Sensitivity of Australian Trade to the Exchange Rate

Duke Cole and Samual Nightingale*

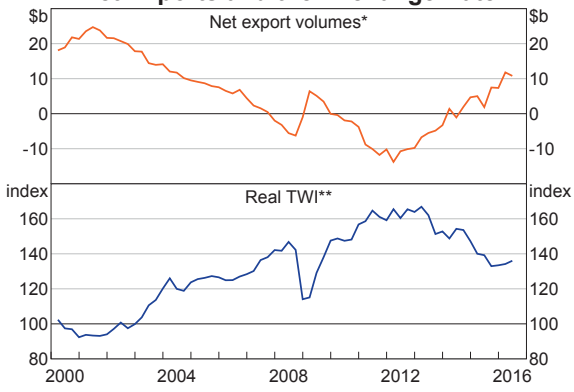
The exchange rate is an important determinant of Australian exports and imports. Movements in the exchange rate affect the relative prices of traded goods and services, and thus the competitiveness of domestic producers of exports and import-competing goods and services. This article provides estimates of the sensitivity of Australian exports and imports to changes in the exchange rate at the aggregate and component level. Other things equal, a 10 per cent depreciation in the real exchange rate is estimated to increase export volumes by around 3 per cent and decrease import volumes by about 4 per cent after two years, which implies a cumulative net exports contribution to gross domestic product (GDP) of around 1½ percentage points over this period. However, the aggregate responses of exports and imports disguise substantial variation in the responses of the components. Trade in services is generally more responsive to movements in the exchange rate than trade in goods, although it takes longer for the full effect to be seen in services trade volumes.

Introduction

The exchange rate plays an important role for Australian exports and imports. Domestically, a depreciation of the Australian dollar encourages substitution from imports to domestically produced goods and services, as imported products become relatively more expensive. A lower exchange rate also makes Australian exports more competitive in world markets, as exported goods and services become relatively cheaper in foreign currency terms.

Movements in the exchange rate assist the economy in adjusting to structural change, such as that experienced in Australia during the recent terms of trade boom (Jääskelä and Smith 2013; Gorajek and Rees 2015; Lowe 2015). Strong demand for resources from the rapidly growing Chinese economy caused commodity prices – and thus Australia's terms of trade – to rise substantially between 2001 and 2011. Associated with this, the Australian dollar appreciated by around 80 per cent in real trade-weighted terms over that period (Graph 1). The appreciation of the exchange rate raised the relative price of Australian-produced goods and services, thereby shifting demand – both domestically and internationally – away from the non-resource traded sectors of the Australian economy. By reducing the demand for labour and production inputs more generally in other parts of the economy, this gave the Australian economy more room to respond to the strong demand for resources without overheating. Over

Graph 1
Net Exports and the Exchange Rate



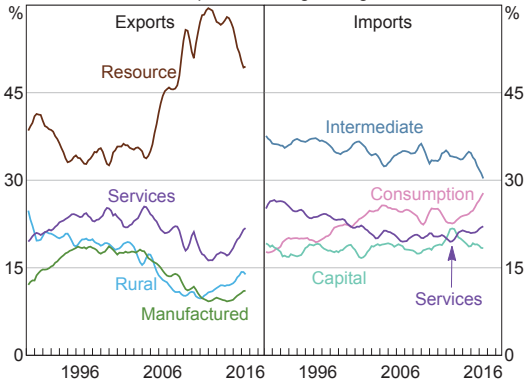
* Reference year is 2013/14
** March 1995 = 100
Sources: ABS; RBA

* The authors completed this work in Economic Analysis Department.

this period, mining investment expanded significantly, while net exports subtracted on average ¾ percentage point from annual GDP growth; although resource exports increased substantially, other exports were subdued and imports increased strongly.

As a result, the composition of Australia's exports changed dramatically. The share of resource exports in Australia's total export mix rose from around one-third in the 1990s to about half today, while the shares of other exports declined (Graph 2). In contrast, the composition of Australia's imports has been more stable; all components grew as incomes increased with the rise in the terms of trade.

