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How does Monetary Policy Affect Business Investment? Evidence from Australia

CAMA Working Paper 9/2025
February 2025

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Abstract

We use administrative and survey evidence from Australia to provide several new empirical facts about how monetary policy affect investment. First, we demonstrate that contractionary policy affects both the intensive and extensive margins of investment, with the latter particularly important for small and young firms, suggesting quadratic adjustment costs do not accurately capture firm-level dynamics. Second, we show that firms' actual and expected investment respond at the same time. This suggests that models of myopia may be more realistic way of incorporating slow aggregate investment responses into models. It also suggests that the user cost channel may be less important than other channels, as user costs would adjust immediately following the policy change. Finally, we show that firms that claim to be financially constrained, a more direct measure of constraints than previously used in the literature, are more responsive to monetary policy, and that more most the difference comes through the extensive margin. Moreover, contractionary policy leads to an increase in the share of constrained firms.

Keywords
investment, monetary policy, financial constraints

JEL Classification

E22, E52

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ISSN 2206-0332

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January 2025

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The authors would like to thank Gianni La Cava and Keaton Jenner for sharing their code on earlier analysis of aggregate investment. We would like to thank Gianni La Cava, Elena Durante, Kevin Lane and John Simon for their helpful comments, as well as seminar participants at the RBA, Central Bank of Ireland, and Australian Conference of Economists. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Reserve Bank of Australia. The authors are solely responsible for any errors.

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https://doi.org/10.47688/rdp2023-09

Abstract

We use administrative and survey evidence from Australia to provide several new empirical facts about how monetary policy affect investment. First, we demonstrate that contractionary policy affects both the intensive and extensive margins of investment, with the latter particularly important for small and young firms, suggesting quadratic adjustment costs do not accurately capture firm-level dynamics. Second, we show that firms' actual and expected investment respond at the same time. This suggests that models of myopia may be more realistic way of incorporating slow aggregate investment responses into models. It also suggests that the user cost channel may be less important than other channels, as user costs would adjust immediately following the policy change. Finally, we show that firms that claim to be financially constrained, a more direct measure of constraints than previously used in the literature, are more responsive to monetary policy, and that more most the difference comes through the extensive margin. Moreover, contractionary policy leads to an increase in the share of constrained firms.

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1. Introduction

As business investment is a key driver of economic growth – both in a structural sense through its contribution to productivity, and in a cyclical sense – it is important to understand whether and how and whether monetary policy affects business investment. The key theoretical channels are well documented. A reduction of the policy interest rate stimulates investment by: increasing aggregate demand; lowering the cost of investment (e.g. borrowing rates) – the 'user cost of capital'; and loosening credit and financing constraints by freeing up cash flow for indebted firms or raising the value of collateral that firms can pledge to obtain loans (Bernanke and Gertler 1995).

Nevertheless, empirical evidence on the importance of the various channels remains mixed. For example, survey evidence (generally for larger firms) suggests that the hurdle rates that businesses require investments to meet can be 'sticky' and not responsive to monetary policy, casting doubt on the user cost channel (Lane and Rosewall 2015; Edwards and Lane 2021; Sharpe and Suarez 2013). Numerous papers have also explored the financial channel in recent years, with some finding that firms that are less leveraged and 'risky' are more responsive (e.g. Ottonello and Winberry 2020; Paranhos 2024), while others find that more leveraged and otherwise constrained firms respond more (e.g. Durante *et al* 2022; Jeenas 2024; Cloyne *et al* 2024).

Moreover, there is ongoing debate around the most appropriate 'frictions' to build into models to capture the slow observed responses of aggregate investment to economic shocks. While the standard has been to use convex adjustment costs, some have argued that fixed adjustment costs are more appropriate for capturing the lumpy nature of firm investment (e.g. Sveen and Weinke 2007; Reiter, Sveen and Weinke 2013). More recently, others have pushed for more behavioural responses, such as myopic expectations (e.g. Gabaix 2020).

Our paper contributes to these debates by documenting three new empirical facts about the effect of monetary policy on investment. We do so using administrative data on the universe of firms in Australia linked to unique surveys, combined with exogenous monetary policy shocks.

First, we find evidence that contractionary monetary policy decreases both the likelihood that firms invest (extensive margin), and the extent of investment (intensive margin). The extensive margin accounts for around 1/3 of the aggregate response of investment, indicating that it is an economically significant margin. Moreover, it is particularly important for smaller and younger firms, many of whom do not invest quarter-to-quarter. These results support the use of fixed adjustment costs in investment in incorporating investment into macroeconomic models, as proposed by Reiter, Sveen and Weinke (2013).

Second, we find evidence that firms that report having been financially constrained at some points are more responsive to monetary policy. This is particularly evident on the particularly on the extensive margin. Moreover, contractionary policy leads to an increase in the share of firms claiming to be constrained, particularly small- and medium-sized firms. This provides strong evidence for the importance of the financial channel of transmission to investment. Moreover, it once again highlights the importance of considering both the intensive and extensive margins of investment when analysis firms' responses to policy.

Finally, we provide some of the first evidence on the effects of monetary policy on expected investment by combining our shock measures with survey measures on expected investment. We find that monetary policy shocks tend to affect both actual and expected investment with a similar lag, rather than influencing expectations earlier. This suggests that firms' expectations are based on current conditions, rather than being based on a clear view of what monetary policy will do to future outcomes. As such, myopic expectations may be a more suitable approach to capturing the slow response of aggregate investment, compared to adjustment costs. Moreover, given the user cost of capital should change immediately, the slow response of firms' investment expectations suggest that this channel may be less important in determining investment than other channels.

Related literature: Our paper contributes to several streams of literature. First, and most directly it adds to the growing empirical evidence looking at the effects of monetary policy on firm investment, and the heterogeneity therein, to better understand the transmission of policy.

For example, Durante (*et al* 2022) focus on firm age and leverage to show the importance of the financial channels, and on durables versus non-durables sectors to highlight the importance of traditional interest rate channels. Several papers have focused on the financial channel using various proxies for constraints. Jeenas (2024) focuses on liquidity, and finds that less liquid firms respond more strongly, consistent with monetary policy easing constraints on firms. Similarly, Cloyne *et al* (forthcoming) assume non-dividend-paying young firms are constrained and find that such firms are more responsive to monetary policy. Somewhat in contrast, Ottonello and Winberry (2020) find that less leveraged and risky firms respond more to monetary policy shocks as it is less constly for them to gain additional financing. We are not aware of any papers that focus on self-reported measures of constraints.

Our paper also touches on the literature on how endogenous capital accumulation should be modelled in macroeconomic models. For example, many models, including Woodford (2005), model investment using convex adjustment costs, leading to smooth investment. This contrasts with the existing evidence (including in this paper) that investment tends to be lumpy. Sveen and Weinke (2007) introduce lumpy investment into a mode;; however, they do so using an exogenous Bernouilli process that implies that monetary policy cannot affect the extensive margin of investment. Reiter, Sveen and Weinke (2013) build on this by incorporating fixed adjustment costs, which allow for variation in the extensive margin.

2. Data

2.1 Tax data on investment

Our analysis uses quarterly data on gross investment for the near universe of Australian firms for the period between September 2001 and June 2017 from ABS BLADE.[1] The particular data we use are reported in firms' quarterly Business Activity Statement (BAS), in which they report the value of capital purchases they made in the quarter. Our analysis is restricted to the non-primary non-financial private sector. The primary sector (agriculture and mining) is excluded as we expect that commodity prices, rather than monetary policy, are the key driver of investment in that sector. The finance sector is removed due to conceptual difficulties in measuring investment and output in this sector from tax data. And the public sector (health, education, public administration) is removed as

1 After 2017 the data collection method changed. For data consistency we end the sample in 2017.

fiscal policy is likely to play a more important role in investment in this sector. We also remove firms with no employees as is standard in the literature, though this has very little effect on the results.

We consider both the intensive (how much firms invest) and extensive (whether they invest) margin of investment. We model the extensive margin as an indicator $ID_{i,t}$, that takes on the value 1 if firm i invests in time t and 0 otherwise. We model the intensive margin as the log of investment $Inv_{i,t}$.

Table 1 provides a summary of the data. The full sample contains around 34 million observations, of which around 29.6 million are from small firms (below 20 employees), 3.9 million are from medium-sized firms (20–199 employees) and the rest are from large firms (200 or more employees). There are a little over 2 million unique firms in each quarter.

Of the 34 million observations, around 9.6 million have positive investment, while the rest have zero investment. This implies that in any quarter, around 28 per cent of firms are investing. The share of firms investing varies moderately over the business cycle, having been strong in the mid-2000s alongside strong economic activity during the mining boom, but lower over the 2010s as overall investment and economy activity also softened (Figure B1). This provides some initial evidence that the extensive margin may be an important margin of adjustment.

