the Australian dollar, while purchases of Australian dollars (sales of foreign exchange) are typically associated with a depreciation. This result suggests that Equation 1 is not estimating the correct causal

relationship from intervention to the exchange rate movement; rather, it appears to be identifying a causal relationship from the exchange rate movement to intervention (which is why the problem is also known as 'reverse causation').

One common approach to addressing the endogeneity problem is to lag the intervention variable by one day, with the rationale being that an observed change in the exchange rate on any given day cannot have influenced the decision to intervene on the previous day. Although this specification averts the problem econometrically, it can be expected to lose much of its explanatory power if the main effect of an intervention on the exchange rate is fairly immediate and short-lived.

<sup>10</sup> The choice of a GARCH model is consistent with the literature. Financial time series typically exhibit volatility clustering, whereby large changes in a variable tend to be followed by other large changes and small changes tend to be followed by other small changes. GARCH models explicitly estimate this relationship and in so doing are able to estimate more accurate standard errors than an ordinary least squares approach. Variations of this standard GARCH model, for example an Exponential-GARCH, did not produce significantly different results.



Unsurprisingly, the estimated coefficient on the lagged intervention term is statistically insignificant (Equation 2). This is consistent with the results of previous work, which to the extent that it has been able to identify a causal effect of intervention on the exchange rate, suggests that this effect occurs on the day on which the intervention occurs (Kearns and Rigobon 2005).

While there is no evidence that previous-day interventions affect the current-day exchange rate return on average, Equation 3 suggests that the effect of a one-off intervention on the exchange rate is different from interventions that take place over two or more consecutive days. Equation 3 not only includes any intervention on the previous day, but also an interactive dummy variable for interventions that take place on the second and subsequent consecutive days of an episode. Taken literally, the coefficient estimates suggest that first-day interventions (including one-off interventions) have an effect counter to expectations: each A\$100 million worth of foreign exchange sold (purchased) would be expected to contribute to a 0.07 per cent depreciation (appreciation) of the exchange rate on the following day. However, when the RBA chooses to follow-up the first-day intervention by intervening on the subsequent day(s), each A\$100 million worth of foreign exchange sold (purchased) on a subsequent consecutive day of an intervention episode is estimated to contribute to a 0.05 per cent appreciation (depreciation) in the exchange rate on the following day (based on the sum of the coefficients on the intervention variables in the regression). This result might indicate that RBA interventions that take place over consecutive days are more 'effective' because the market views consecutive interventions to be more credible than one-off interventions. This effect is, however, still very small and it could be that these results are still affected by issues related to endogeneity.

Another problem with assessing the effectiveness of exchange rate intervention is that in some periods, the daily exchange rate return may not be an

adequate proxy for the 'success' or 'failure' of these transactions (the 'dependent variable' problem). There are at least three possible reasons for this: (1) the effects of foreign exchange intervention may be very short-lived; (2) alternatively, interventions may have longer-term implications that are very hard to assess; or (3) in practice, the objective of intervention may not be to reverse the direction of an exchange rate move, but to simply improve market liquidity and/or slow the pace of the move, thereby restoring some order to trading conditions. Data constraints make it difficult to assess the relevance of the first two alternatives, but the third option (in particular, slowing the pace of the move) is examined in Equation 4.

Equation 4 uses the change in the exchange rate return – a measure of the speed with which the exchange rate is moving – as the dependent variable. Consistent with this, instead of using the level of intervention as the explanatory variable, this specification uses the (lagged) change in intervention. In effect then, Equation 4 can be interpreted as a weaker version of Equation 2, with all the variables used in Equation 2 expressed in changes in Equation 4.<sup>11</sup> The coefficient estimate from this exercise suggests that a A\$100 million increase in sales (purchases) of foreign exchange is expected to lead to a 0.063 percentage point higher (lower) change in the exchange rate the next day. Whether this leads to an appreciation or a depreciation on the following day depends on the magnitude of the same-day move in the exchange rate and the size of the intervention. For example, if the exchange rate had depreciated by 0.5 per cent on the day of a A\$100 million intervention to support the Australian dollar, it would still be expected to depreciate on the following day, but by less, at 0.44 per cent. However, if the size of the intervention was instead

<sup>11</sup> Given that the dependent variable is now the change in the exchange rate return, Equation 4 is estimated as a moving-average (MA) model using ordinary least squares. The addition of a lagged intervention variable (in levels) to this equation did not yield statistically significant results. Note also that the R-squared term has a slightly different interpretation under an MA model, as it includes the explanatory power of the lagged residual term.

A\$1 billion, the exchange rate would be expected to appreciate by 0.13 per cent on the following day. Consistent with the results of Equation 3, these effects will persist if interventions take place over consecutive days. Although a somewhat weaker test, it is arguably more appropriate for assessing the success of some of the RBA's foreign exchange interventions over time, particularly those designed to calm disorderly markets rather than to affect the level of the exchange rate per se.

While alternative dependent variables could be considered, or more sophisticated econometric techniques employed, the primary problem of endogeneity is very difficult – if not impossible – to overcome.

## Conclusion

This article presents a new and improved data series on interventions by the RBA in the foreign exchange market. These data allow a documentation of the evolution in the approach to foreign exchange market intervention after the float of the exchange rate. This evolution reflects a recognition that when foreign exchange markets are deep and liquid (and the capital account is open), the effects of intervention on the level of the exchange rate are generally short-lived. Moreover, under these 'normal' circumstances, the practical difficulties involved in determining what the 'fair value' of an exchange rate should be suggest that it is difficult for policymakers to systematically improve on market outcomes, particularly in real time. Nevertheless, in instances of severe market dysfunction, intervention can exert an important stabilising influence on the foreign exchange market.

The article uses the new data to reassess previous empirical assessments of the effectiveness of foreign exchange market intervention. It shows

that it is not possible to draw strong conclusions, notwithstanding the use of an improved measure of RBA interventions. The well-known limitations of this type of analysis suggest that the estimates of the effect of intervention on the exchange rate are expected to be understated, and may even be perverse. Moreover, as the goal of intervention has evolved toward addressing instances of extreme market dysfunction, it has become less clear that such specifications are still well-suited for assessing the effectiveness of foreign exchange market intervention. ✎

## References

- Adler G and C Tovar (2011)**, 'Foreign Exchange Intervention: A Shield against Appreciation Winds?', IMF Working Paper WP/11/65.
- Becker C and M Sinclair (2004)**, 'Profitability of Reserve Bank Foreign Exchange Operations: Twenty Years after the Float', RBA Research Discussion Paper No 2004-06.
- Debelle G, P D'Arcy and C Ossolinski (2009)**, 'Recent Conditions in the Australian Foreign Exchange Market', *RBA Bulletin*, March, pp 9–18.
- Edison H, P Cashin and H Liang (2003)**, 'Foreign Exchange Intervention and the Australian Dollar: Has it Mattered?', IMF Working Paper WP/03/99.
- Kearns J and R Rigobon (2005)**, 'Identifying the Efficacy of Central Bank Interventions: The Australian Case', *Journal of International Economics*, 66(1), pp 31–48.
- Neely C (2005)**, 'An Analysis of Recent Studies of the Effect of Foreign Exchange Intervention', *Federal Reserve Bank of St. Louis Review*, 87(6), pp 685–717.
- Poole E and P D'Arcy (2008)**, 'Liquidity in the Interdealer Foreign Exchange Market', *RBA Bulletin*, December, pp 1–6.
- Vitale P (2007)**, 'An Assessment of Some Open Issues in the Analysis of Foreign Exchange Intervention', *International Journal of Finance and Economics*, 12(2), pp 155–170.