Graph 2
Trade Shares*
Four-quarter moving average



* Shares do not sum to 100: 'other' goods exports are excluded from exports and non-monetary gold imports are excluded from imports

Sources: ABS; RBA

Australia's terms of trade have fallen substantially since the peak in 2011, as growth in China has moderated and the global supply of many commodities has increased. The Australian dollar has depreciated by about 20 per cent in real terms from its peak in 2013. This has contributed to a rise in demand for a range of exports and a decline in imports, notably of services. Net exports have contributed around 1½ percentage points to annual GDP growth on average during this period.[1] This has helped to sustain growth in the economy as investment in the resources sector has been wound back sharply.

In light of the important role played by the exchange rate for the Australian economy, this article provides estimates of the effects of exchange rate changes on trade volumes. These effects are estimated for exports and imports in total, as well as at the component level given the very different nature and developments of the components of trade.

Sensitivity of Trade Volumes to the Exchange Rate

We use an econometric model to quantify the historical relationship between changes in the exchange rate and their effects on exports and imports (see Appendix A).[2] The key determinants of trade volumes are demand and the real exchange rate. In the estimated models, the relevant demand variables are major trading partner growth (weighted by export shares) for exports, and domestic final demand plus exports (minus ownership transfer costs) for imports. Real exchange rate movements are captured by real trade-weighted indices, one for exports and one for imports. Weighting the indices by export and import trade shares, respectively, accounts for differences in the importance of destination and source countries for each side of the trade ledger.

The exchange rate elasticity – or sensitivity of trade volumes to changes in the exchange rate – is measured as the change in trade volumes (in per cent) that follows a 1 per cent change in the real exchange rate, all else equal. The estimates suggest that if the real exchange rate depreciates by 10 per cent, total exports will increase by around 4 per cent in the long run (Table 1). However, the responses of different components of exports vary

1 For discussion of recent developments in the trade of services, see RBA (2016). A slowdown in global trade in recent years has also contributed to the decline in imports, see Jääskelä and Mathews (2015).

2 This article focuses only on the direct effect of exchange rate changes on trade, using an error correction framework. Kohler, Manalo and Perera (2014) discuss the aggregate impact of the exchange rate on GDP and inflation and Rees, Smith and Hall (2015) provide estimates of the effects of the exchange rate in Australia using a dynamic stochastic general equilibrium model.

Table 1: Long-run Responses to a 1 per cent Depreciation in the Real Exchange Rate[a]
March 1983–December 2015, percentage points

	Response
Exports	**0.41*** **
Resource	0.22**
Rural	0.08
Manufactured	2.00***
Services	1.15***
Imports	**–0.35*** **
Consumption[b]	–0.13
Capital[b]	–0.69***
Intermediate[b]	0.10
Services	–1.13***

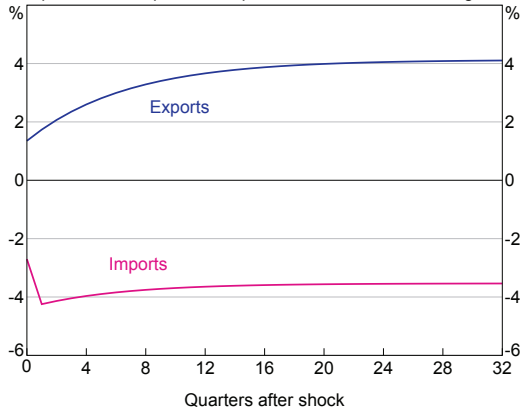
(a) *,** and *** indicate statistical significance at the 10, 5 and 1 per cent levels respectively for Wald tests
(b) Model estimated from March 1986
Sources: ABS, RBA

substantially.[3] Manufactured and service exports show a larger response than total exports to a change in the exchange rate. In contrast, resource exports appear less sensitive, while the response of rural exports is not statistically significant; that is, the estimates suggest that they do not respond to a depreciation in the long run. The models for goods exports are of generally poor fit. This suggests that they do not explain much of the variation in goods export volumes; other factors, not included in the model, may be more important. For example, rural exports are heavily impacted by weather events, such as droughts.