Even conditional on investing, the amount of investment is highly heterogenous. While the average investment, conditional on investing is $170,682, the standard deviation is almost $11 million. This also indicates that investment activity is highly positively skewed, with a small number of very large investment observations.

Table 1: Summary Statistics

Data on actual investment from BAS, 2002–2017

	Mean	Median	Standard deviation
Extensive margin – %			
Share of firms investing	28		
Intensive margin[(a)] – $			
Investment, conditional on investing, real	170,682	7,024	10,800,000
No of observations	33,900,332		

Note: (a) Capital expenditure deflated to 2017/18 dollars using investment deflator.
Sources: ABS; Authors' calculations.

2.2 Survey data on expected investment

Data on firms' expected investment is sourced from the ABS survey of New Capital Expenditure (CAPEX). This is a quarterly survey of around 10,000 firms. It is a census of the largest investors, with the rest of the sample being made up of a random stratified sample. For our analysis we do not apply sampling weights. As such, for regressions over the entire sample we will overweight large firms (at least in terms of the number of large firms).

Our CAPEX sample is made up of around 519,000 observations covering from September 2001 to June 2021. Consistent with the relatively larger number of large firms in this sample, in any given quarter around 48 per cent of firms have positive investment (Table 2).

As well as asking firms about their current investment, it asks about their short-term and long-term investment expectations. The horizon of these expectations differs based on the calendar quarter, but the short-term expectations tend to cover investment over the next one to two quarters, while long-term expectations cover investment over a period of two to four quarters, starting in one to two quarters in the future. For example, in December 2022 firms will be asked about their expected investment over the next two quarters (short-term expectation), and their expected investment from September 2023 to June 2024 (the 2023/24 financial year; long-term expectations).[2] As discussed in Cassidy, Doherty and Gill (2012) and Berkelmans and Spence (2013), these forecasts are noisy estimates of actual investment, particularly at longer horizons, with firms tending to systematically underestimate their investment.

Table 2: Summary Statistics
CAPEX, 2002–2019

	Mean	Median	Standard deviation
Extensive margin – %			
Share of firms investing	48		
Share of firms expecting to invest, short-term expectation	42		
Share of firms expecting to invest, long-term expectation	41		
Intensive margin[(a)] – $			
Investment, conditional on investing, real	2,828	118	18,984
Investment, short-term expectation, conditional on investing, real	5,085	202	31,987
Investment long-term expectation, conditional on investing, real	9,146	346	59,335
No of observations	519,000		

Note: (a) Capital expenditure deflated to 2017/18 dollars using investment deflator.
Sources: ABS; Authors' calculations.

3. Methodology

Our analysis closely follows Durante *et al* (2022), who analyse the heterogeneous effects of monetary policy shocks on European firms' investment. We employ a local projections approach (Jordà 2005) of the following form to trace out the effect of monetary policy shocks ($shock_t$) over a number of horizons ($h = 0,\text{K},12$).[3]

$$I_{i,t+h} = \beta_h shock_t + \alpha_h I_{i,t-1} + \sum_{j=1}^{1} \gamma_h \mathbf{X}_{t-j} + \nu_{i,t+h}$$

where $I_{i,t}$ is our measure of investment ($ID_{i,t}$ or $Inv_{i,t}$). When focusing on the extensive margin, the model is effectively a linear probability model and can be interpreted as the effect on the share

2 In March 2023 the short-term expectation will be for the next quarter, and long-term is again for the 2023/24 financial year. In June 2023, the short-term expectation is for the next two quarters (September and December 2023), and the long-term expectation is for the subsequent two quarters (March and June 2024). And finally in September 2023, the short-term expectation is for the next quarter (December 2023) and the long-term expectation is for the subsequent two quarters (March and June 2024).

3 For the analysis using BAS data we only use information out to horizon 12 given the slightly shorter sample. For the rest of the analysis we use data out to horizon 16.

of firms investing, or the probability of investing. When the intensive margin is used, we are considering the percentage change in investment for those firms continuing to invest from the quarter of the shock.

The vector $\mathbf{X}_{t-j}$ is a set of control variables, including one lag of firm-level revenue growth, GDP and CPI growth, as well as industry and firm size and age (specifically an indicator if the firm was above or below five years old).[4] As the shocks are exogenous, controls are not strictly needed, but they help improve the precision of our estimates, particularly the firm-level controls. We cluster the errors for each period, allowing cross-sectional correlation across firms. This is important given the variable of interest is the same across all firms for a given period (Cameron and Miller 2015). We do not allow for serial correlation as this is addressed by the lagged variables.

Our measure of monetary policy shocks is the measure constructed in Beckers (2020), which covers the sample period up to December quarter 2018. This is a Romer and Romer (2004) style shock that measures the shock as a deviation from a Taylor Rule, augmented with measures of financial conditions and financial market participants' expectations.

In particular, Beckers (2020) estimates an augmented Taylor rule that includes forecasts for economic conditions, as well as a number of indicators of financial conditions (e.g. bond spreads, option-implied volatility). The shocks are then constructed as the deviation of the actual policy rate from that implied by the rule. He produces two main measures: a preferred measure that also accounts for market expectations for the policy rate, and another version that does not. We use the preferred measure for our analysis, though the results are almost identical using the other measure.

We choose the Beckers measure as our preferred measure as it has been shown to resolve the so-called price puzzle in Australian data: that contractionary monetary policy is often estimated to lead to higher prices. Other measures, including those constructed from high-frequency changes in bond yields, are also explored below.

We allow the shock to enter the model directly, similar to Durante *et al* (2022), rather than using it as an instrument for changes in the cash rate. As such, we are implicitly taking the measure to be a true estimate of the shock, rather than a noisy estimate. That said, the results are reasonably robust to using the shock as an instrument for cash rate changes, which allows for the possibility that the Beckers shock is a noisy proxy for the true shock, though the estimated effects are larger and there is slightly less evidence of significance on the intensive margin (see Figure B2).

4. Intensive and Extensive margins

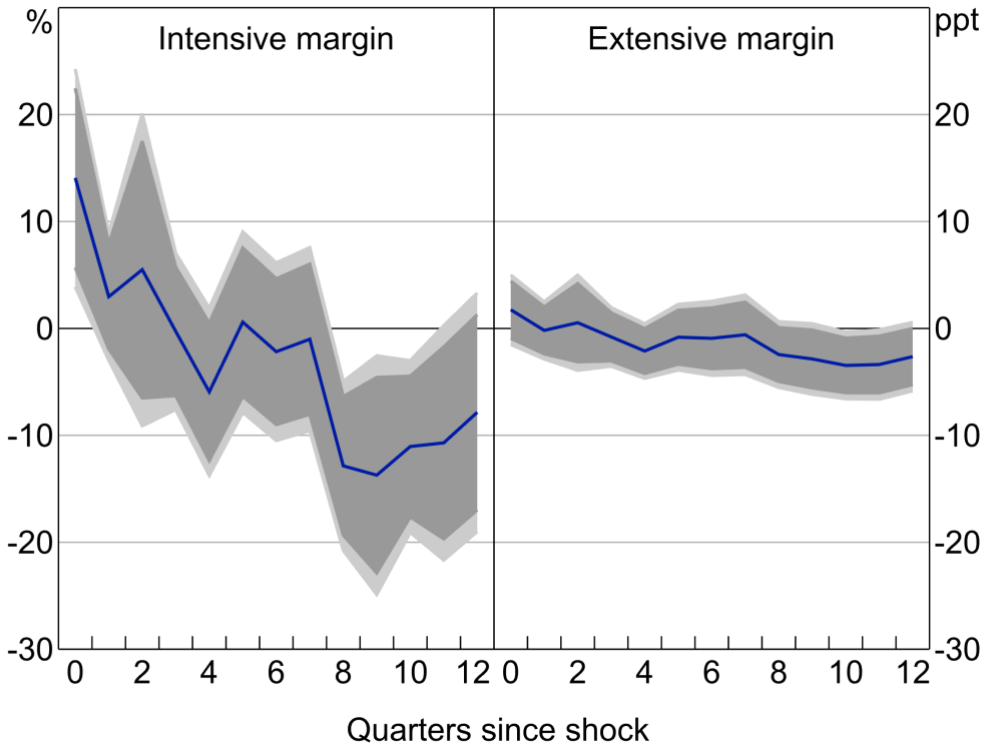
Figure 1 shows the results for the full sample. A 100 basis point contractionary monetary policy shock leads to a decline in investment both at the intensive and extensive margin. The decline in both margins is statistically significant (at the 95 per cent level), and peaks after around two years. In terms of magnitude, the share of firms investing falls by a little less than 5 percentage points two

4 The results are generally robust to including more lags of the right-hand side variables, as well as including the contemporaneous controls which imposes the implicit assumption that monetary policy cannot affect current conditions (Ramey 2016).

to three years after the shock, and the average investment for previously investing firms falls by around 10 per cent.[5]

Interpreting the relative importance of the two channels is difficult, given their different nature. To try to provide some insight we take a simple, back-of-the-envelope approach to quantification. In 2016, the average investment by a firm investing both in the current and previous period (those in the intensive margin estimation) was around $273,000. Taking the peak 10 per cent decline in investment, this equates to $27,300 less per continuing firm. And these firms account for around 17 per cent of the population, so average firm-level investment falls by $4,700. For the extensive margin, average investment for firms investing this period, but not in the previous period, is $52,000. Multiplying this by the peak 5 per cent decline in the probability of investing lowers average firm-level investment by $2,600. So using this simple framework, the intensive margin is about twice as important as the extensive margin.[6]

Figure 1: Investment Response to 100 Basis Point Monetary Policy Shock
Full sample



Note: Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

5 Note that the magnitude of the effects is quite large, and larger than suggested by macroeconomic models of Australia (e.g. Ballantyne *et al* 2019; Gibbs, Hambur and Nodari 2018). This appears to reflect the nature of the shock, which has a half-life of almost two years. The response is similar running the local projections with macroeconomic time series of investment, or a VAR with the shock ordered last (Figures A1-2).

