Monetary Policy, Equity Markets and the Information Effect

Calvin He

RESERVE BANK
OF AUSTRALIA

Enquiries:

> Phone: +61 2 9551 9830
> Facsimile: +61 2 9551 8033
> Email: rbainfo@rba.gov.au
> Website: https://www.rba.gov.au

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Calvin He

Author: hec at domain rba.gov.au

Media Office: rbainfo@rba.gov.au

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Abstract

Central banks analyse copious amounts of information to assess the economic outlook to then set monetary policy. So, could changes in monetary policy reveal some additional information about the economic outlook to the public? This channel is known as the 'information effect'. The information effect posits that, in addition to the usual effects of monetary policy, agents interpret an interest rate increase as signalling some additional positive economic information. This effect, if strong enough, could then lead to dynamics where an increase in interest rates causes an expansion in economic activity.

I evaluate whether the information effect can be detected in Australia through the lens of equity markets. I find that, contrary to the predictions of the information effect, a surprise monetary tightening from a monetary policy announcement causes equity prices to fall. I also show that this response in equity prices is, at least in part, driven by downward adjustments in expected earnings growth. These responses are consistent with conventional views of the effects of monetary policy. However, looking beyond monetary policy announcements yields some evidence that an information effect could be present through other forms of Reserve Bank of Australia (RBA) communication. I find speeches delivered by the RBA Governor generate responses in equity prices and earnings forecasts consistent with the information effect. But this result appears to be the exception rather than the rule. For most monetary policy communication, at least in equity markets, the information effect is not an important channel of monetary policy.

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1.   Introduction

The 'information effect' occurs if monetary policy actions reveal new information to agents about the state of the economy. For example, if the central bank unexpectedly raises interest rates, individuals could infer that the central bank has information about stronger future economic growth that they do not have. This might have positive real effects as agents act on this new information by consuming and investing more. Hence, the predictions of the information effect can run counter to conventional macroeconomic models, where interest rate increases reduce economic activity.

The existence of the information effect could potentially alter the optimal monetary policy prescription. For example, if the conventional effects of cash rate changes (e.g. exchange rate and cash flow channel) are partially offset by the information effect, then monetary policy may need to be more aggressive in offsetting any given demand shock. Taking this further, if the information effect were consistently larger than all other monetary policy effects, then the monetary policy prescription would actually be the reverse of what conventional wisdom dictates. Indeed, concerns about the existence of the information effect have been raised by market economists and media commentary in Australia (e.g. Kehoe 2019).

The information effect is often premised on the central bank acting on a superior information set relative to other economic agents. This superior information could arise from the resources that central banks devote to analysing and forecasting the economy. In Australia, the Reserve Bank of Australia (RBA) employs just under 400 people in 'core policy' functions (RBA 2020); excluding staff involved in payments system work and various support functions within the policy areas, around 170 staff are directly involved in monitoring and forecasting economic and financial developments and implementing monetary policy decisions. This headcount is likely far more than any private sector organisation employs for monitoring the Australian economy. As a result, the RBA's assessment of the economy could be of higher quality than any other individual organisation's assessment.[1] A similar observation has also been made for the Federal Reserve in the United States:

> ... the Federal Reserve commits far more resources to forecasting than even the largest commercial forecasters. As a result, it is able to produce superior forecasts from publicly available information (Romer and Romer 2000, p 437)

In this paper, I examine whether the information effect of monetary policy exists in Australia using the lens of equity markets. Specifically, I estimate the effect of surprise changes in monetary policy on equity prices and forecasts of equity earnings growth. If monetary policy actions contained additional information about the economy and the information effect dominated, we would expect agents to upwardly revise their equity earnings forecasts and – if the earnings revision was large enough – equity prices to increase in response to a surprise tightening of monetary policy, and vice versa. Meanwhile, standard models of monetary policy would predict the opposite; a surprise tightening of monetary policy would cause equity prices to fall as agents downwardly revise their earnings forecasts. To my knowledge, this is the first paper that combines both equity prices and equity earnings growth forecasts to explore the information effect of monetary policy.

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1   Though it is likely that the RBA's assessment is of higher quality than any individual organisation's assessment, previous research has shown aggregated market forecasts have produced superior GDP forecasts to the RBA. However, the RBA has outperformed the same aggregated market forecasts for CPI inflation (Tulip and Wallace 2012).

Measuring the effects of monetary policy is inherently difficult. The RBA's actions are not random, rather they are in response to the prevailing and expected economic conditions at the time. This presents a challenge for empirical analysis as agents are often able to predict monetary policy prior to the announcement and adjust their actions accordingly. Hence, if a particular monetary policy announcement were predicted perfectly there should be no observable change following the announcement. To overcome this issue I use high-frequency financial data of Australia's overnight index swap (OIS) market, which measures expectations of the cash rate. Taking OIS pricing around the window of monetary policy announcements effectively isolates the 'unexpected' or 'surprise' component of the monetary policy announcement and allows for direct analysis of the effect of this unexpected component of monetary policy. This methodology was pioneered by Cook and Hahn (1989), Kuttner (2001) and Cochrane and Piazzesi (2002), and then furthered by Gürkaynak, Sack and Swanson (2005).

I find little evidence that the information effect is an important or strong channel in these markets. Instead, the results support the conventional understanding of monetary policy channels: a monetary tightening causes equity prices to fall and earnings forecasts to be revised down. In response to a 100 basis point contractionary monetary policy surprise, I estimate that the ASX 200 index declines by around 3 per cent. One-year-ahead ASX 200 earnings growth forecasts also fall by 1.9 percentage points following the same monetary policy tightening. This suggests that the decline in equity prices following a monetary policy tightening is, at least in part, driven by downward revisions in expected earnings.

The main focus of this paper, and most of the literature, is on monetary policy announcements. Looking beyond monetary policy announcements, however, provides a more nuanced view of the information effect. Central bank communication via speeches and publications has become an important element of the monetary policy toolkit and may contain more information content than monetary policy announcements (Cieslak and Schrimpf 2019). I find some evidence that monetary policy surprises generated from RBA Governor speeches produce responses in equity prices and forecasted earnings consistent with the information effect. However, the evidence I find suggests that these responses could also reflect the speech communicating changes in the policy reaction function rather than information about the economic outlook.

Monetary policy surprises can be decomposed into three components: changes to the policy reaction function, changes in underlying economic data (information) that policy responds to, and deviations from the reaction function. This raises the question: what do 'surprise' monetary policy moves signal? The equity market responses to monetary policy surprises suggest changes in information are not the primary driver of these surprises. One possibility is that the results are driven by 'random' deviations from a policy rule. Alternatively, they might reflect either an update to or new information about the – generally unobservable – policy reaction function that surprises market participants.

To answer this I directly test if changes in the policy reaction function can be detected. If the release of economic news could predict the monetary policy surprises this would imply that the RBA has been systematically changing its policy reaction function in response to certain economic news. I test this by examining the relationship between the monetary policy surprises and surprises in economic news, in particular GDP, inflation and unemployment. I find little evidence that surprises in these economic releases can predict the monetary policy surprises, suggesting that the monetary policy reaction function has not consistently changed to incoming economic news. This provides

tentative evidence that the 'surprise' monetary policy changes are likely better interpreted as being driven by 'random' deviations from a policy rule than by systematic changes in the policy reaction function (or, as noted above, the information effect). However, more work needs be done to establish this relationship as the monetary policy surprises could still reflect changes in the reaction function to economic news not included in the regressions.

One limitation of my work is that I only focus on the equity market. However, equity markets may not be representative of the expectations of households and businesses in the Australian economy, and so RBA policy changes may still provide information to them. Moreover, as Australian monetary policy heads towards the zero lower bound it is possible that, through forward guidance, monetary policy announcements could convey relatively more information than before. Notwithstanding this, the results show that historically the information effect of monetary policy has not been an important factor in the transmission of monetary policy to Australian equity markets. And conventional interpretations of monetary policy are likely more informative.

The argument in support of these conclusions proceeds as follows. Section 2 outlines a framework that shows how equity price and earnings growth responses to monetary policy can facilitate the identification of the underlying cause of monetary policy actions. Section 3 reviews previous research on this topic, which has produced mixed evidence for the information effect channel. Section 4 outlines the data and method used in this paper to construct monetary policy surprises and the econometric framework used to evaluate the effects of monetary policy on equity prices and earnings growth forecasts. Section 5 outlines the main results of the research and Section 6 explores the appropriate interpretation of the results. I then conduct the same analysis in Section 7 using a broader definition of monetary policy surprises that includes other RBA communication such as speeches from the Governor, Board minutes, and the release of the *Statement on Monetary Policy* (*SMP*). Section 8 applies various robustness tests to the main results. Section 9 discusses the results and Section 10 concludes.

2.   The Information Effect and Equity Prices

To better understand the information effect, it is useful to decompose changes to the nominal short-term interest rate, which the central bank controls (the cash rate in Australia), into its various components. Changes in the cash rate could reflect 'random' deviations from the policy reaction function, changes in the reaction function itself, or changes in the outlook of macroeconomic variables used to guide policy, such as unemployment and inflation. More formally, the nominal interest rate, i_t, set by the central bank can be represented as:

$$i_t = f_t\left(X_t\right) + \epsilon_t \tag{1}$$

where:

- t is a time index

- $f_t\left(\cdot\right)$ represents the (unobservable) monetary policy reaction function, which can vary over time

- X_t represents the (observable and unobservable) information set that the interest rate decision is based on, this could include, for example, the central bank's own economic forecasts

- ϵ_t represents a deviation from the monetary policy reaction function.

The information effect of monetary policy would occur if changes to the nominal interest rate were interpreted by market participants as driven by changes in the information set, X_t, that are only observable to the central bank (the 'unobservable' component). However, only the change in the nominal interest rate, i_t, is directly observable, whereas changes in its determinants ($f_t(\cdot)$, X_t or ϵ_t) are not. In fact, at any point in time, all 3 factors may explain part of the interest rate change made by the central bank.

To draw inference about the information effect, I aim to identify the *relative* importance of these 3 factors based on the direction of the responses of equity prices and their determinants to surprise changes in the nominal rate. For this, it is useful to consider how equity prices are determined.

The price of equities can be expressed as the expected present discounted value of future dividends, as follows:

$$P_t = \sum_{s=1}^{\infty} \mathrm{E}\left[\frac{D_{t+s}}{1+R_{t+s}}\right] \tag{2}$$

where:

- P_t is the equity price at time t

- E is the expectations operator

- D represents equity earnings (dividends or buybacks)

- R represents the relevant discount rate for equities; this includes the zero coupon (or risk-free) rate, term premia and the equity risk premium.

This framework demonstrates that changes in equity prices could reflect changes in earnings, risk-free rates or risk premia. To infer the relevance of the information effect from other interpretations of changes in the nominal rate, it is useful to consider how each of the interpretations of a change in the nominal policy rate moves the individual determinants of equity prices.