The estimates imply that imports decline by a little less than 4 per cent in the long run following a 10 per cent depreciation of the real exchange rate. As with exports, the responses of import components vary. Service imports move around one-to-one with the exchange rate. Goods imports are relatively less sensitive to movements in the exchange rate; the response of capital imports is moderately smaller than service imports, while consumption imports respond only modestly. Although the estimated elasticity of intermediate imports has the wrong sign, it is not statistically different from zero which suggests that intermediate imports do not respond to movements in the exchange rate.

Overall, the response to a 10 per cent depreciation of the real exchange rate implies a net exports contribution to GDP of around 1½ percentage points after two years. The full effect of an exchange rate change on trade volumes takes longer to occur. This can be illustrated with impulse response functions, which provide an estimate of the path of trade volumes following a change in the real exchange rate, assuming all other factors remain unchanged. For exports, about half of the adjustment occurs within a year of the depreciation (Graph 3). Imports respond slightly faster, with most of the response occurring in the first year. Services trade generally responds a bit more slowly than goods trade to a change in the exchange rate (Graph 4; Graph 5). In the case of service exports, it takes about two years for half of the effect of a change in the exchange rate to flow through to volumes.[4]

Graph 3
Trade Impulse Response Functions
Response to a 10 per cent depreciation of the real exchange rate

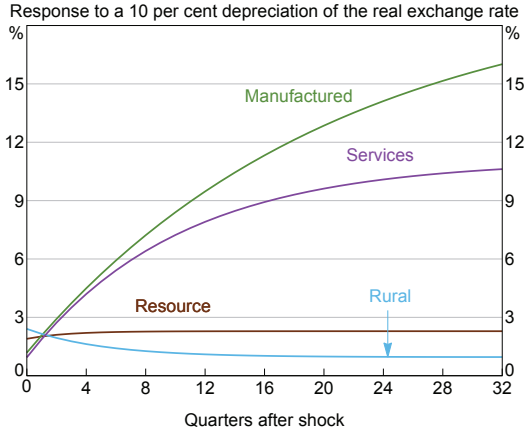


Source: RBA

3 The weighted average of the component elasticities is close to the elasticities of both total exports and total imports, despite the components being estimated separately.

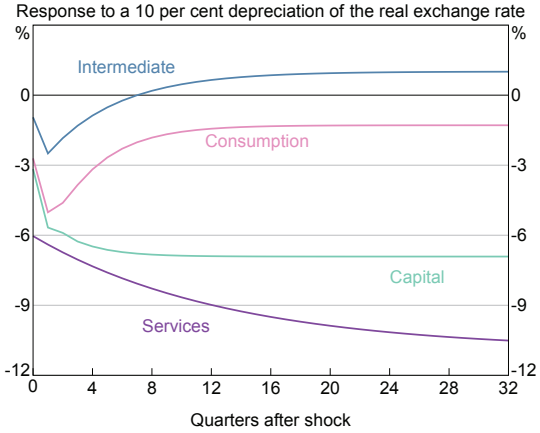
4 These estimates are for the most part in line with previous Reserve Bank of Australia work on trade elasticities: see, for example, Kohler *et al* (2014) and Dvornak, Kohler and Menzies (2003).