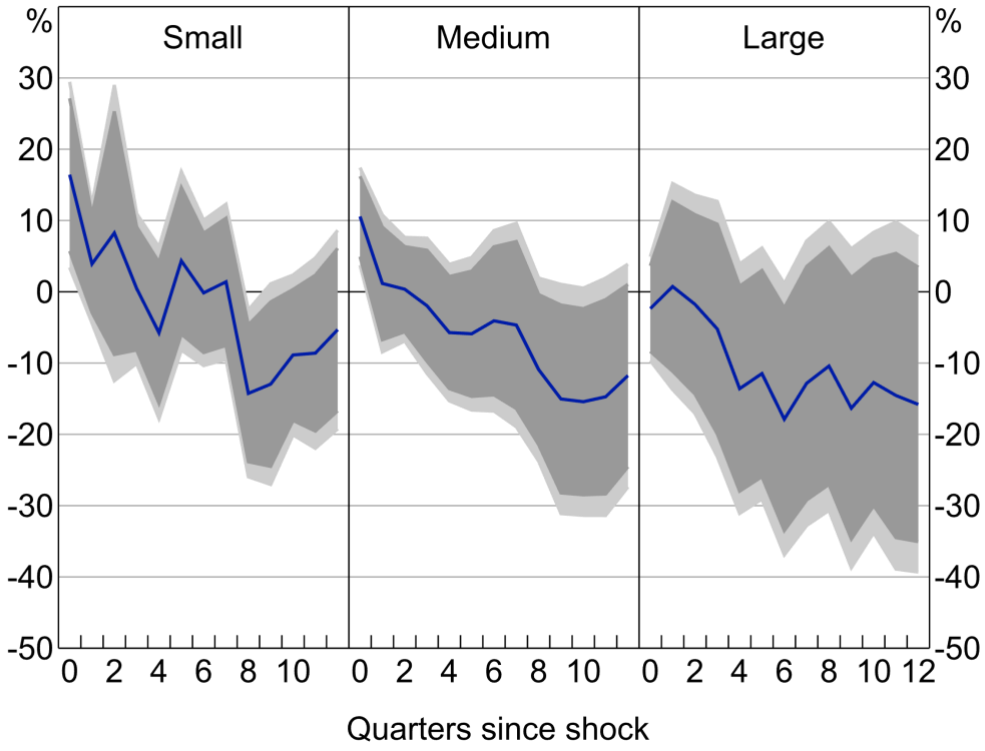
6 This is not surprising given continuing investors account for around 90 per cent of investment. Note that this approach does not take any account of the fact that firms with lower levels of investment may tend to have higher percentage increases, or differences between the marginal firm incentivised to invest by policy and the average firm that moves from non-investing. As such, it should be seen as a very simple indication, not a precise quantification.

As a robustness check, we also consider a shock measure derived from high-frequency changes in yields around the time of the RBA's monetary policy announcements (30 minutes before and 90 minutes after) in our microdata regressions. In particular, we use the level shock from Hambur and Haque (2023), which focuses on high-frequency changes in the policy rate.[7] Doing so yields a similar profile for the response of investment to monetary policy, with both margins being important, but the size of the response is much smaller and there is less evidence of a significant effect (Figure B5).

There is some heterogeneity in the importance of the two margins across firms. For example, the intensive margin appears to be more important for older firms, and the extensive for younger (in relative terms (Figure 2). Similarly, for smaller firms the intensive margin is more important (Figure 3). These findings are consistent with the fact that small and young firms are less likely to invest in any quarter (Table 3). This suggests that not only is the intensive versus extensive margins potentially important in modelling aggregate investment, it could be particularly important if we want to effectively capture firm heterogeneity.

Figure 2: Investment Response to 100 Basis Point Monetary Policy Shock

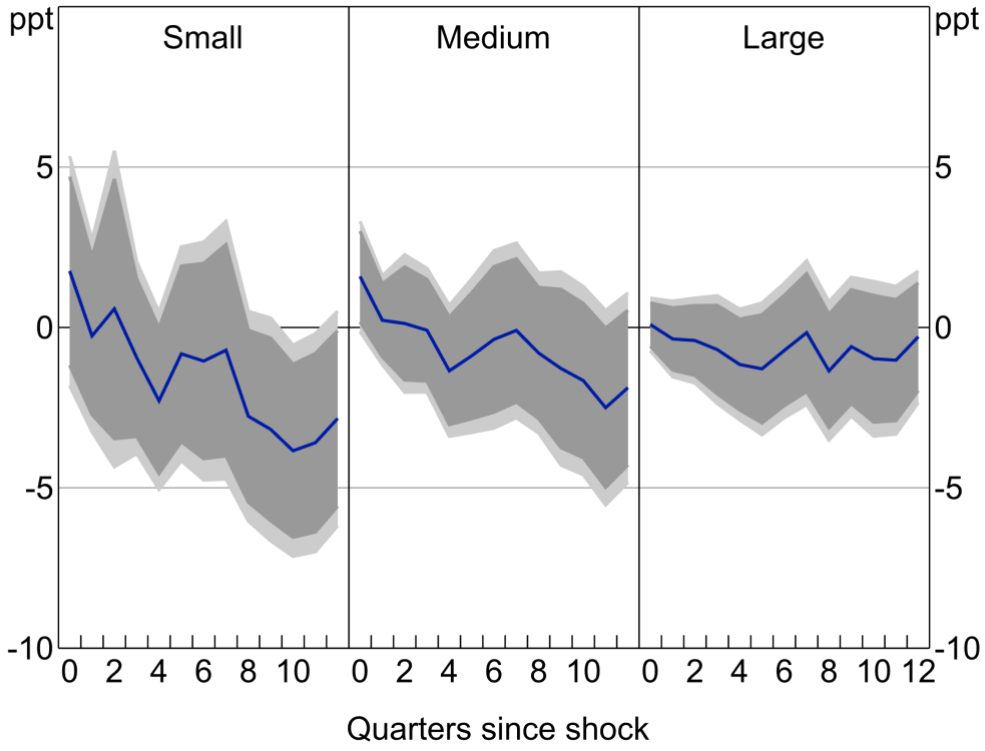
By size, intensive margin



Note: Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

7 This measure is only available for a slightly shorter sample, starting in 2004.

Figure 3: Investment Response to 100 Basis Point Monetary Policy Shock
By size, extensive margin



Note: Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

Table 3: Summary Statistics
Extensive margin, by size

	Large	Medium	Small
BAS[(a)]			
Share of firms investing – %	78	50	25
No of observations	287,801	3,961,966	29,650,565
CAPEX[(b)]			
Share of firms investing – %	86	61	24
No of observations	140,296	112,490	152,599

Notes: Size is defined as small (< 20 staff), medium (20–199 staff) and large (200+ staff).
(a) Calculations over full sample period.
(b) Sample is smaller to that shown in Table 2 due to the exclusion of firms with undefined sizes.
Sources: ABS; Authors' calculations.

5. Financial Constraints

The existing literature tends to focus on proxies for financial constraints, like leverage, liquidity, or age when assessing the role of financial constraints and the financial channel in the transmission of monetary policy to investment. Instead, focus on a self-reported survey measure of financial

constraints collected as part of the annual ABS Business Characteristics Survey (BCS). This survey asks whether a lack of funds has hampered the firm's operations.[8]

Focusing on a survey measure allows us to get around the inherent issues in using proxies, where a certain threshold may be arbitrary, or only appropriate for some firms. For example, high leverage in one industry, or amongst growing firms, may not be high for others. It also directly captures the concept of interest: a lack of access to funds. The downside is that the survey measure is only available for a subset of generally slightly larger and older firms. Still relative to many studies that focus on public companies, our sample remains large. The other downside is that self-reported measures can be noisy.