These predictions are presented in Table 1. Changes in the cash rate unambiguously move the zero coupon rate in the same direction, but the effect on expected earnings depends on what market participants believe is the driver of a cash rate change.[2] If market participants concluded that the primary driver behind an increase in i_t was the central bank having received a private, positive signal about the state of the economy (a revision in X_t) and this caused participants to update their view on the economic outlook, we would expect forecasted earnings to increase and, if the earnings effect

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2   For simplicity, I am abstracting from risk premia. In reality, the response of risk premia to monetary policy would be ambiguous regardless of the reason for the change in the nominal interest rate.

was large enough, equity prices to increase.[3] These responses would be indicative of an information effect. If the increase in i_t is viewed as an unusually strong policy tightening for a given information set (a deviation from the policy rule, ϵ_t) the opposite response would be expected (equity prices and forecasted earnings would decrease); this is the response that standard macroeconomic models would predict. Lastly, if a change in the nominal interest rate, i_t, causes market participants to update their perception of the policy reaction function, $f_t(\cdot)$, this could lead to a variety of different results based on how the change is perceived.

<div align="center">

Table 1: Expected Response to an Increase in i_t

Reason	Variable		
	X_t	ϵ_t	$f_t(\cdot)$
Discount factor[a]	↑	↑	↑
Earnings forecasts	↑	↓	Ambiguous
Equity prices	Ambiguous[b]	↓	Ambiguous

</div>

Notes: (a) For convenience I consider the discount factor as being primarily driven by the zero coupon rate; in theory the equity risk premium could also respond to changes in monetary policy
(b) If the increase in earnings *dominates* the increase in zero coupon rate equity prices would rise, and equity prices would fall if the increase in the zero coupon rate *dominates* the increase in earnings

It is worth emphasising that the predictions are based on how market participants interpret the changes in monetary policy. And that these interpretations may not resemble the true reason for the changes in monetary policy. For example, interest rates may increase because the central bank reacts to information that market participants had not previously realised could be important (i.e. a change in the policy reaction function). But if market participants interpret the increase as occurring because the central bank has upgraded its economic outlook, this would produce responses consistent with the information effect. In this case, we would still be able to conclude that the information effect of monetary policy is present even if the true underlying reason for interest rate change is unrelated to new economic data. This would, however, raise questions about how long this misunderstanding could persist and whether the resulting reactions were temporary or permanent. This is not a question I pursue in this paper; instead I only focus on short-term responses.

In this paper, I use the predictions in Table 1 to evaluate the relative importance of the information effect channel (X_t). Firstly, I evaluate the response of equity prices to changes in monetary policy. Though equity prices provide a useful starting point in determining which components of equity prices dominate, cleanly disentangling all the drivers of equity prices, including risk premia, would be difficult. I therefore also evaluate the response of forecasted earnings growth to changes in monetary policy to disentangle the numerator in Equation (2) and evaluate if the response of expected earnings is consistent with the change in equity prices. This leads to a more complete analysis of the information effect in the context of equity markets.

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3 In theory, the effect of changes in interest rates driven by revisions in information on equity prices is ambiguous. This is because interest rates affect both the earnings component and the discount factor of equity prices. However, the literature has pointed to the response of equity prices as evidence of an information effect (e.g. Cieslak and Schrimpf 2019; Jarociński and Karadi 2020). That is, the literature assumes that if equity price responses are consistent with an information effect it is a sufficient condition to identify the information effect channel.

Though the responses of equity prices and earnings forecasts to monetary policy are useful in potentially identifying an information effect, I would still be unable to uniquely identify the underlying reason for the responses. This is because equity market responses to reaction function changes depend on how the changes are interpreted by the market. For example, suppose monetary policy became increasingly responsive to certain economic news, such as the unemployment rate, over the sample. That is, the central bank raises interest rates more aggressively in response to positive economic news and cuts more aggressively in response to bad news. If equity market participants interpreted this change in the reaction function as an improvement in how the monetary policy regime contributes to economic stability, we could potentially observe equity prices and earnings expectations increasing to interest rate increases, which could be conflated with an information effect.

Though the effect of reaction function changes are ambiguous, an important first step is to determine if the reaction function has changed. One way to do this, and the method taken in this paper, is to examine if the measure of monetary policy surprises used can be predicted by surprises in economic data. If the release of economic news has predictive power for the monetary policy surprises, this would suggest that the monetary policy reaction function has consistently changed its response to economic news.

3.   Literature Review

Previous work has considered the information effect from a theoretical perspective using a number of vantage points: central bank credibility (Barthélemy and Mengus 2018), central bank information (Ellingsen and Söderström 2001; Frankel and Kartik 2018), the central bank reaction function (Brassil 2019), uncertainty (Tang 2015), the presence of other economic shocks (Berkelmans 2011), the type of economic shock (Jia 2019), dispersed information (Melosi 2017) or heterogeneous beliefs among agents (Andrade *et al* 2019). Jointly these papers provide useful context on how the information effect could occur.

Though theory provides various plausible mechanisms for the information effect, Romer and Romer (2000) first provided empirical evidence of the central bank information effect. They show that the Federal Reserve's inflation forecasts are superior to private forecasters, and that this superior information could be inferred from the Federal Reserve's monetary policy decisions. However, Faust, Swanson and Wright (2004) find that this result is not robust to changes in the sample period and modifications in methodology.

More recent work on the information effect has directly estimated the effect of monetary policy surprises on revisions to professional forecasts. In the United States, it has been shown that a surprise monetary policy tightening can drive declines in unemployment rate forecasts (Campbell *et al* 2012) and increases in GDP forecasts (Nakamura and Steinsson 2018; Janson and Jia 2020). These results are consistent with the idea that monetary policy surprises contain information about the economy. The findings also suggest that the information effect could indeed be a powerful channel of monetary policy. However, Bauer and Swanson (2019) provide evidence that the results in these papers are confounded by economic news that affect both the central bank's policy response and private forecasts.

An alternative lens to view the information effect is through the equity market. Bauer and Swanson (2019) find little evidence that the information effect dominates the response of equity prices to monetary policy surprises for the United States. Their results are consistent with earlier work from Bernanke and Kuttner (2005). On the other hand, Cieslak and Schrimpf (2019) find evidence in the United States and Europe that the response of equity prices are consistent with the information effect for certain forms of central bank communication such as press conferences and minutes.

To reconcile the information effect with standard macroeconomic predictions of monetary policy, Jarociński and Karadi (2020) attempt to disentangle the information component of monetary policy actions by combining high-frequency identification of monetary policy surprises with sign restrictions. Exploiting the fact that the predictions of the information effect are different from standard effects (Table 1), they show that decreases in interest rates driven by information indeed have a significant contractionary effect on equity prices and future GDP, while a pure increase in interest rates (not driven by information) has the opposite and standard effect.

This paper uses the approach taken in Bauer and Swanson (2019) by looking at the response of the Australian equity market to monetary policy surprises. I also complement this approach by examining forecasts of equity earnings. To my knowledge, this is the first attempt in evaluating the information effect of monetary policy using equity earnings forecasts.

4. Data and Method

4.1 Data

To calculate monetary policy surprises I use data from the OIS market. An OIS is an over-the-counter agreement between two parties where one party agrees to pay the other a fixed interest rate in exchange for receiving the average cash rate over the term of the swap.[4] The OIS market therefore captures expectations of the cash rate. OIS contracts have various tenors and for this study I use 8 contract tenors (1 month, 2 months, 3 months, 4 months, 5 months, 6 months, 9 months and 12 months). This helps to capture the forward looking nature of monetary policy. For these contracts, I use the OIS rate on monetary policy announcement days and a window of 30 minutes before announcements and 90 minutes after announcements to capture the monetary policy surprise component.[5] The data run from April 2001 to May 2020.[6]

To capture equity market information I use two data series: the ASX 200 index and equity earnings growth expectations. Specifically, I use high-frequency ASX 200 price data from Refinitiv, which are measured every 10 minutes. The sample used is from April 2001 to May 2020. To capture earnings expectations I use the Institutional Brokers Estimate System (I/B/E/S) database from Refinitiv and extract weekly forecasts for earnings growth of the ASX 200 and Australian Global Industry Classification Standard (GICS) sectors. A stylised time line of an earnings forecast is shown in Figure 1. Forecasts are done on a weekly basis and I consider the forecasts where a monetary policy decision occurred between the weekly forecasts. The forecasts are done on a rolling window basis,

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4   RBA (2002) provides details on the OIS market in Australia.

5   This window is wider than other similar work from the United States, this is because the Australian OIS market is relatively small. Expanding the window gives time for the OIS market to price in the announcement. Varying the size of this window does not meaningfully change the results.

6   There are a few missing data points from late 2001 to mid 2002. See Appendix A for more details.

meaning that the forecast window shifts by a week between the forecasts. Though ideally the forecast end date would be fixed for this analysis, a one week shift should not materially change the results. The earnings growth forecasts have 2 horizons, one-year-ahead and 'long-term', and the data are available from February 2006 to February 2020.

Figure 1: Earnings Forecast Time Line
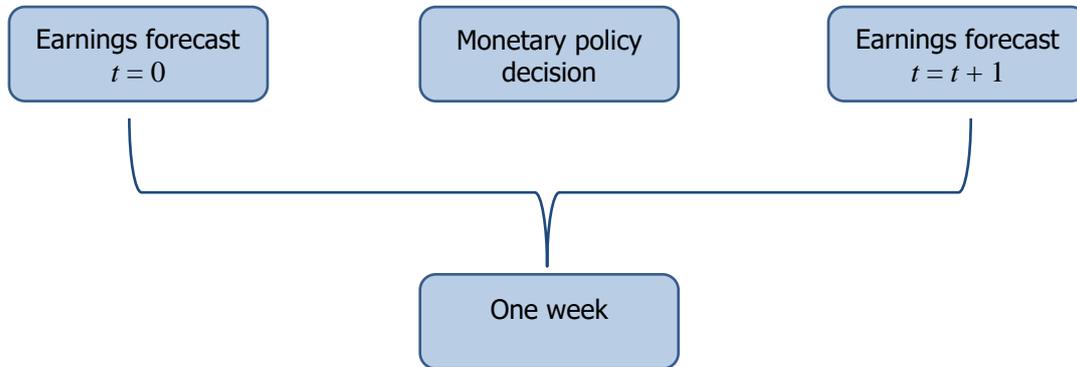
4.2 Method

4.2.1 Information effect regression

To evaluate the information effect of monetary policy I run the following regression:

$$\Delta y_t = \beta_0 + \beta_1 mps_t + \varepsilon_t \tag{3}$$

where:

- Δy_t is the change in the outcome variable of interest (the natural log of the ASX 200 index and equity earnings growth forecasts)

- mps_t is a measure of monetary policy surprises (details in Section 4.2.2)

- β_0 is a constant and ε_t is an error term.

To measure the dependent variable, this analysis uses both high-frequency equity price data and weekly revisions to equity earnings growth forecasts. For equity prices, I take the change in the ASX 200 index around monetary policy announcements. I use the same time window used to calculate the monetary policy surprises. While for equity earnings growth forecasts, I take the weekly revision of the ASX 200 earnings growth forecasts following the monetary policy announcement as the dependent variable.

For Equation (3) to provide well-identified and unbiased results on the effect of monetary policy on the dependent variable there are 2 key assumptions:

1. The monetary policy surprises only reflect changes in the expectations of the nominal interest rate, that is, no omitted variable bias.