Graph 4
Exports Impulse Response Functions
Response to a 10 per cent depreciation of the real exchange rate



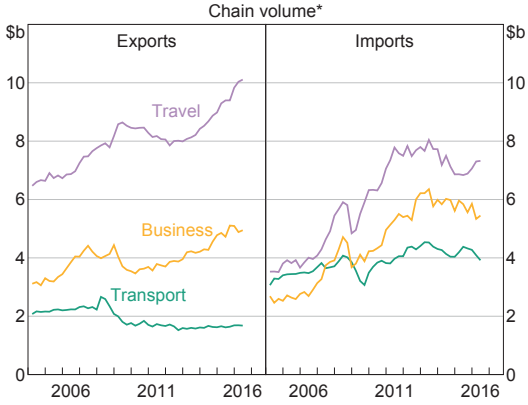
Source: RBA

Graph 5
Imports Impulse Response Functions
Response to a 10 per cent depreciation of the real exchange rate



Source: RBA

Graph 6
Services Trade Components
Chain volume*



* Reference year is 2013/14
Source: ABS

The Variation in Trade Volume Responses

Service exports and imports

Trade in services shows a relatively large response to movements in the exchange rate, although the full response only occurs with a lag of a few years. To understand this result, we consider the two major components of services trade – travel services and business services (Graph 6). Travel service exports capture spending on goods and services by foreigners in Australia, including overseas students, while travel service imports include spending by Australians overseas. Business services trade covers activities such as accounting, architecture, consulting and technical services.

The adjustment of travel services trade to an exchange rate change is likely to occur over an extended period because there is generally a lag associated with planning overseas travel or study. In the medium term, a depreciation is likely to increase the number of visitors to Australia and decrease the number of Australians travelling overseas, as it encourages both foreigners and Australians to shift some of their travel expenditure to Australia from overseas destinations (and the opposite should hold true for an appreciation). However, there is also a more immediate effect on travel services trade from exchange rate changes. Following a depreciation, the purchasing power of foreign currencies rise in Australian dollar terms; this allows foreign visitors to increase spending in real terms and thus boosts travel service exports. Similarly, Australians travelling overseas experience a fall in the purchasing power of Australian dollars in foreign currency terms and are likely to reduce their spending in real terms, which reduces travel service imports.

There are also expected to be short-term and medium-term effects of exchange rate changes on business services trade. For business services, the

initial response to the exchange rate is likely to be driven by contract-based work. Following a depreciation, Australian firms become more competitive for contracts both in Australia and abroad. This boosts exports of business services (Australian firms providing services to overseas clients) while business service imports (Australian clients purchasing services from foreign firms) are likely to be curtailed.

However, the decision by Australian firms to find a provider of services offshore – or return to an Australian provider – in response to an exchange rate change is only likely to be made if it is expected to be profitable over the medium-to-long term. Such decisions also depend on factors such as the relative availability of skilled labour, technical knowledge, production capacity and desires for longer-term cost reductions (Manalo and Orsmond 2013). If the exchange rate were to remain elevated for an extended period, some firms may be encouraged to source more services from offshore at the margin. On the other hand, a sustained depreciation of the exchange rate may encourage some firms to defer the decision to acquire services offshore, or choose to bring production of services back to Australia that had previously been moved offshore.

Resource and rural exports

Resource exports exhibit a relatively modest response to the exchange rate compared with manufactured and service exports.[5] During Australia's recent mining boom, resource exports increased strongly in the face of the large appreciation of the exchange rate. All else equal, a higher Australian dollar reduces the Australian dollar price received for commodity exports, which are typically priced in US dollars, thus discouraging these exports. However, the Australian dollar appreciated strongly because increased demand for bulk commodities drove commodity prices higher. In these circumstances, resource exporters found it profitable to invest in further capacity and export as much as they could to benefit from the commodity price increase, notwithstanding the appreciation.

Resource export volumes are likely to be relatively insensitive to exchange rate changes in the near term. There is generally a long lag between new investment and additional capacity. For a given level of capacity, the marginal cost of production is relatively low, so resource exports are not likely to respond to moderate changes in the exchange rate or commodity prices.[6] In addition, many Australian commodity producers are low cost by international standards. Indeed, declining commodity prices over recent years in large part reflect increased supply from low cost producers, including from Australia.