To use this measure, we split the sample into firms that have reported being constrained at some point in the survey, versus those that were in the survey but never reported being constrained. This allows us to maximize our sample, given the rotating nature of the survey.[9]

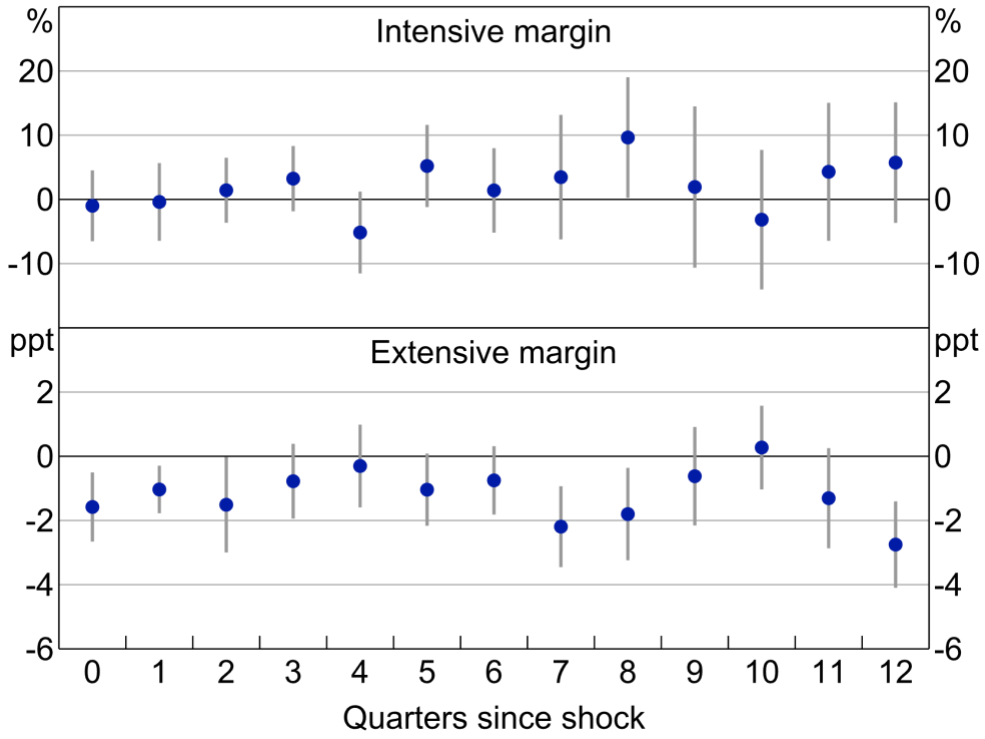
Focusing first on the extensive margin, monetary policy appears to have a larger effect on the probability of investment for constrained firms (Figure 4). Contractionary policy decreases the probability of investment by around 2 percentage points more for constrained firms than for unconstrained firms. In contrast, there is little evidence of a difference on the intensive margin. Given the lumpy nature of investment this is perhaps not surprising, and once again highlights the importance of considering both the extensive and intensive margins of investment.[10] Work that focuses only on the intensive margin could potentially understate the importance of financing constraints in influencing policy transmission.

8 The survey covers around 8,000 firms per year. It is a census of firms with more than 300 employees and a stratified random sample for firms with less than 300 employees. Stratification by industry and business size is implemented to produce data that are representative of Australian businesses. The ABS does not provide the sample weights so our analysis is based upon the unweighted data. Firms with fewer than 300 employees are included on a rotating five-year basis.

9 Splitting firms based on whether they reported being constrained in the previous year provides a similar result. An alternative would be to use constrained in the year of the shock, but the shock itself may influence the firm's constraint status making interpretation difficult.

10 For a graph of the levels responses, see Figure B4.

Figure 4: Investment Response to 100 Basis Point Monetary Policy Shock
Difference between constrained and unconstrained firms



Notes: Dots represent the point estimates of the differences in impulse responses. Bars represent 90 per cent confidence intervals.
Sources: ABS; Authors' calculations.

The above results indicate that firms that are prone to facing financial constraints are more responsive to monetary policy. To consider whether this reflects policy loosening/tightening financial constraints, we can look directly at the effects of policy on the share of firms reporting to be constrained. Given the BCS is an annual survey we run these regressions at an annual frequency, summing shocks across the year. The sample runs from 2005/06 to 2019/20. Given the small number of years and so clusters, we assess significance based on a t-distribution with T-n degrees of freedom, where T is the sample length and n is the number of coefficients on variables that do not vary across firms, as discussed in Cameron and Miller (2015).

We can see that contractionary policy leads to a moderate increase in the share of firms reporting constraints (Table 4). This is particularly notable for small and medium enterprises (SMEs), defined as those with fewer than 200 employees. Amongst SMEs the share noting a lack of funds rises by around 2 percentage points following a 100 basis point policy shock. This compares to around 15 per cent of SMEs noting such constraints in a normal year. The fact that the effects are more notable for SMEs is not surprising, given the more limited avenues they have for accessing additional finance.

Table 4: Effect of 100 basis point shock on share firms reporting lack of funds hampering activity

	Year 0	Year 1	Year 2	Year 3
Small and Medium firms				
Effect	1.83	2.62**	1.71**	1.64
(s.e.)	(1.17)	(1.04)	(1.30)	(1.51)
Observations	*28,971*	*21,754*	*14,278*	*7,088*
Large firms				
Effect	1.39	-0.60	-1.62	-0.13
R^2	*(1.69)*	*(1.45)*	*1.21*	*(0.44)*
Observations	*14,981*	*13,018*	*11,314*	*9,907*

Note: Standard errors in parentheses, ***P < 0.01; **P < 0.05; *P < 0.1. Standard errors clustered at an annual level. Significance assessed using T-distribution with t-n degrees of freedom as suggests by Cameron and Douglas (2015) to account for small number of clusters, where t is sample length and n is number of coefficients. All regressions include controls for industry, (lag) GDP growth, (lag) inflation, (lag) growth in the exchange rate, (lag) turnover growth and (lag) employment, and lag of the shock and dependent variable.

Source: Authors' calculations

Taken together, these rsults suggest that monetary policy in part transmits by making financail constraints more bindings, that that firms that are prone ot financial cosntraints are more repsonsive. This provides storng evidence regarding the importance of the fianncail channel of transmission to investment.

6. Effect on Expectations with Survey Data

We now turn to the expectations data to better understand how monetary policy affects investment expectations. For the regressions, as well as looking at the effect of the shocks on investment at horizon h, we also look at the effect on expected investment take at time h for the future. More precisely we estimate regressions of the following form:

$$E_{i,t+h}\left(I_{i,t+h+k}\right) = \beta_h shock_t + \alpha_h I_{i,t-1} + \sum_{j=1}^{1} \gamma_h \mathbf{X}_{t-j} + \nu_{i,t+h}$$

where k represents the period covered by the short- or long-term expectation measure (e.g. the next quarter or full financial year beginning in a quarter's time). In general, if expectations are rational and forward looking they should be based on expected future outcomes. So if contractionary monetary policy today is expected to weaken outcomes in one year's time, we should expect to see expectations of the investment that will be undertaken next year decline immediately, ahead of any response from actual investment. For short-term expectations, this should appear as expectations leading investment by 1-2 quarters. For long-term expectations, this should have them leading by 3-6 quarters.

Overall, it appears that monetary policy shocks affect both actual and expected investment. Somewhat surprisingly though, both appear to respond after around one to two years, rather than expectations falling ahead of actual investment (Figure 5). It also seems to be broadly consistent