2. The monetary policy surprises are uncorrelated with relevant known information, that is, no reverse causality.

If assumption (1) is violated, the effects identified would not represent the pure effects of monetary policy on the dependent variable. That is, it would be identifying the effects of monetary policy and additional variables, such as risk premia, on the dependent variable. This could happen if a change in the cash rate also resolves some uncertainty in the market, thereby reducing risk premia. In this example, any observed change in the OIS curve could include the monetary policy surprise and the change in risk premia. While, if assumption (2) is violated, this would confound the results by introducing reverse causality to the analysis. Reverse causality could be introduced if the monetary policy surprises are a function of the dependent variable itself.

The frequency of the data used ameliorates concerns of omitted variable bias and reverse causality. The high-frequency nature of equity prices and the monetary policy surprises means that relevant information should already be accounted for prior to the monetary policy announcement. While for earnings forecasts, the relatively high frequency of the data (weekly) also reduces (but does not eliminate) the chance that there is news between the initial forecast period and the monetary policy announcement that would confound the results. Though useful in addressing assumption (2), the high-frequency nature of the data does not preclude the possibility of assumption (1) being violated.

4.2.2   Monetary policy surprises

Monetary policy actions are not random but rather a response to prevailing economic conditions. This often makes monetary policy actions predictable, giving agents time to adjust behaviour before the monetary policy announcement has been made. In the case of equity markets, agents will 'price in' anticipated changes in monetary policy and will only respond to unanticipated or surprise changes in monetary policy. This highlights the need to use a measure of monetary policy surprises. I exploit the information within financial markets to extract the 'unexpected' or 'surprise' component of monetary policy. This measures the difference between the actual and the expected change in monetary policy. As this measure of monetary policy surprises should not be incorporated into equity markets, I can hence measure the subsequent movements of the variables of interest against these measured surprises.

To capture monetary policy surprises, I take changes in the OIS contracts 30 minutes before and 90 minutes after monetary policy announcements over 8 horizons, ranging from one month to one year.[7] In principle, the changes in one OIS contract around monetary policy announcements could constitute a monetary policy surprise (e.g. Kuttner 2001; Cochrane and Piazzesi 2002). However, taking a surprise in a single contract may not adequately capture the forward-looking nature of monetary policy. To capture these dynamics I follow Gürkaynak *et al* (2005) and estimate factors

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7   Prior to 2008, the RBA announced monetary policy decisions at 9.30 am. Since 2008, the RBA's monetary policy announcements have been delivered at 2.30 pm.

using principal component analysis on the changes in all 8 OIS contracts around RBA Board announcements.[8] Hence, I estimate the following:

$$\mathbf{X} = \mathbf{F}\Lambda + \eta \tag{4}$$

where:

- $\mathbf{X}$ is a T-by-n matrix of OIS contract changes around monetary policy announcements, where T represents the number of time observations and n is the number of OIS contracts

- F is a T-by-m matrix of unobserved factors, with $m \le n$

- Λ is a matrix of factor loadings

- η is a white noise error.

In the analysis on the information effect, I only use the first factor (F_1) to measure monetary policy surprises (mps_t) defined in Equation (3). This is because the first factor captures the vast majority of the variation in the contracts, explaining 95.7 per cent of total variation across all contracts.

This factor aligns closely to level shifts in the OIS curve, principally because every contract contributes similar amounts to the factor (11.7 to 12.9 per cent). One drawback with only using one factor is that it may be that actions such as forward guidance would lead to 'twists' or changes in the slope of the OIS curve, and these changes in monetary policy could have different informational content. However, given that the first factor explains such a large amount of the data variation, additional factors are unlikely to be well identified or lead to externally valid estimates.

To aid interpretability I scale the first factor to the one-month OIS contract; hence a one unit change in this factor can be roughly interpreted as a 100 basis point level shift in the OIS curve.

Figure 2 presents the generated monetary policy surprise series (after scaling). The size of the surprises are generally small, with a standard deviation of around 6 basis points. However, there are notable spikes in the series, especially around the global financial crisis (GFC).

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8   Gürkaynak *et al* (2005) use 2 factors from 5 contracts: current and 3-months-ahead fed fund futures, and 2-, 3- and 4-quarters-ahead eurodollar futures contracts.

Figure 2: Monetary Policy Surprises
Factor 1, scaled to one-month OIS
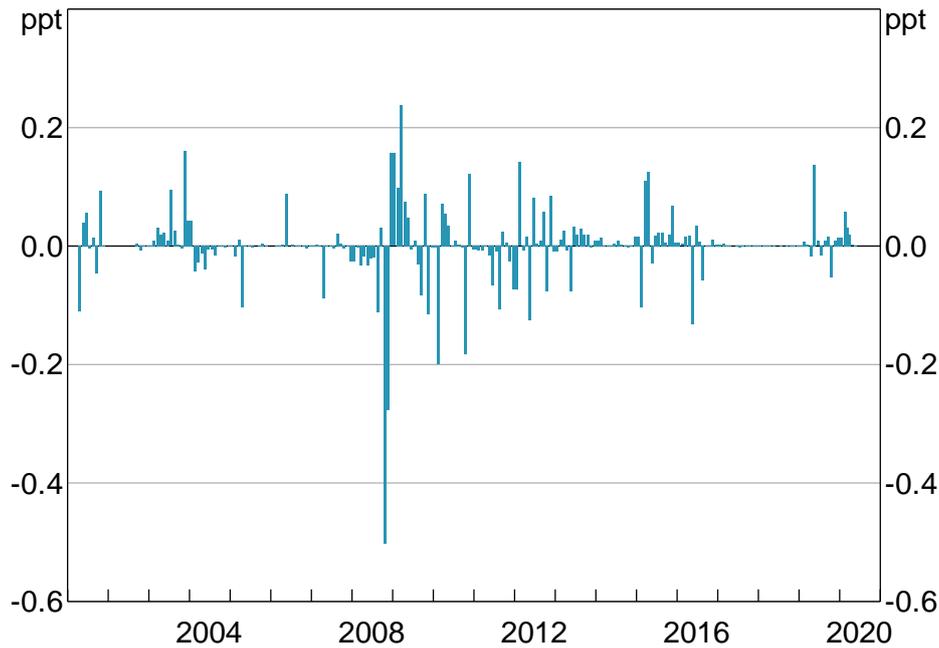
Sources: Author's calculations; RBA; Refinitiv

5.   Results

5.1   ASX 200

I present the estimated response of the ASX 200 index to a 100 basis point contractionary monetary policy surprise. All results are symmetric unless stated otherwise, so the opposite result would occur to a 100 basis point monetary policy easing.

Consistent with standard models, unexpected increases in the cash rate cause equity prices to fall (Figure 3). The estimates suggests that a 100 basis point increase in the OIS curve drives around a 3 per cent decline in the ASX 200 index. This result is significant at all conventional levels.

The results also highlight the upward bias present when using the cash rate change instead of the monetary policy surprises. The absolute value of the effect is much smaller when using the cash rate as the independent variable. Indeed it is around zero (at 0.04) and statistically indistinguishable from zero, indicating the ASX 200 on average does not respond in real time to changes in the cash rate. This is likely because changes in the cash rate are predictable and mostly already incorporated into the ASX 200 price prior to the monetary policy announcement.

Figure 3: Response of ASX 200 to Monetary Policy
100 basis point monetary policy tightening
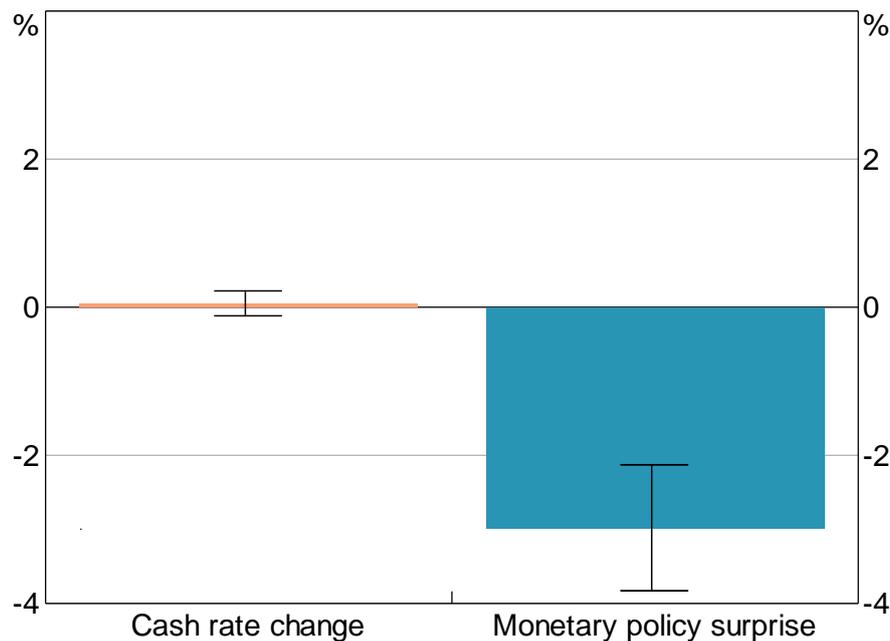
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: Author's calculations; RBA; Refinitiv

The estimated results are consistent in sign with studies from the United States such as Bernanke and Kuttner (2005) and Bauer and Swanson (2019). However, the estimates appear to be smaller in Australia than the United States, which are estimated to be around 3 to 8 per cent. But the estimates do closely align with findings using Australian data (Chapman 2014; Brown and Karpavičius 2017).[9]

Despite the result, it is hard to disentangle the underlying driver of the equity price response. This is because equity prices are driven by changes in expected earnings, the zero coupon rate and premia as represented in Equation (2). We know changes in monetary policy move the zero coupon rate in the same direction, but the effects on expected earnings and premia are ambiguous. This makes generating inference from only equity prices difficult. Nonetheless, the results still suggest that, at the very least, the information effect of monetary policy does not dominate the response of equity prices. Instead, an unexpected tightening in monetary policy has the standard contractionary effect on equity prices.

5.2   Earnings forecasts

To disentangle the mechanism behind the response of equity prices, I estimate the response of earnings growth forecasts to the monetary policy surprises. To do this I take the weekly revisions of the ASX 200 earnings growth forecasts (one-year-ahead and 'long-term') around the monetary policy decisions as the dependent variable in Equation (3).[10] If the information effect operated through

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9   In general, the literature estimate the semi-elasticity of monetary policy surprises on equity prices. A comparison between the elasticity and semi-elasticity is presented in Appendix C.

10 It is unclear what the precise definition of 'long-term' is. Some internal analysis at the RBA suggests that it is a decent approximation of the 3 to 5-year growth rate.

earnings expectations we would expect a positive response of forecasted earnings to a monetary tightening.

The results show that a tightening of monetary policy has a negative and significant effect on the one-year-ahead forecast of ASX earnings growth (Figure 4). For the one-year-ahead forecast, a 100 basis point increase in the OIS curve causes expected earnings growth of the ASX 200 to fall by 1.9 percentage points. The results for long-term earnings growth are less clear, with a monetary policy surprise having a small and statistically insignificant effect on forecasted ASX 200 earnings growth. This is unsurprising given that it is unclear whether monetary policy has any long-term – as opposed to cyclical – effects, and the fact that longer-term expectations of earnings growth are likely pinned down by a range of other factors outside the control of monetary policy, such as technology and population growth.