Rural exports also exhibit only a limited response to the exchange rate. In a similar manner to resource exports, supply decisions for rural exports – the planting of crops and breeding decisions – are generally made well in advance of the goods being exported. Additionally, weather conditions are a key driver of rural production and, in turn, export volumes.

Manufactured exports

Historically, manufactured exports have been quite responsive to movements in the exchange rate, albeit with some lag before the full effect occurs.[7] Many manufactured goods are trade exposed, and the share of production in the manufacturing industry that is exported is relatively large (Kohler *et al* 2014).

However, it appears that the relationship with the exchange rate has weakened somewhat of late.[8]

5 The Australian dollar is heavily influenced by commodity prices, which poses a challenge for disentangling the effect of the exchange rate on resource exports from the effect of commodity prices. If a commodity price variable is included and the model is run in a vector error correction model framework, the exchange rate elasticity of resource exports is not statistically different from zero.

6 This also adds to the difficulty of modelling the relationship between the exchange rate and resource exports.

7 See Menzies and Heenan (1993) for discussion of the drivers of the growth in manufactured exports from the mid 1980s to the early 1990s.

8 When the manufactured exports model is estimated with a rolling window, the magnitude of the exchange rate elasticity declines consistently over the sample, eventually turning positive in the latter parts of the sample (which counterintuitively implies that manufactured exports decline following a depreciation of the exchange rate).

Manufactured export volumes have been little changed since 2012 despite a large exchange rate depreciation. There is evidence, both via the Bank's business liaison program and in academic literature, that this is a structural phenomenon.[9] The Bank's liaison suggests that some manufacturers moved production offshore following the Australian dollar appreciation during the mining boom, but there has been limited evidence of companies moving production processes back to Australia following the depreciation of the dollar in recent years (Langcake 2016). Over the past one and a half decades, Australian manufacturers have faced intense competition from the rapid expansion of industrial capacity in lower-cost countries, in particular China after it joined the World Trade Organization in 2001. Some manufacturers have also noted significant lags between an exchange rate depreciation and their ability to change production, due to delays or lags in their supply chains.[10]

Goods imports

The response of goods imports to a change in the exchange rate is smaller than the response of service imports. This may reflect the lack of domestic substitutes for some imported products. An increase in the price of imported goods should encourage consumers to substitute away from imports to domestic goods, which become relatively cheaper. However, this 'substitution effect' is likely to be limited for goods imports if domestic alternatives are not readily available. Even if Australian-produced substitutes are available, it may not be simple or quick for firms to switch from using imported inputs in their supply chains to inputs produced in Australia.

Changes in the Australian dollar generally flow through fairly quickly to the prices of imports.[11] However, the response of goods import volumes to the exchange rate may be limited somewhat by the actions of domestic retailers and distributors, who may choose to absorb some of the changes in the cost of imported goods in their margins. Moreover, the effect of higher import prices, owing to the depreciation of the Australian dollar over the past three years, on final prices faced by consumers has been partly offset by recent developments in the retail sector, such as competition from new entrants and efficiency gains, which have placed downward pressure on retail margins (Ballantyne and Langcake 2016).

Conclusion

The exchange rate is an important determinant of Australia's exports and imports. Estimates suggest that, all else equal, a 10 per cent depreciation of the real exchange rate results in total exports increasing by around 3 per cent and total imports decreasing by just under 4 per cent over a two-year period; this would increase the level of GDP by around 1½ per cent, holding trade shares constant at current levels. However, there is substantial variation across the different components of trade. Trade in services is generally more responsive to movements in the exchange rate than trade in goods, although the full effect of the exchange rate on services takes some time. The relatively high sensitivity of services trade appears to reflect the greater availability of substitutes. In terms of goods exports, manufactured exports have historically shown the strongest response to the exchange rate, although this empirical relationship has weakened over time.