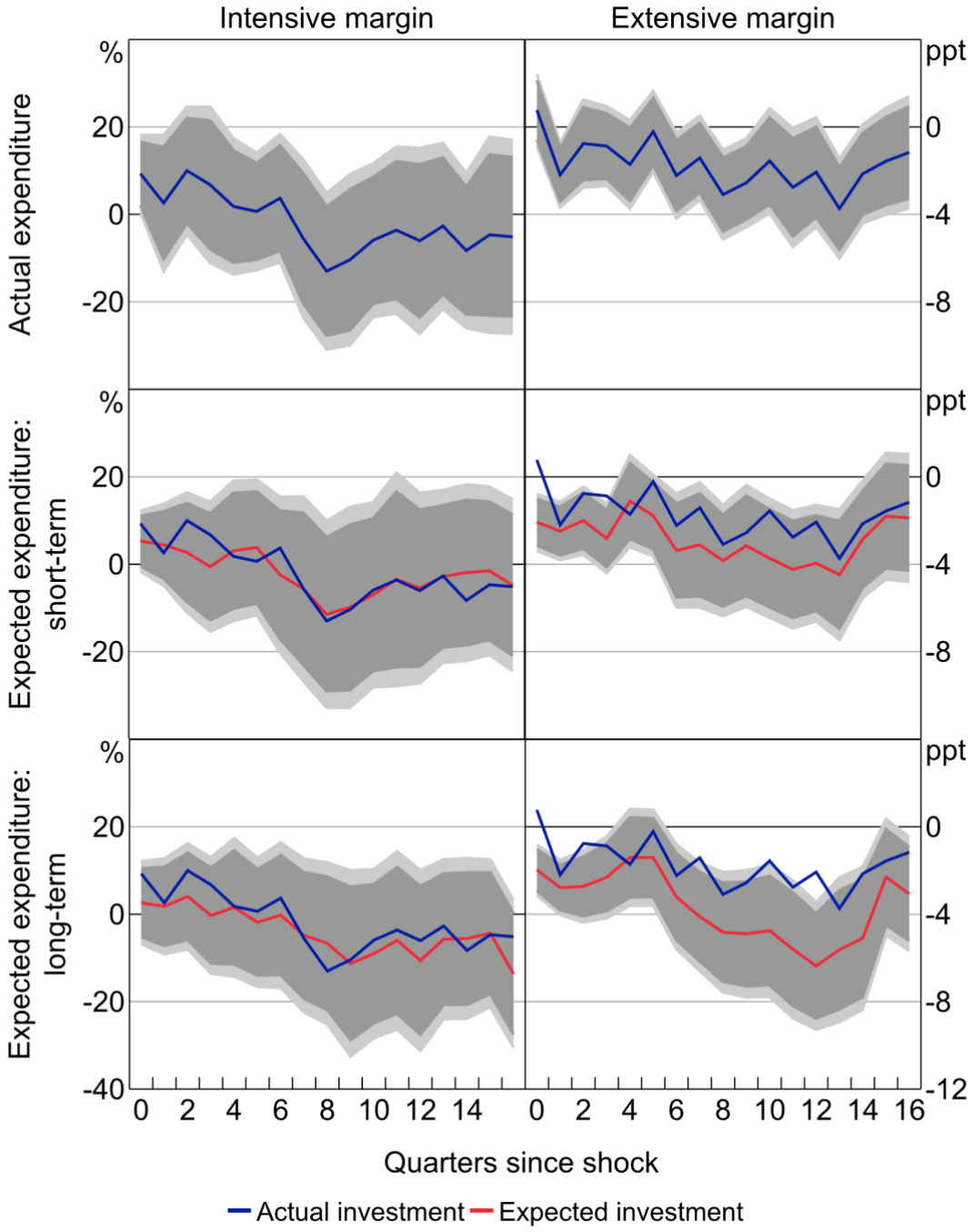
across SMEs and larger firms, though particularly pronounced for the former (Figure 6).[11] Taken together, these findings suggest that firms' expectations are largely based on current investment and conditions, rather than reflecting future conditions and how interest rates will affect those conditions.

This finding has two implications. First, it suggests that firms are somewhat myopic in their expectation formation. As such, models that incorporate myopic expectations in order to capture the slow response of firms' investment may be more appropriate than ones that do so (only) using adjustment costs. This is not to say that adjustment costs do not exist. But simply that myopic expectations also appear to be important.

The second implication is that the user cost channel may be less important than other channels of transmission. Changes in firm's user cost of capital should flow through quickly, as interest rates will change immediately following a shock. So if this was the most important channel, firms should quickly realise that certain projects are not profitable and adjust investment expectations accordingly, which is somewhat inconsistent with these findings. In contrast, firms will only experience the weaker demand stemming from contractionary policy after several periods and may only update their expectations then, which would be consistent with these findings. So the demand channel being particularly important would be consistent with these results. How these findings relate to the financial constraint channel is less clear. Changes in collateral values and therefore borrowing capacity should be evident immediately to firms. However, firms may only realise that they will face cash flow constraints once economic activity weakens, which would be consistent with the delayed response of expectations. So the findings are still consistent with the importance of a financial channel, particularly on propagated thought liquidity constraints.

11 We see similar results if we focus on the aggregate CAPEX data, rather than the microdata (Figure A3).

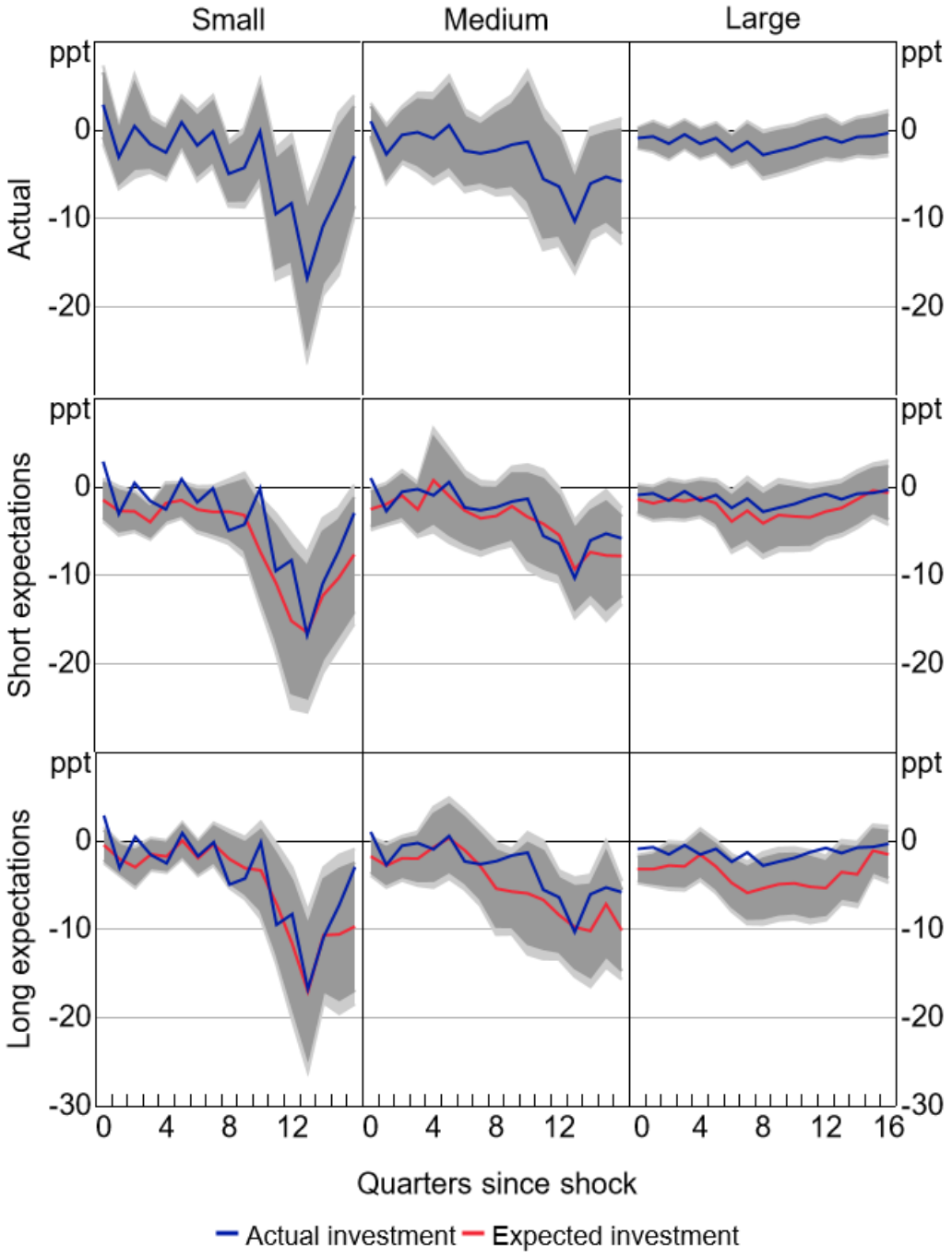
Figure 5: Investment Response to 100 Basis Point Monetary Policy Shock
Firm-level CAPEX data



Source: ABS.

Note: Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

Figure 6: Investment Response to 100 Basis Point Monetary Policy Shock
CAPEX data, extensive margin, by size



Notes: Non-mining. Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

7. Conclusion

Investment is a crucial driver of economic growth, both in cyclical and structural terms. As such, it is important to understand the extent that monetary policy affects business investment, as well as the channels through which this occurs, as it helps to inform policy, and helps us to understand how the effects of monetary policy could change over time. This is particularly relevant in the context of the surprisingly low levels of non-mining investment evident in Australia over the past decade.

Using exogenous monetary policy shocks and firm-level administrative and survey data we document several empirical facts:

- Monetary policy decreases both the likelihood that firms invest (extensive margin), and the extent of investment (intensive margin).