Figure 4: Response of ASX 200 Earnings Growth Forecasts to Monetary Policy
100 basis point monetary policy tightening
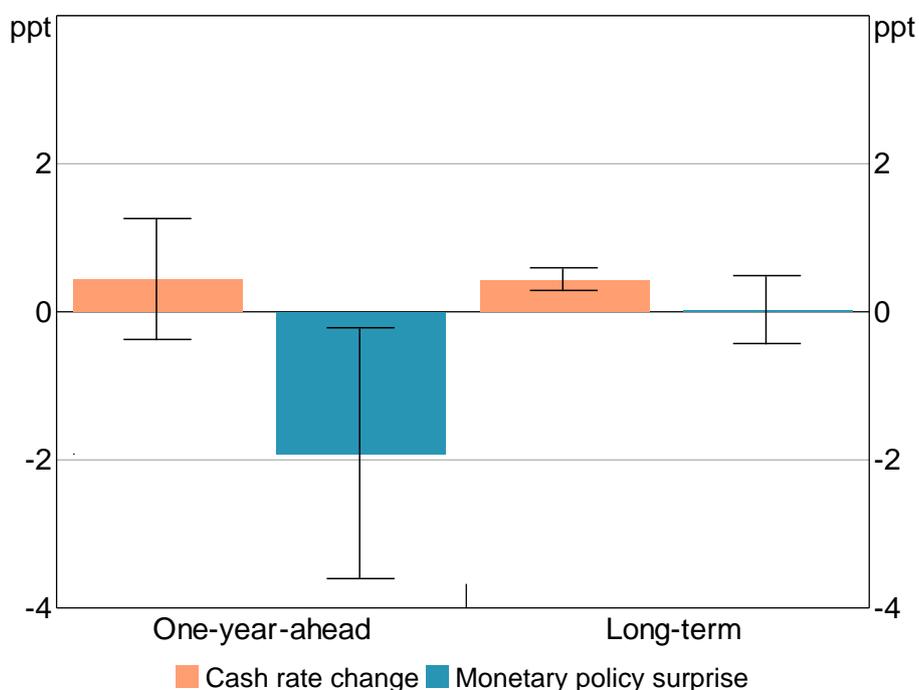
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

Similar to the results in Section 5.1, using the cash rate as the independent variable instead of the monetary policy surprise has large effects on the results. The sign of the estimated response of earnings revisions for both forecast horizons becomes positive, suggesting that cash rate increases cause upward revisions to ASX 200 growth forecasts. This likely reflects cash rate changes being a response to known information that also affect earnings growth forecasts.

Overall, I find little evidence that the information effect is present in the earnings component of the ASX 200. Rather the results suggest that earnings are one of the drivers behind the negative ASX 200 response to tighter monetary policy found in Section 5.1. This illustrates that any information effect of monetary policy is not being masked by changes in the discount factor of equity prices. That is, the response of the ASX 200 to an unexpected monetary policy tightening is a function of both an

increase in the discount rate (from a higher zero coupon rate) and a decline in earnings growth expectations. Overall, the results support the conventional view that equity markets interpret a monetary policy tightening as contractionary for economic activity.

6.   Policy Rule Changes or Deviations?

The results suggest that the information effect is not a strong channel of monetary policy in Australian equity markets. However, it remains unclear whether the monetary policy surprises identified reflect deviations from a policy rule (ϵ_t) or changes in the policy rule ($f_t(\cdot)$). Bauer and Swanson (2019), for example, provide evidence that the results in work finding support for the information effect in the United States (Campbell *et al* 2012; Nakamura and Steinsson 2018) can be better explained by the Federal Reserve becoming progressively more responsive to economic news.

To evaluate if the 'surprises' should be interpreted as policy rule changes or deviations, I test if the policy reaction function has changed systematically over the sample. One way to do this is to determine if the constructed monetary policy surprises can be explained by economic news known at the time. If economic news has a statistically significant relationship with the identified monetary policy surprises, this would suggest that the RBA has consistently changed its policy reaction rule to economic news and market participants have lagged behind in updating their estimate of the central bank reaction function as they observe monetary policy changes.[11] I estimate the following equation, which is similar to the approach adopted by Bauer and Swanson (2019).

$$F_{1,t} = \gamma_0 + \gamma_1 economic\,news_t + \xi_t$$

where:

- $F_{1,t}$ is the first factor from Equation (3), scaled to the one month OIS contract. Only the observations immediately following the release of economic news are used.

- $economic\,news_t$ represents the unexpected component of an economic release. To measure economic news I take the difference between the first release of actual GDP growth, CPI inflation and the unemployment rate from the ABS against the average forecasts from the Bloomberg survey of market economists.[12]

- γ_0 is a constant and ξ_t is the error term.

I find little evidence that the constructed measure of monetary policy surprises can be explained by the economic news included here. The confidence intervals for these economic releases include zero, indicating that market participants have not consistently been surprised by changes by the RBA to its policy reaction function to any of the economic variables over time (Figure 5).

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11 An alternative explanation would be that the monetary policy surprises are not exogenous and have not incorporated all known information.

12 All data are seasonally adjusted.

Figure 5: Monetary Policy Surprises and Economic News
Response by economic news
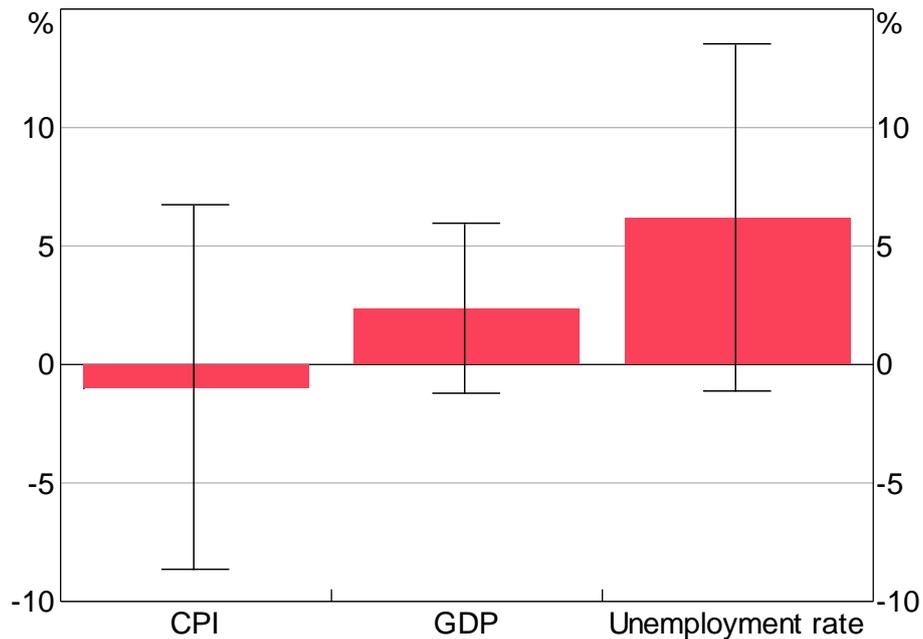
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: ABS; Author's calculations; Bloomberg; RBA; Refinitiv

The estimate for the unemployment rate is only marginally insignificant (at the 10 per cent level). Interpreting the point estimate suggests that the RBA may have become less responsive to surprise increases in the unemployment rate. Nonetheless, it is unlikely this could explain all of the response in equity prices and earnings forecasts given the uncertainty of this estimate.

The results provide little evidence that the monetary policy surprise series can be predicted by unemployment, GDP or inflation news. This lends some evidence to the responses from the baseline information effect regressions being the result of deviations from a policy rule, rather than from changes in the policy rule itself. However, it is possible that the measured monetary policy 'surprises' include policy reactions to variables not included in these regressions. Moreover, the results should not be interpreted as saying that the monetary policy reaction function has been stable over the sample. They only show that on average over the sample, economic news (defined as GDP, CPI inflation and unemployment) has not resulted in *consistent* surprise changes in the policy reaction function. It is still possible that there have been changes in the reaction function. For example, if the reaction function changed but this was announced or well communicated ahead of the actual policy decision, this would not be captured by these regressions.

7.   Beyond Board Meetings

The analysis so far focuses on monetary policy surprises following the monetary policy announcement after RBA Board meetings. This has also been the focus of other work in the literature. However, this does not reflect the only way monetary policy in Australia could be communicated. RBA communication, through speeches or publications, can also be part of the monetary policy toolkit, particularly to the extent that it signals future actions by the RBA. Moreover, these media may contain more information content than the monetary policy announcement

following a Board meeting. For example, the RBA's *Statement on Monetary Policy* (*SMP*) contains a detailed discussion of economic conditions and the RBA's forecasts of key macroeconomic variables including inflation, GDP and the unemployment rate. International evidence also supports the idea that there is more information conveyed through other central bank communication channels such as press conferences and minutes (Cieslak and Schrimpf 2019). For this reason, it may be important to consider other forms of central bank communication when evaluating the information effect.

Hence, I expand the range of monetary policy tools I consider to also include other RBA communications including the release of RBA Board minutes, the *SMP*, and speeches by the RBA Governor. To determine the effects of this expanded range of potential monetary policy tools on equity prices and earnings forecasts I recalculate the monetary policy surprises to also include the times of these events. I then re-estimate Equation (3) but allow each type of RBA communication to have a different effect on the dependent variable. That is I estimate:

$$\Delta y_t = \psi_0 + \sum_{c \in \{board, speech, minutes, smp\}} \psi_c mps_t I[mps\,type = c] + \xi_t \tag{5}$$

where $I[mps\,type = c]$ is an indicator variable equal to one if the monetary policy surprise is from an event of type c, which includes Board announcements, the *SMP* release, the release of RBA Board minutes and speeches delivered by the RBA Governor. All other variables are as previously described.

The addition of non-monetary policy announcement events does not appear to result in any large monetary policy surprises, but there is more variation around the GFC (Figure 6). A secondary question is whether these surprises are of a similar nature to the surprises using only the monetary policy announcements. The first factor continues to explain the vast majority of the variation – 93.87 per cent – and resembles level shifts in the OIS curve. Hence, it appears that the augmented monetary policy surprises continue to reflect movements in the entire OIS curve.

Looking at the effects of different forms of RBA communication on the ASX 200 provides a more nuanced view of the information effect. Monetary tightening from the release of RBA Board minutes and *SMP* have negative but insignificant effects on the ASX 200 index (Figure 7). However, monetary policy surprises generated from speeches by the Governor provide some evidence of an information effect. A 100 basis point contractionary monetary policy surprise from Governor speeches causes a 10.4 per cent increase in the ASX 200 index. This result is significant, and runs counter to conventional interpretations of the effects of monetary policy, and provides evidence that it is possible for increases in the OIS curve to result in increases in equity prices, as predicted by the information effect. It is worth noting that the large size of the central estimate does not mean these surprises have been historically important given that the surprises themselves have been small. That is, a monetary policy surprise from a Governor speech is likely smaller than 100 basis points given historical variation.[13]

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13 Another possible explanation for the significant estimate for Governor speeches is simply a false positive. This is especially the case given the multiple hypothesis tests that are conducted.