9 Gorajek and Rees (2015) note the subdued response of manufactured exports to the exchange rate depreciation in recent years. In the global context, Ahmed, Appendino and Ruta (2015) find evidence that the response of manufactured exports to an exchange rate depreciation has fallen over time due to increased 'cross-border production linkages', such as participation in global value chains (GVCs). GVCs are more likely to exist in high value-added production processes, which may be more differentiated, and less sensitive to the exchange rate. However, the Organisation for Economic Co-operation and Development (OECD) suggests that this factor may not be very important for Australian exports due to Australia's geographic isolation (OECD 2015).

10 For a broader discussion of developments in the manufacturing industry, see Langcake (2016).

11 Gillitzer and Moore (2016) discuss the role of invoice currency in the transmission of changes in the exchange rate to the Australian-dollar prices of imports. See also Chung, Kohler and Lewis (2011).

In contrast, the response of resource and rural exports to the exchange rate tends to be limited by relatively fixed supply in the short term. The response of goods imports to the exchange rate may be limited by the lack of readily available domestic substitutes, or the actions of domestic retailers and distributors.

Appendix A

The error correction model for total exports takes the form:

$$\Delta exports_t = \beta_0 + \beta_1 exports_{t-1} + \beta_2 TWI_{t-1} + \beta_3 demand_{t-1} + \phi_1 \Delta TWI_t + \phi_2 \Delta demand_t + \gamma Dummy. \quad \text{(A1)}$$

The long-run elasticities are obtained from the regression output. The exchange rate elasticity, in Table A1, is $-\beta_2/\beta_1$. The speed of adjustment, β_1, indicates how quickly exports respond to disequilibrium in the long-run equilibrium relationship. The long-run relationship is $exports_t = (-\beta_2/\beta_1)TWI_t + (-\beta_3/\beta_1)demand_t$. The imports models take the same form (Table A2).

Lags of the differences of key variables are included to capture the dynamic responses of these variables, and dummies are included in certain equations to account for large exogenous shocks. Each of the component models are formulated in the same way, though the lagged differences and dummies vary slightly.

The natural log of all variables is used. For each of the exports models, the demand variable is an index of GDP of Australia's major trading partners, weighted by export shares. For the imports models, the demand variable is domestic final demand plus exports minus ownership transfer costs.

Each of the variables in the long-run relationship is non-stationary, while the long-run relationship is stationary. This implies that the variables are cointegrated, and therefore can be modelled in an error correction framework.

Table A1: Estimation Results – Exports[(a)]
March 1983–December 2015

Model	Total exports	Services	Manufactured	Resource	Rural
Constant	0.93***	0.71***	0.42***	1.74***	1.03***
$Exports_{t-1}$	–0.14***	–0.09***	–0.05*	–0.31***	–0.16***
$Demand_{t-1}$	0.19**	0.14***	0.10	0.40***	0.14**
TWI_{t-1}	–0.06*	–0.10***	–0.09**	–0.07*	–0.02
$\Delta Demand_t$	0.55	0.17	1.63**	0.18	–0.13
ΔTWI_t	–0.14**	–0.09	–0.13	–0.19*	–0.24*
Olympic dummy[(b)]	0.04**	0.16***			
SARS dummy[(b)]		–0.08***			
9/11 dummy[(b)]		–0.09***			
R^2	0.17	0.53	0.12	0.18	0.12

(a) *, ** and *** indicate statistical significance at the 10, 5 and 1 per cent levels respectively for standard t-tests
(b) Olympic dummy equals 1 in September 2000 (when the Olympics were held in Sydney), –1 in December 2000, 0 otherwise; SARS (Severe Acute Respiratory Syndrome) dummy equals 1 in June 2003 (when the SARS virus epidemic started), –0.5 in September and December 2003, 0 otherwise; 9/11 dummy equals 1 in December 2001 (immediately after the 11 September 2001 terrorist attacks in the United States), 0 otherwise
Sources: ABS; RBA