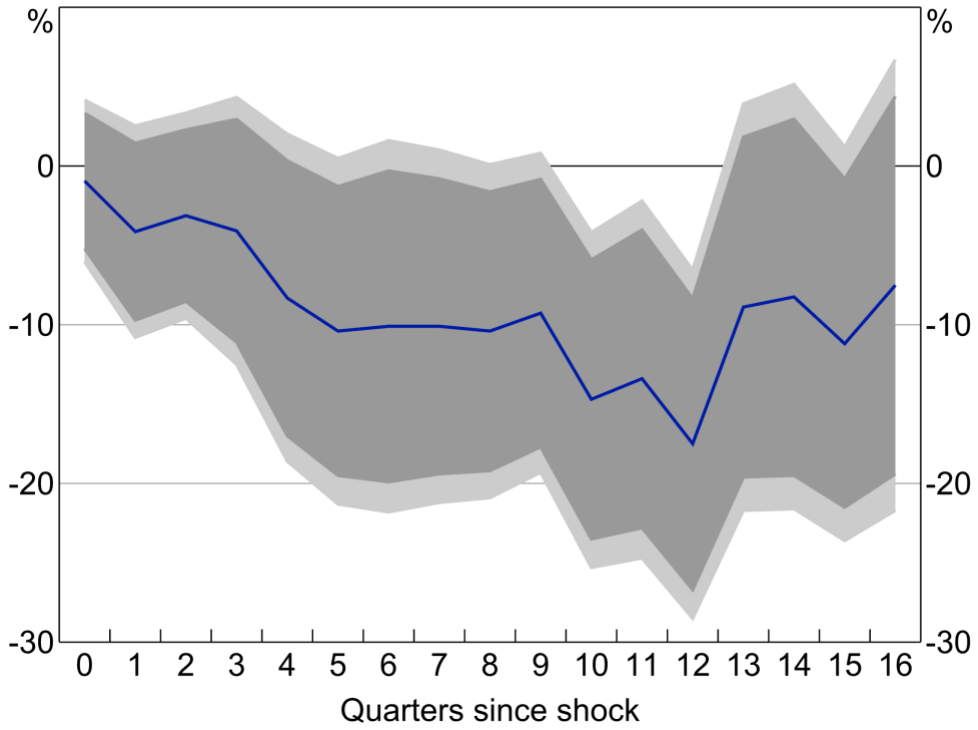
- Monetary policy has larger effects on firms that are prone to being constrained, particularly through the extensive margin of investment, and increases the share of constrained firms.

- Monetary policy affects investment expectations. However, expectations respond at the same time as actual investment, rather than before.

Taken together, these findings point suggest that standard models with convex adjustment costs do not match the reality of firm-level investment. Rather, models with fixed investment costs and myopic expectations are closer to reality. Moreover, the financial channel and demand channel appear to be important transmission channels, while the traditional user cost channel is potentially more muted.

Appendix A: Aggregate Data Results

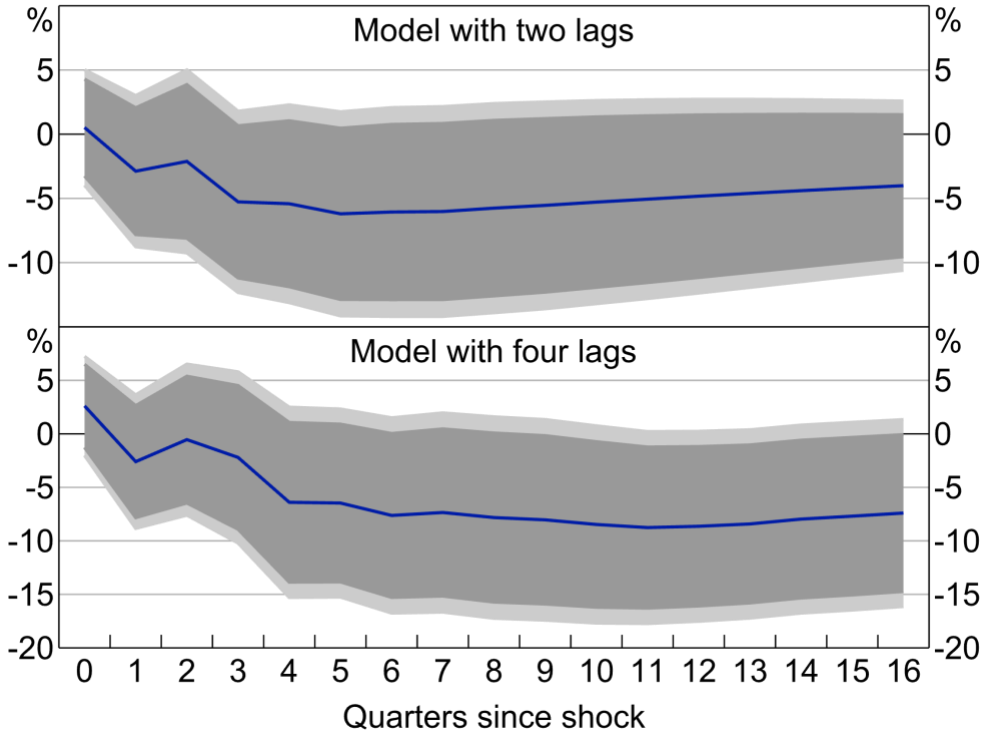
Figure A1: Investment Response to 100 Basis Point Monetary Policy Shock
National accounts, non-mining investment



Note: Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

Figure A2: Aggregate Non-mining Investment Response

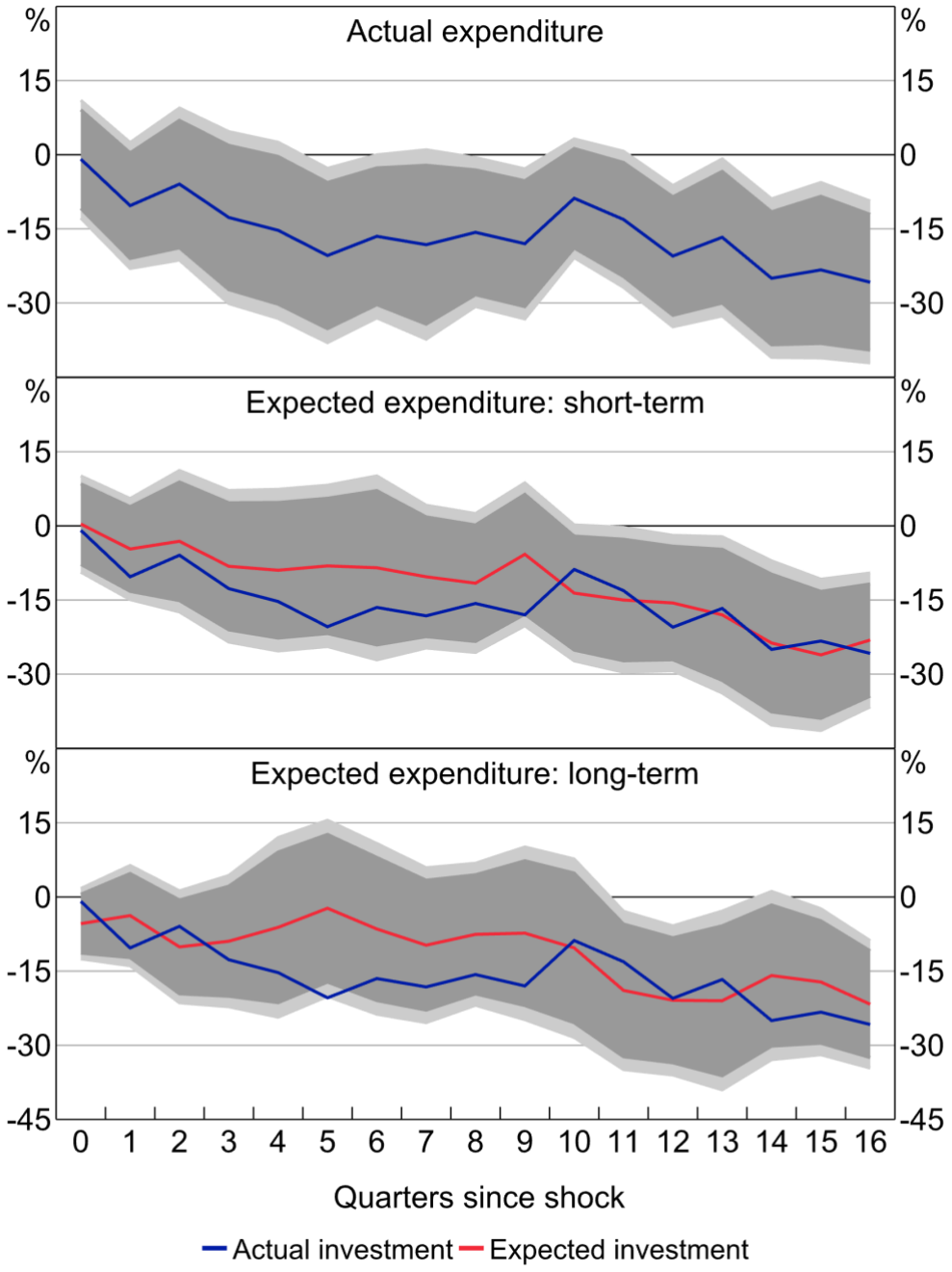
100 basis point monetary policy shock, VAR model



Notes: Small VAR with (log) real trade-weighted index, (log) consumption, (log) non-mining business investment, (log) dwelling investment and cash rate, with shock ordered last. Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.