Figure 6: Monetary Policy Surprises

By communication type

● Board meeting announcement ● Minutes ● *SMP* ● Speech by Governor
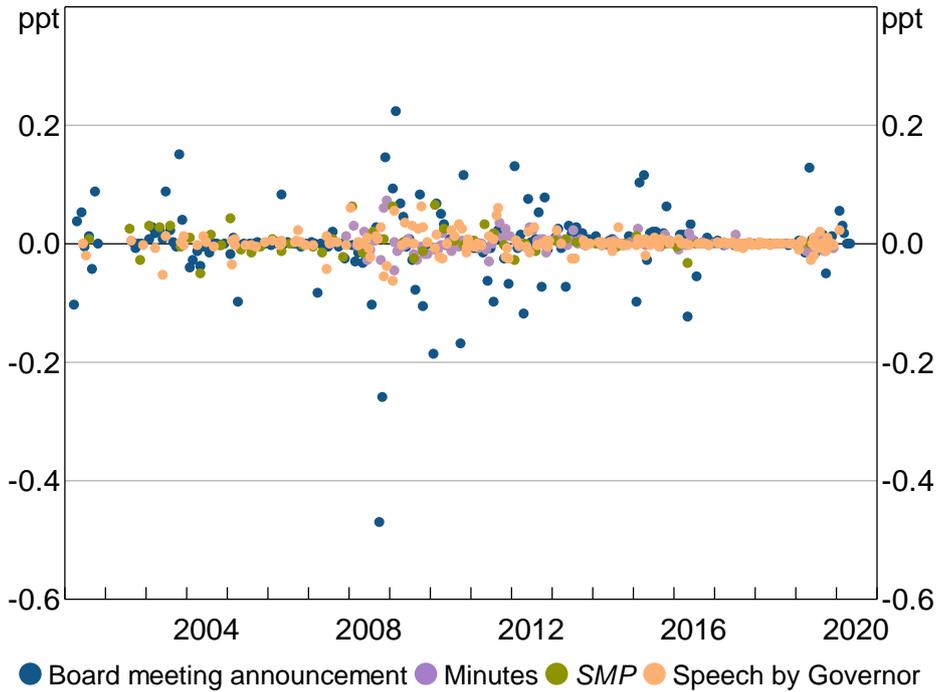
Sources: Author's calculations; Bloomberg; RBA; Refinitiv

Figure 7: Response of ASX 200 to Monetary Policy

100 basis point monetary policy tightening, by communication type
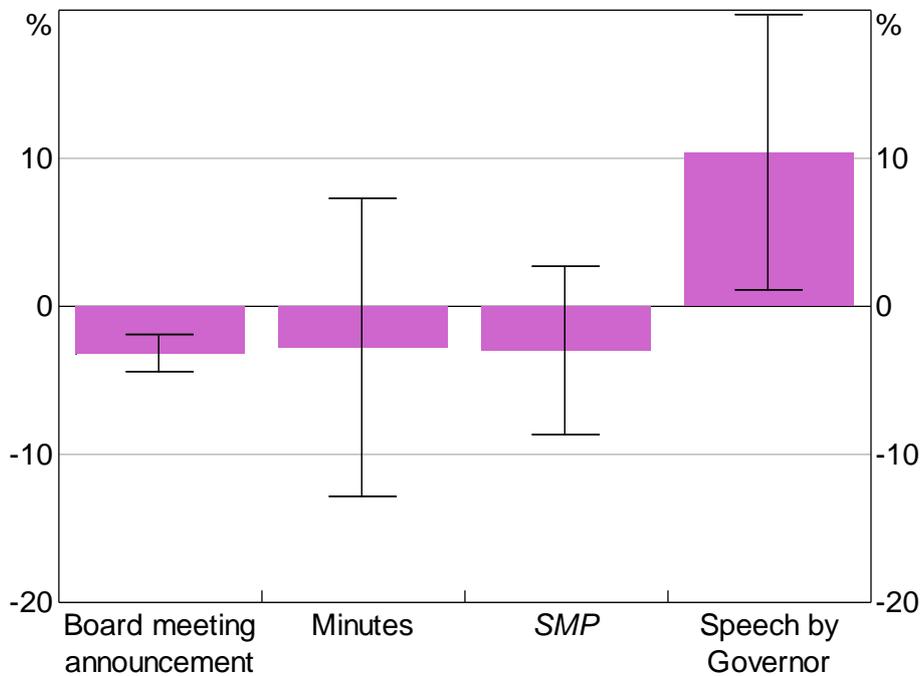
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors

Sources: Author's calculations; Bloomberg; RBA; Refinitiv

Though the responses of the ASX 200 indicates that the information content in speeches delivered by the Governor are potentially high, the results are somewhat weaker when analysing the response of one-year-ahead ASX 200 earnings forecasts (Figure 8). Consistent with the ASX 200 index results, a monetary tightening signalled by a Governor speech results in an upward revision in the one-year-ahead ASX 200 earnings growth forecasts; with a 100 basis point increase in the OIS curve causing around a 7.9 percentage point increase in earnings forecasts. However, this result is statistically insignificant. Taken together with the response of the ASX 200 index, the results suggest there is some evidence to support the notion that other levers of monetary policy, speeches by the Governor in this case, can produce an information effect. However, more work is needed to establish this relationship as the effects on earnings growth are not well identified.

Figure 8: Response of ASX 200 Earnings Growth Forecasts to Monetary Policy

100 basis point monetary policy tightening, by communication type
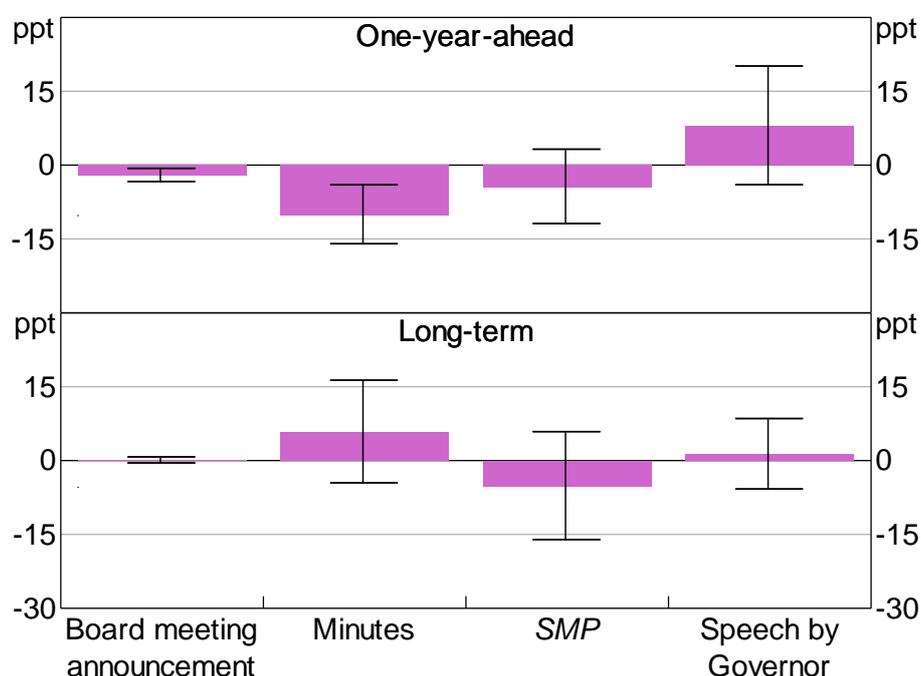
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors

Sources: Author's calculations; Bloomberg; RBA; Refinitiv; Thomson Reuters

Similar to the ASX 200 index response, one-year-ahead ASX 200 earnings forecasts do not meaningfully respond to monetary policy surprises from the release of the *SMP*. But, unlike the ASX 200 index response, one-year-ahead forecasted earnings have a meaningful response to monetary policy surprises generated from the release of the RBA Board minutes. The direction of response from the release of Board minutes aligns with conventional interpretations of monetary policy, with a 100 basis point upward shift in the OIS curve driving a downward revision in earnings forecasts of 10.1 percentage points.

Lastly, consistent with the baseline results, the estimates for the long-term earnings forecast are insignificant for all the different types of monetary policy surprises (Figure 8).

Overall, looking across different types of monetary policy communication reveals a more nuanced picture of the effects of monetary policy on equity markets. I find some evidence that the information

effect of monetary policy may indeed be present in other communication formats; in this case speeches by the Governor. This is consistent with Cieslak and Schrimpf (2019) who find that there is more information present in central bank communication outside of the policy rate announcement. However, the type of communication matters as other forms of RBA communication (*SMP* and RBA Board minutes) do not appear to produce responses consistent with the information effect hypothesis, but rather the responses are consistent with standard interpretations of monetary policy or show no effect at all.

7.1   Governor speeches – information or reaction function?

Though the responses from Governor speeches are consistent with the information effect, they may actually be communicating the RBA's policy reaction function. To examine this I re-estimate Equation (5) but only include the monetary policy surprises generated from Governor speeches as the dependent variable.

Monetary policy surprises from Governor speeches could have been predicted by surprises in GDP growth, with the coefficient being positive and statistically significant at the 5 per cent level (Figure 9). The result suggests that over time Governor speeches may have revealed an increased responsiveness to GDP surprises, with upward GDP surprises leading to higher interest rates (and vice versa). Therefore, it is possible that the monetary policy surprises from Governor speeches conveyed details of the policy reaction function, as opposed to new information about the state of the economy.

Figure 9: Monetary Policy Surprises and Economic News

Speech by Governor, response by economic news
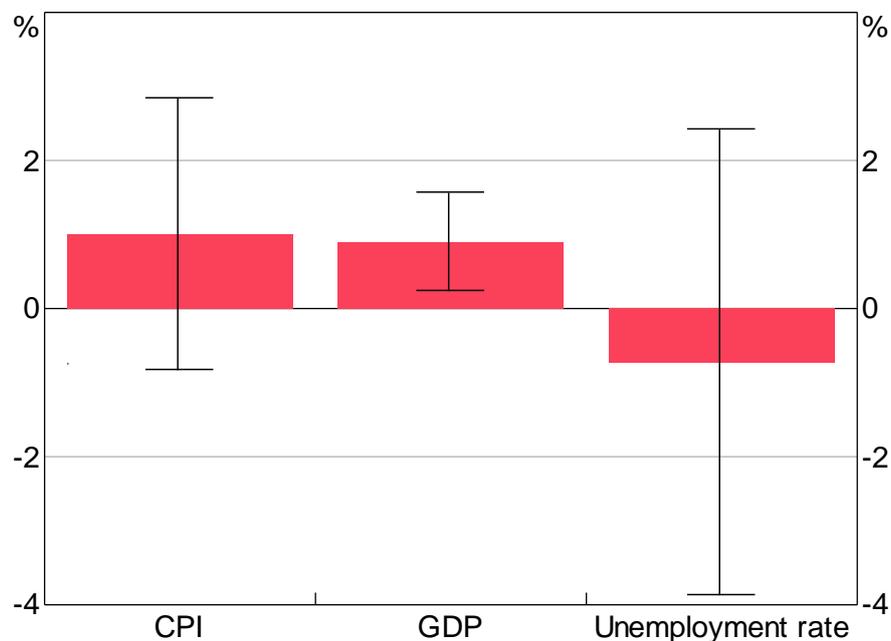
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors

Sources: ABS; Author's calculations; Bloomberg; Refinitiv

However, it is slightly surprising that GDP news can explain the monetary policy surprises from Governor speeches. The relatively long time lag from the GDP release and the reference period often means that information from the release could be less relevant for monetary policy. One possible way to reconcile this is that the timing of GDP releases usually occurs the day after a Board meeting, meaning any subsequent Governor speech could be communicating information about the RBA's interpretation of that release, which was not fully evident in its communication following the Board decision.