Table A2: Estimation Results – Imports[a]
March 1983–December 2015

Model	Total imports	Services	Consumption[b]	Capital[b]	Intermediate[b]
Constant	–1.89***	–0.64**	–3.69***	–10.69***	–1.50***
$Imports_{t-1}$	–0.15***	–0.07**	–0.21***	–0.39***	–0.19
$Demand_{t-1}$	0.26***	0.07*	0.43***	1.00***	0.27***
TWI_{t-1}	0.05***	0.08***	0.03	0.27***	–0.02
$\Delta Demand_{t}$	1.59***	0.87***	1.00***	3.71***	1.48***
ΔTWI_{t}	0.27***	0.61***	0.27***	0.32**	0.09
$\Delta Demand_{t-1}$	0.65***	0.52**	0.22		0.69***
ΔTWI_{t-1}	0.14***		0.22***	0.14	0.19***
$\Delta Imports_{t-1}$			0.17*	–0.10	
$\Delta Demand_{t-2}$			0.61**		
SARS dummy[c]		–0.07**			
R^2	0.57	0.61	0.45	0.43	0.38

(a) *, ** and *** indicate statistical significance at the 10, 5 and 1 per cent levels respectively for standard t-tests
(b) Model estimated from March 1986
(c) SARS (Severe Acute Respiratory Syndrome) dummy equals 1 in June 2003 (when the SARS virus epidemic started), –0.5 in September and December 2003, 0 otherwise
Sources: ABS; RBA

References

Ahmed S, M Appendino and M Ruta (2015), 'Depreciation without Exports? Global Value Chains and the Exchange Rate Elasticity of Exports', World Bank Policy Research Working Paper 7390.

Ballantyne A and S Langcake (2016), 'Why Has Retail Inflation Been So Low?', RBA *Bulletin*, June, pp 9–17.

Chung E, M Kohler and C Lewis (2011), 'The Exchange Rate and Consumer Prices', RBA *Bulletin*, September, pp 9–16.

Dvornak N, M Kohler and G Menzies (2005), 'Australia's Medium-Run Exchange Rate: A Macroeconomic Balance Approach', Economic Record, 81(253), pp 101–112.

Gillitzer C and A Moore (2016), 'Trade Invoicing Currency and First-Stage Exchange Rate Pass-Through', RBA Research Discussion Paper No 2016–05.

Gorajek A and D Rees (2015), 'Lower Bulk Commodity Prices and Their Effect on Economic Activity', RBA *Bulletin*, September, pp 31–38.

Jääskelä J and T Mathews (2015), 'Explaining the Slowdown in Global Trade', RBA *Bulletin*, September, pp 39–46.

Jääskelä J and P Smith (2013), 'Terms of Trade Shocks: What Are They and What Do They Do?', Economic Record, 89(285), pp 145–159.

Kohler M, J Manalo and D Perera (2014), 'Exchange Rate Movements and Economic Activity', RBA *Bulletin*, March, pp 47–54.

Langcake S (2016), 'Conditions in the Manufacturing Sector', RBA *Bulletin*, June, pp 27–33.

Lowe P (2015), 'Managing Two Transitions', Speech at the Corporate Finance Forum, Sydney, 18 May.

Manalo J and D Orsmond (2013), 'The Business Services Sector', RBA *Bulletin,* March, pp 1–10.

Menzies G and G Heenan (1993), 'Explaining the Recent Performance of Australia's Manufactured Exports', RBA Research Discussion Paper No 9310.

OECD (Organisation for Economic Co-operation and Development) (2015), 'Australian Manufacturing in the Global Economy', Study for the Australian Government, Department of Industry, Innovation, Science, Research and Tertiary Education.

RBA (Reserve Bank of Australia) (2016), 'Box A: Australian Services Trade', *Statement on Monetary Policy*, May, pp 36–38.

Rees D, P Smith and J Hall (2015), 'A Multi-Sector Model of the Australian Economy', RBA Research Discussion Paper No 2015-07.