Figure A3: Investment Response to 100 Basis Point Monetary Policy Shock

Aggregate CAPEX data

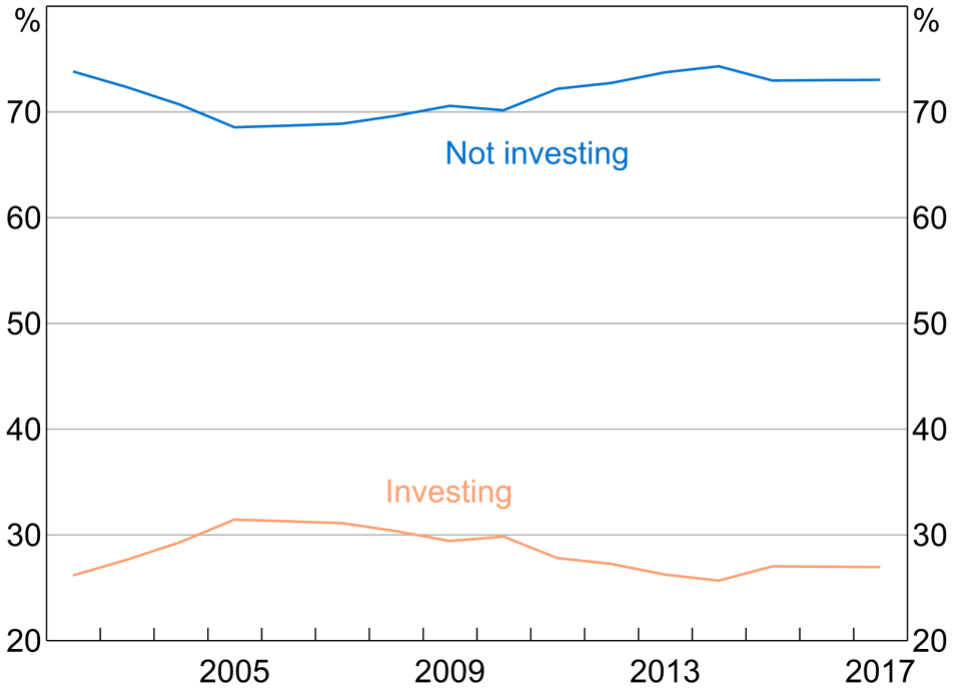


Source: ABS.

Notes: Non-mining. Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

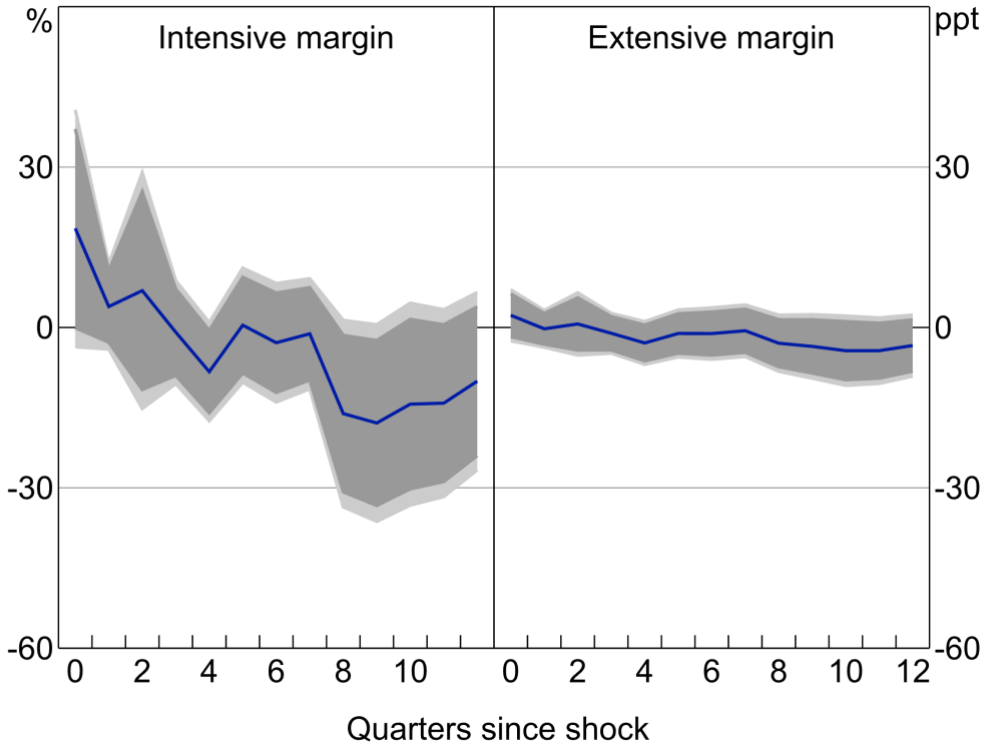
Appendix B: Additional Microdata Results

Figure B1: Share of Firms by Investment



Sources: ABS; Authors' calculations.

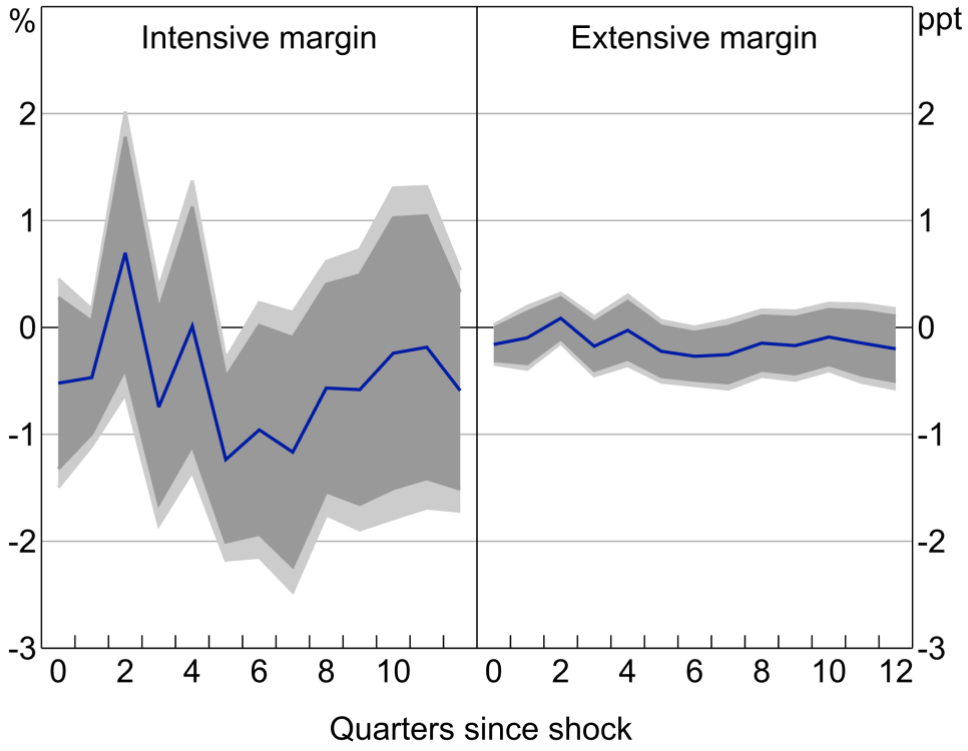
Figure B2: Investment Response to 100 Basis Point Monetary Policy Shock
IV approach, full sample



Notes: Monetary policy shock is instrumented via cash rate. Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