Nonetheless, the results provide some evidence that the results found earlier in this section could potentially be explained by market participants updating their beliefs about the central bank's policy reaction function. However, it is difficult to rule out the potential for an information effect from Governor speeches without further analysis.

8. Robustness and Extensions

### 8.1 Earnings across sectors

The response of the ASX 200 earnings growth forecasts to monetary policy surprises may not be representative of the effects of monetary policy across industries. The ASX 200 is heavily weighted towards the financial and materials sectors, which jointly account for around 45 per cent of the index, while other industries such as 'information technology' (IT) and 'consumer discretionary' account for only around 3 per cent and 6.5 per cent of the index. However, it is possible that the information effect could be observable in some industries but not others. For example, sectors more reliant on consumer spending could be more exposed to changes in monetary policy. To investigate the effect of monetary policy announcements across industries I perform the same analysis on earnings growth forecasts at the GICS sector level.

The results from these regressions are generally consistent with the aggregate ASX 200 earnings forecasts results: an unexpected tightening of monetary policy causes forecasters to revise down their earnings growth forecasts. However, many of the estimates suffer from low power and are not statistically significant.

The results reveal that one-year-ahead forecasted earnings of the materials, utilities and IT sectors are particularly sensitive to unexpected changes in monetary policy (Figure 10). The one-year-ahead earnings growth forecasts for the materials sector fall by 9.4 percentage points following a 100 basis point level increase in the OIS curve. Similarly, the IT sector's earnings forecasts fall by 6.9 percentage points, while the utilities sector earnings forecasts fall by 3.2 to the same increase in the OIS curve. One possible explanation for the relatively large estimates are that these sectors are particularly exposed to the exchange rate, which monetary policy is a key determinant of. Indeed, these sectors broadly correspond to the sectors most sensitive to the exchange rate found in Manalo, Perera and Rees (2015).

Figure 10: Response of One-year-ahead ASX 200 Earnings Growth Forecasts to Monetary Policy

100 basis point monetary policy tightening, GICS sectors
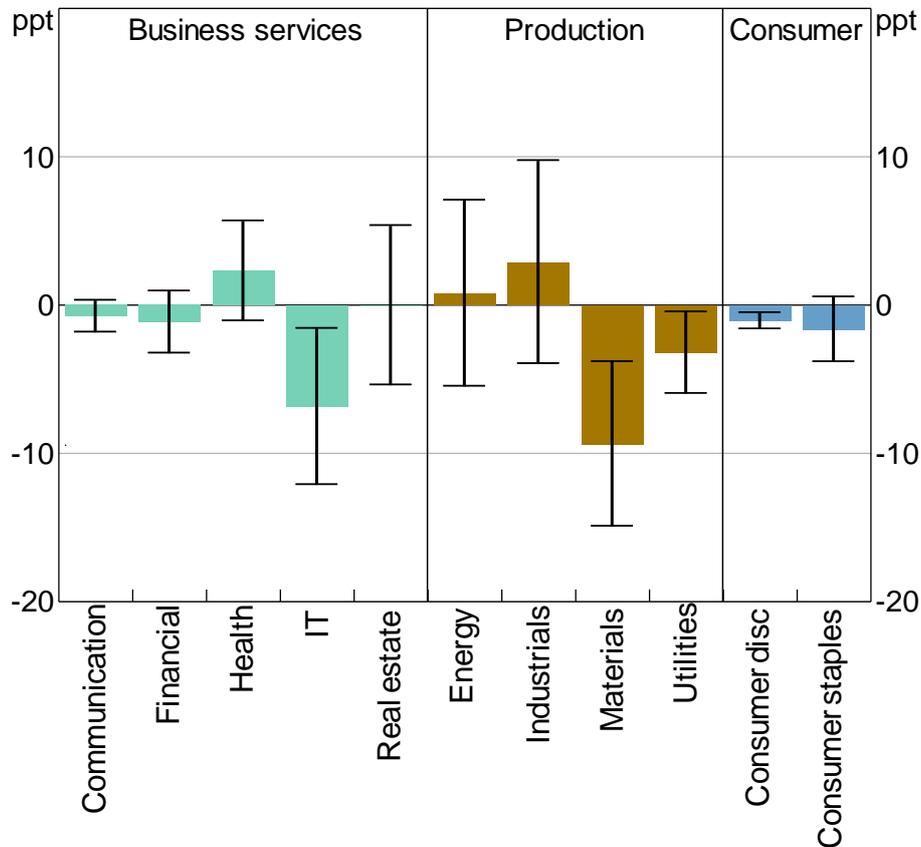
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

The results also show that the one-year-ahead earnings forecasts in consumer-related sectors – consumer discretionary and consumer staples – are less sensitive to changes in monetary policy. The forecasted earnings revisions to monetary policy tightening in these industries are small, but still negative. Again, the exchange rate could be an important factor here, as these sectors could be less sensitive to the exchange rate and hence less exposed to changes in monetary policy.

Also, it is worth highlighting that the estimated one-year-ahead forecast revision is positive for only three sectors and in all these cases the estimates are statistically insignificant.

Similar to the findings for the overall ASX 200 earnings forecasts, the results for the 'long-term' forecast horizon are unclear (Figure 11). In general, the estimated effects of a surprise monetary tightening are small, and for all sectors the effects are statistically insignificant. Overall, I interpret these results as indicating that changes in monetary policy are unlikely to affect the long-term earnings growth of sectors.

Figure 11: Response of Long-term ASX 200 Earnings Growth Forecasts to Monetary Policy

100 basis point monetary policy tightening, GICS sectors
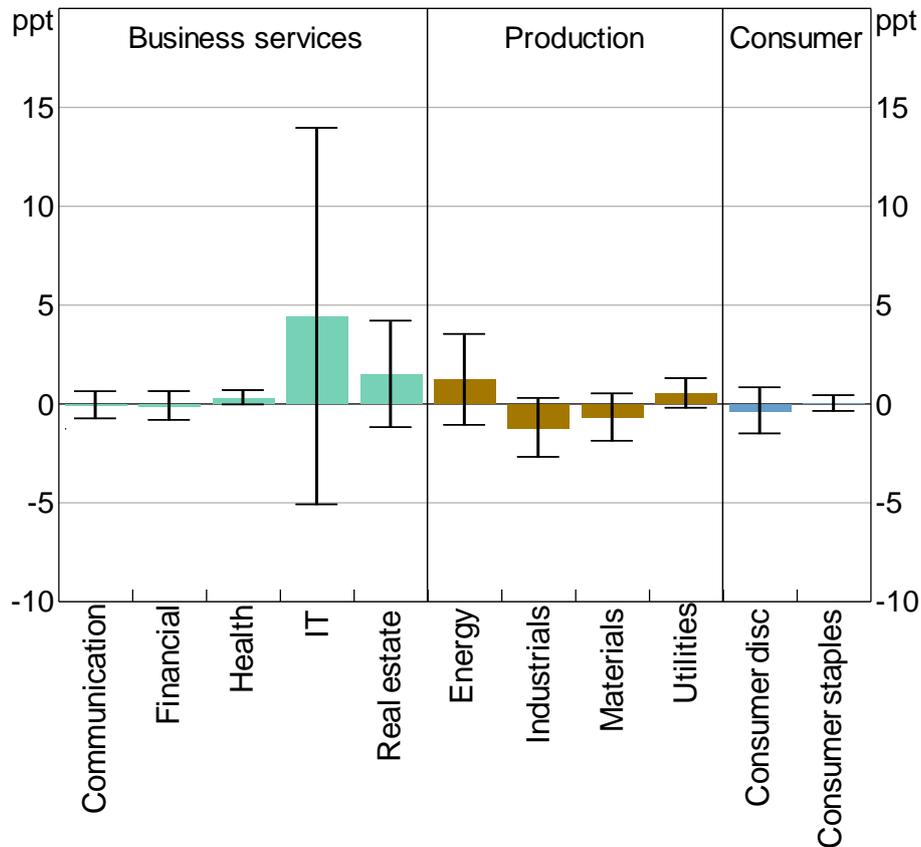
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors

Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

8.2 Removing the global financial crisis

One concern with the results is that the GFC could have a strong influence on the estimates. This is especially concerning as the largest monetary policy surprises occur during the GFC, which could make these observations highly influential. This issue is amplified as it is probable that any findings based on monetary policy surprises from the GFC are not externally valid as these surprises represent monetary policy responses to an extraordinary situation. For example, the RBA cut the cash rate by 1 percentage point on 3 separate occasions during the GFC (October 2008, December 2008 and February 2009). These represented the largest changes in the cash rate since the early 1990s. The unprecedented nature of the GFC make it (almost) impossible for market participants to have known the RBA's reaction function to these events. Therefore monetary policy surprises in this period may be more reflective of market participants updating their knowledge about the central bank reaction function to novel events or a particular set of data relative to other times. Another reason to be cautious about the inclusion of the GFC is that the abrupt nature of the GFC meant monetary policy became highly dependent on incoming news. If the monetary policy surprises during this period were correlated to incoming news (in the windows that I consider) this would violate assumption (2) and bias the results.

To address this issue, I remove the observations between September 2008 and April 2009 (inclusive) from the information effect regressions.[14] Over this period, the RBA cut the cash rate by 4.25 percentage points, with 3 percentage points being in 1 percentage point increments.

Figure 12 compares the response of the ASX 200 index to monetary policy surprises when using the full sample of monetary policy announcements, from Section 5.1, and when excluding the GFC period. The regression estimates are almost completely unaffected by the exclusion of the GFC period. The point estimates are similar and not statistically different from one another, indicating that the results are not contingent on variation during the GFC.

Figure 12: Response of ASX 200 to Monetary Policy
100 basis point monetary policy tightening, by sample
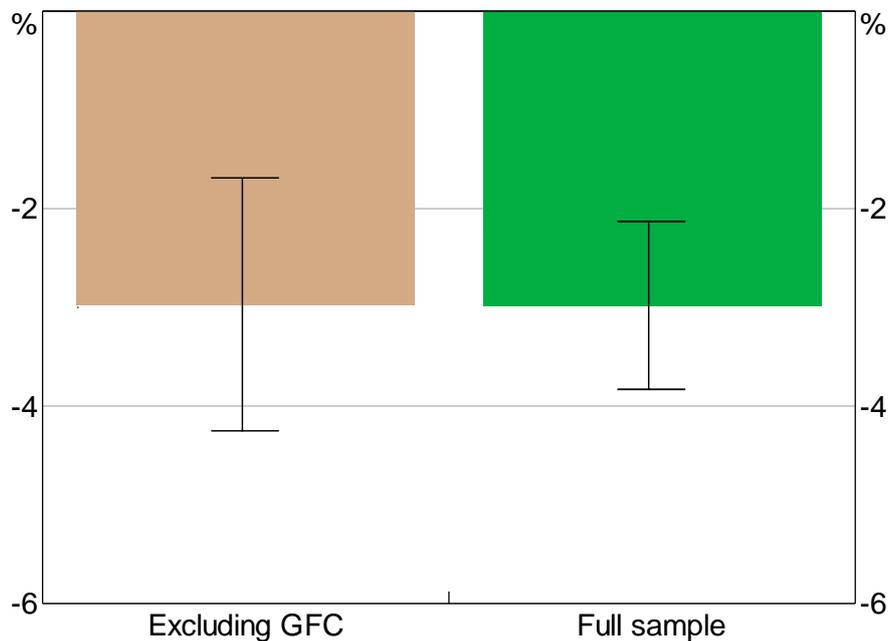
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: Author's calculations; RBA; Refinitiv

Similar results can be found when comparing the ASX 200 earnings revision estimates using the full sample and the truncated sample (Figure 13).The estimates between the sample periods are not statistical different from one another indicating that the GFC does not play a large role in the results.