Figure B3: Investment Response to 100 Basis Point Monetary Policy Shock

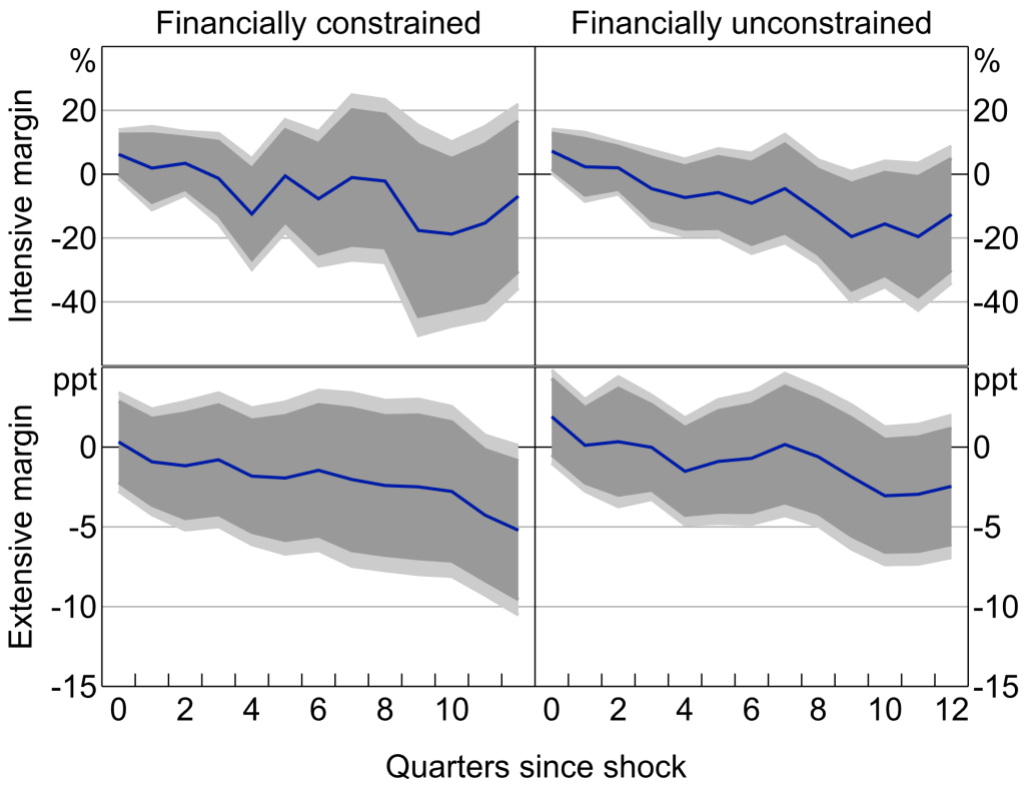
With Hambur and Haque (2023) shock, full sample



Notes: Monetary policy shock is defined as in Hambur and Haque (2023). Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.

Sources: ABS; Authors' calculations.

Figure B4: Investment Response to 100 Basis Point Monetary Policy Shock
By financially constrained



Notes: Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

Appendix C: By Sectoral Financial Dependence

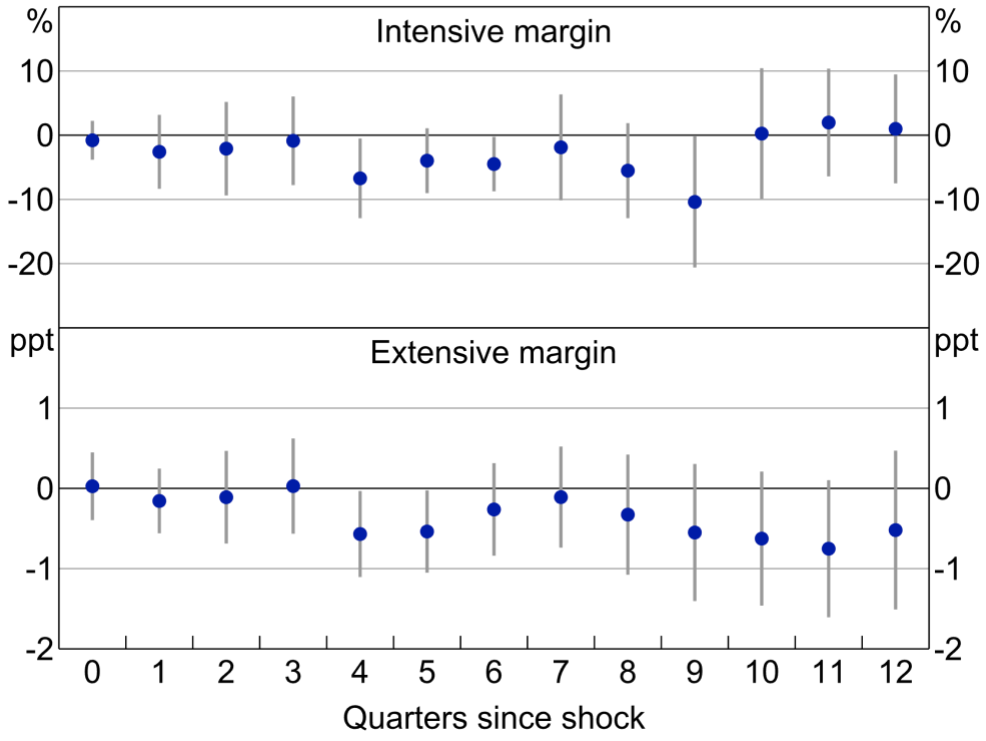
As an additional approach to exploring the financial channel we use industry-level measures of external finance dependence. Specifically we use the measures of US industry-level finance dependence from Demmou, Stefanescu and Arquie (2019), who update Rajan and Zingales' (1998) approach, and assume these funding structures apply to Australian firms. We split firms based on whether they were in one of the most dependent sectors (top quartile) or least dependent (bottom quartile). Demmou *et al* (2019) produce these measures on an ISIC Revision 4 basis, and we map them to ANZSIC 4-digit industries.

This measure is constructed using information on the average of the funding requirements of US firms. Using US-based metrics has some advantages and some disadvantages. The obvious disadvantage is that industries may finance themselves differently in Australia and the United States. Still, there are several advantages: using an external dataset limits potential endogeneity concerns; the US data are based on a much longer sample than we have available; the US-based metrics are well-documented and have been used in numerous different studies, making them a robust and comparable set of indicators.

As expected, in sectors that are more dependent on external finance firms' investment appears slightly more responsive to monetary policy shocks (Figure C1). These differences are statistically significant at the 10 per cent level, indicating that more financially dependent sectors are somewhat more responsive, though the magnitude of the difference is not large.

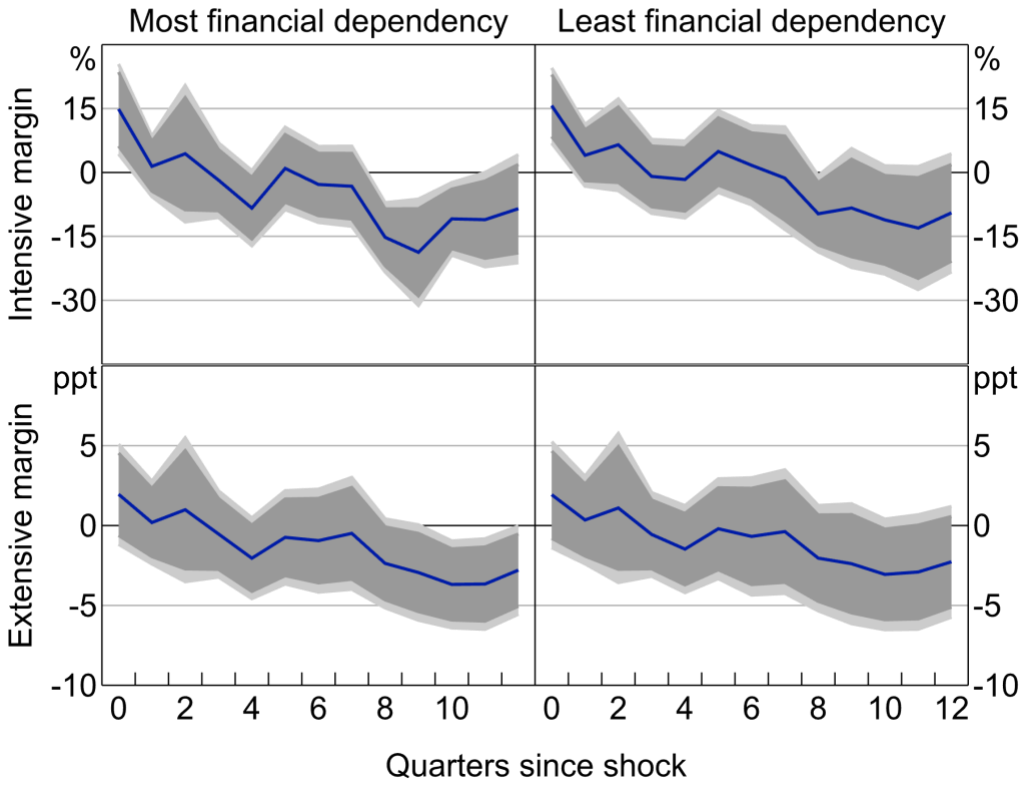
Figure C1: Investment Response to 100 Basis Point Monetary Policy Shock

Difference between sectors with high and low external finance dependence



Notes: Dots represent the point estimates of the differences in impulse responses. Bars represent 90 per cent confidence intervals.
Sources: ABS; Authors' calculations.

Figure C2: Investment Response to 100 Basis Point Monetary Policy Shock
By financial dependency



Note: Lighter shaded areas show 95 per cent confidence interval; darker show 90 per cent confidence interval.
Sources: ABS; Authors' calculations.

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