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14 I do not recalculate the factors as this would change the factor loadings and the monetary policy surprises used. This would ultimately make the results not comparable to the baseline results.

Figure 13: Response of ASX 200 Earnings Growth Forecasts to Monetary Policy

100 basis point monetary policy tightening, by sample
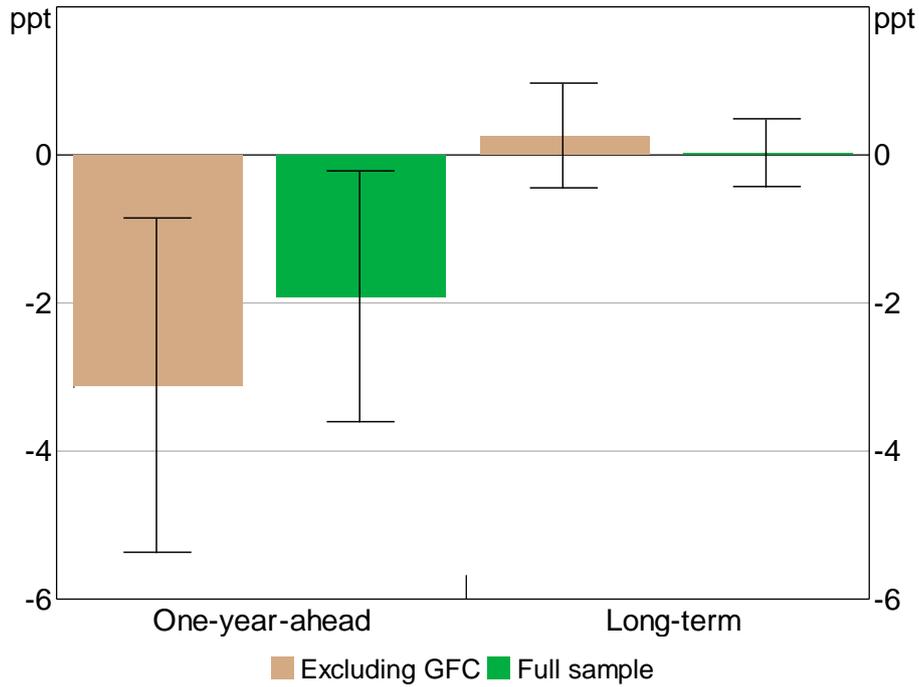
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors

Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

8.3 Surprise easing or tightening

The information effect regression (Equation (3)) is specified to be linear in the monetary policy surprises. Hence, monetary policy surprises in either direction are assumed to have the same effect on the dependent variable. However, it is possible that the effects of monetary policy are nonlinear; the responses to a monetary tightening could be different to a monetary easing (Florio 2004; Karras 2013). This could occur if, for example, agents weight the information content from monetary easing differently to monetary tightening. To examine this, I allow the coefficient on unexpected changes in monetary policy (β_1) from Equation (3) to differ depending on whether the direction of the monetary policy surprise is positive or negative. Therefore, I estimate the following:

$$\Delta y_t = \alpha_0 + \alpha_{pos} F_{1,t} I\left[F_{1,t} > 0\right] + \alpha_{neg} F_{1,t} I\left[F_{1,t} \leq 0\right] + \varepsilon_t \tag{6}$$

All variables are as they were in Equations (3) and (4), however now $I\left[F_{1,t} > 0\right]$ is an indicator variable for when the monetary policy surprise ($F_{1,t}$) is above zero, and $I\left[F_{1,t} \leq 0\right]$ is an indicator variable for when it is less than or equal to zero. Hence, α_{pos} represents the estimated effect to a surprise monetary policy tightening, and α_{neg} for a surprise monetary policy easing. Both coefficients should be interpreted as the effect of a surprise increase in the OIS curve on the dependent variable.

For both the ASX 200 price index and one-year-ahead ASX 200 earnings growth forecasts the point estimates from a surprise monetary policy easing are larger (in absolute terms) than a surprise monetary policy tightening (Figures 14 and 15). However, the estimates are not statistically different from one another.

Similar to the baseline results, the estimated effect of monetary policy surprises on long-term ASX 200 earnings growth forecasts are statistically insignificant for both easing and tightening surprises. This similarly indicates that there is little evidence for asymmetries in monetary policy based on the direction of the monetary policy action.

Figure 14: Response of ASX 200 to Monetary Policy
100 basis point monetary policy tightening, by monetary policy surprise direction
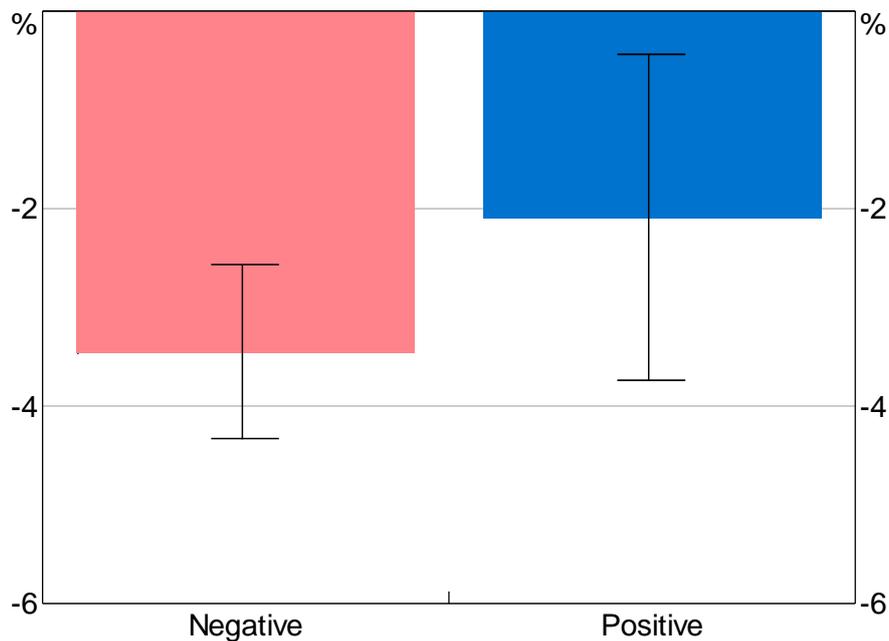
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: Author's calculations; RBA; Refinitiv

Figure 15: Response of ASX 200 Earnings Growth Forecasts to Monetary Policy
100 basis point monetary policy tightening, by monetary policy surprise direction
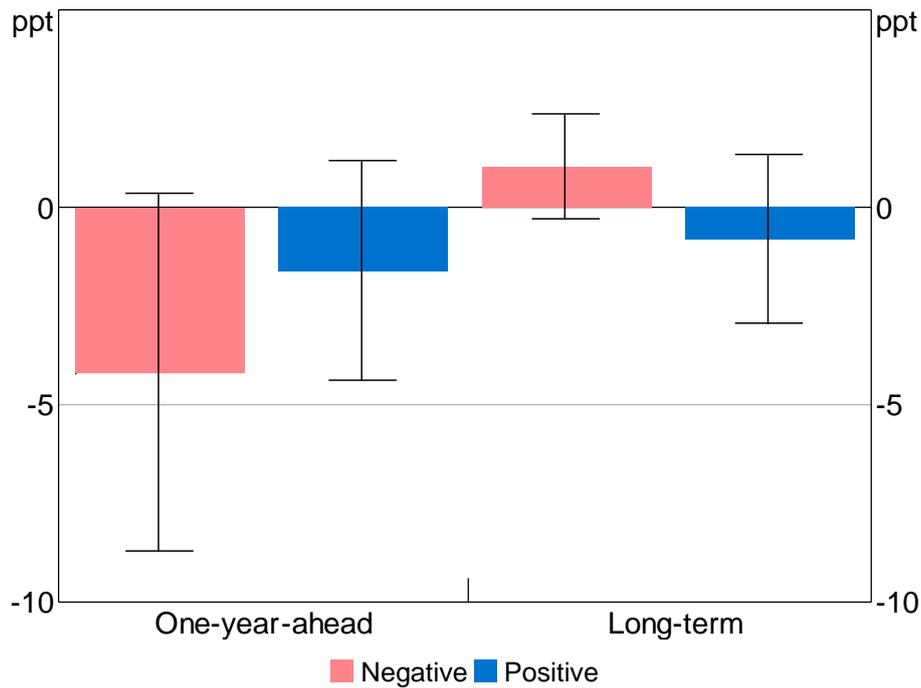
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

8.4 Cash rate change or no change

The measure of monetary policy surprises used is agnostic to whether any actual change in the cash rate occurs. That is, monetary policy surprises can occur in months where no change is made to the cash rate. Though this measure is theoretically sound, it is possible that monetary policy surprises that occur when the cash rate is changed could have a different effect on equity markets relative to monetary policy surprises when there is no change in the cash rate. One way this could occur is if agents perceive monetary policy surprises accompanied with an actual change to the cash rate as more salient changes in information. In this example, we would expect smaller (or possibly positive) equity market effects from surprise monetary policy tightening that are coupled with a cash rate change.

To examine this I re-run the information effect regressions by allowing the coefficient to vary depending on if there was an announced change in the cash rate target. That is, I estimate the following:

$$\Delta y_t = \rho_0 + \rho_{change} F_{1,t} I\left[\Delta Cash\,rate \neq 0\right] + \rho_{no-change} F_{1,t} I\left[\Delta Cash\,rate = 0\right] + \varepsilon_t \qquad (7)$$

All variables are as they were in Equations (3) and (4), however now $I\left[\Delta Cash\,rate \neq 0\right]$ is an indicator variable for when the cash rate target was changed, and $I\left[\Delta Cash\,rate = 0\right]$ is an indicator variable for there was no announced changed in the cash rate. Hence, ρ_{change} represents the

estimated effect to a monetary policy surprise when the cash rate target was also changed, and $\rho_{no-change}$ for when there was no accompanying cash rate change.

For the ASX 200 index, the estimates suggest contractionary monetary policy drives a decline in equity prices regardless of if an actual change in the cash rate occurs (Figure 16). However, the estimated effect of monetary policy surprises when a change in the cash rate occurs is around 1.6 times larger than the estimate for when there is no cash rate change. But the overlap in the confidence intervals shows that the difference is not statistically distinguishable.

Figure 16: Response of ASX 200 to Monetary Policy
100 basis point monetary policy tightening, by if cash rate changed
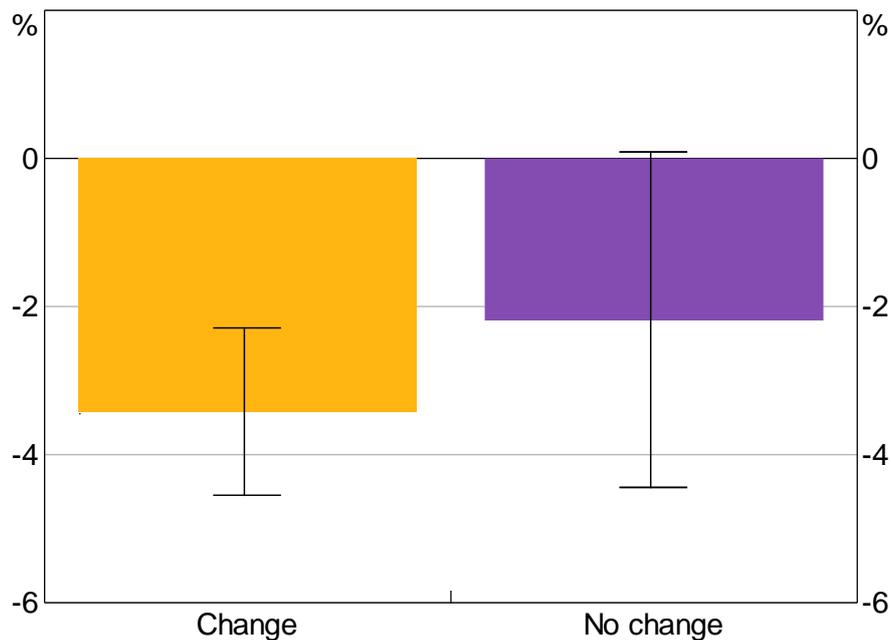
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: Author's calculations; RBA; Refinitiv

The results for the one-year-ahead forecasts are similar to the ASX 200 index (Figure 17). Both estimates show that one-year-ahead forecasts are revised down in response to contractionary monetary policy surprises. But monetary policy surprises accompanied with a cash rate change are estimated to have a larger response, with a 100 basis point monetary tightening driving a 4.96 percentage point decline in earnings forecasts, compared to a 1.98 decline when there is no change in the cash rate. However, similar to before, this difference is not statistically significant, indicating that the difference in estimates should be interpreted with caution. Lastly, consistent with the baseline results, the long-term earnings growth forecast estimates are small and statistically insignificant regardless of if there is an actual change in the cash rate or not.

Figure 17: Response of ASX 200 Earnings Growth Forecasts to Monetary Policy
100 basis point monetary policy tightening, by if cash rate changed
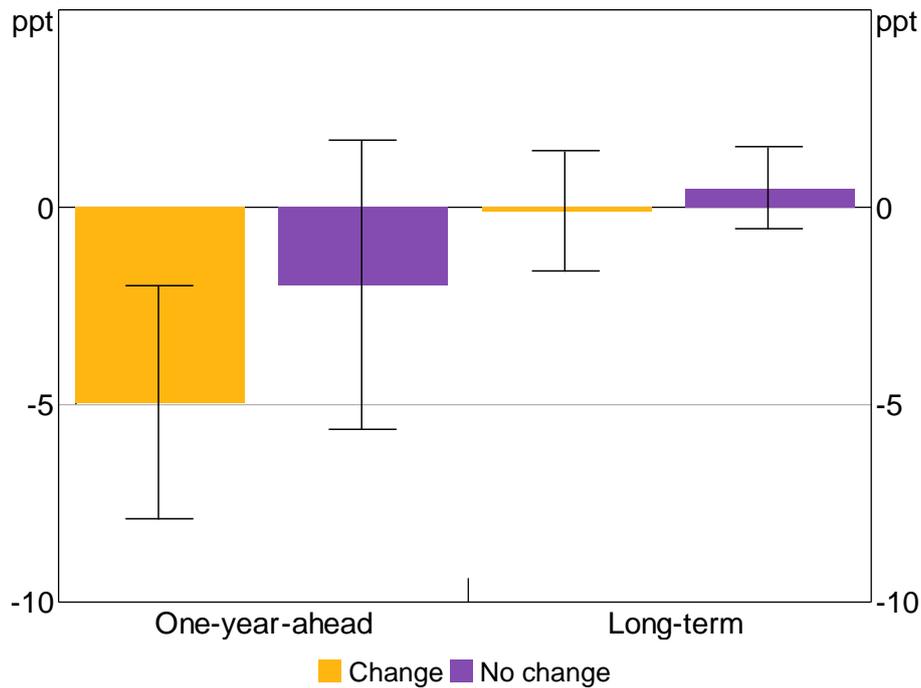
Overall, I find some differences in the sensitivity of equity prices and one-year-ahead earnings forecasts based on if the monetary policy surprise is accompanied by an actual change in the cash rate or not; with the effects of monetary policy surprises occurring with a cash rate change displaying larger absolute estimated effects. This could indicate that there may be an additional effect when there are changes in the cash rate – possibly because of the increased salience that cash rate changes generate. Nonetheless, it is difficult to come to a definitive conclusion as the estimated coefficients are not statistically different from one another.

8.5   Parameter stability

The information content of monetary policy announcements has changed substantially over time. Prior to December 2007, monetary policy board decisions were only accompanied with a statement if there was a change in the cash rate target. Since then, every board meeting decision has been accompanied by a statement. More recently, the use of forward guidance has become more common. Taken together, these developments in the RBA's communication could result in information effects being more prominent in certain sub-samples of the data. If true, this would result in the baseline specification (Equation (3)), which is predicated on parameter stability, to be misspecified.

To explore this possibility I conduct the Bai-Perron structural break test on the coefficient β_1 from Equation (3) for both the ASX 200 and ASX 200 earnings growth forecasts (Bai and Perron 2003).

I find evidence of 2 structural breaks between the relationship of the one-year-ahead earnings growth forecasts and monetary policy, occurring in February 2009 and June 2010. The timing of

these breaks are around the GFC, potentially indicating that the structural break test could simply be identifying this unique period where there were large changes in information flow, which in turn could affect the information effect regression. Notwithstanding this, to account for these structural breaks I add dummy interaction terms to Equation (3) corresponding to the break dates. That is I estimate:

$$\Delta y_t = \beta_0 + \beta_1 mps_t + \beta_2 mps_t I\left[t \geq Feb09 \text{ and } t < Jun10\right] + \beta_3 mps_t I\left[t \geq Jun10\right] + \varepsilon_t$$

The regressions results are presented in Figure 18. The coefficients for both breaks are more negative than the baseline period, indicating that the effect of monetary tightening has become even more negative over time. This runs against the idea that the information effect has become stronger over time. However, the results could possibly indicate that there have been different drivers behind the monetary policy surprises over different samples. But it is difficult to draw any conclusions from the results as all coefficients are statistically insignificant, suggesting that the evidence for breakpoints is weak.

Figure 18: Response of One-year-ahead ASX 200 Earnings Growth Forecasts to Monetary Policy

Break adjusted
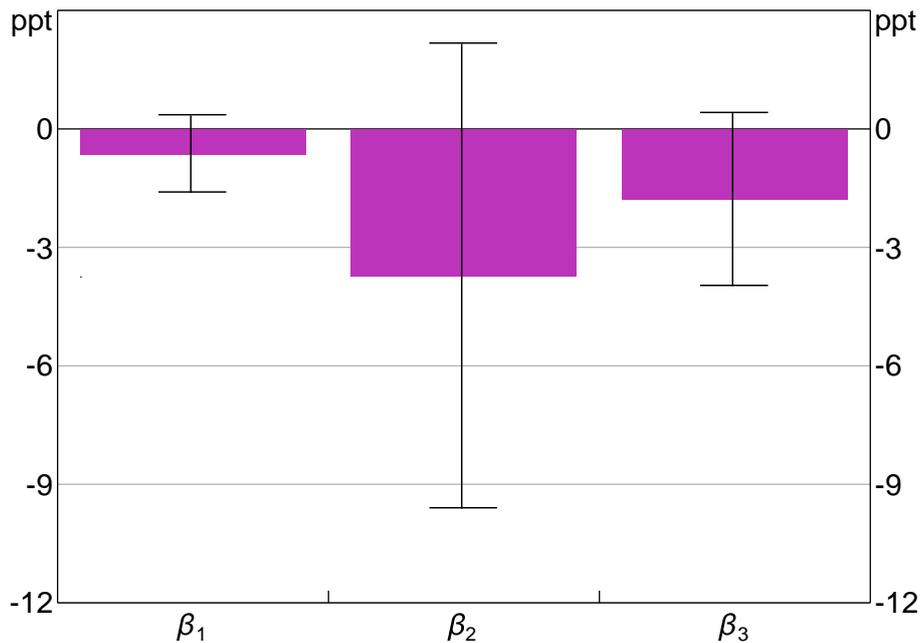
Note: Confidence intervals shown are 95 per cent and calculated using Newey-West standard errors
Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

Looking at the other structural break tests, I find no evidence of structural breaks in the response of the ASX 200 index and long-term earnings growth forecasts to the monetary policy surprises. Taken together, I find only weak evidence that parameter stability is an issue in the estimation of Equation (3).

9.   Discussion, Limitations and Future Research

My results provide little evidence that the information effect of monetary policy is an important factor in the response of equity prices to monetary policy announcements in Australia. This runs counter to the findings of Campbell *et al* (2012) and Nakamura and Steinsson (2018), who find evidence of the information effect of monetary policy in the United States when observing forecast revisions of macroeconomic variables by professional forecasters. Notwithstanding this, the results are consistent with other research that focuses on the effects of monetary policy on equity prices (Bernanke and Kuttner 2005; Bauer and Swanson 2019). The results also survive a variety of robustness tests.

Delving deeper into the equity prices findings, I also find little evidence for an information effect in equity earnings growth forecasts. Instead, consistent with the moves in equity prices, I find that a monetary tightening causes forecasters to revise down their expectations of earnings growth. This implies that the decline in equity prices following a contractionary monetary policy surprise is driven by both a decline in expected dividends and an increase in the discount factor. Moreover, looking across industries suggests that the decline in earnings forecasts following a tightening in monetary policy is broad based but strongest in exchange rate-exposed sectors. This is unsurprising as it is well documented that the exchange rate is an important channel for monetary policy in Australia.

Extending the analysis to include other forms of central bank communication outside of the monetary policy announcement reveals that the information effect could be stronger across different communication channels. Specifically, I find some evidence that speeches delivered by the RBA Governor produce responses consistent with the information effect; contractionary monetary policy surprises induced by Governor speeches drive increases in equity prices and forecasted equity earnings. This indicates that the information content of speeches by the RBA Governor, on average, outweighs other monetary news. However, I find some evidence that this effect could be driven by communication of changes in (or new information about) the reaction function. Nonetheless, the result is consistent with international research on central bank communication (Cieslak and Schrimpf 2019). The findings suggest that Governor speeches could potentially influence the information set and expectations of private agents. Indeed, this result could reflect a deliberate strategy by the RBA to use Governor speeches to release information. One implication of this is that 'jawboning' could indeed play a role in the monetary policy toolkit.

This paper's findings have implications for the conduct of monetary policy in Australia. Specifically, at first sight, the work suggests that concerns over the information effect of monetary policy in Australia should be small when constructing an optimal monetary policy prescription. However, the work also highlights that central banks could deliberately use specific forms of communication to convey information to the public. Despite this, it is important to consider the limitations of this research.

First, the focus on this paper is on Australian equities, which may not be representative of Australian households and firms. It is possible that the findings in this paper do not reflect the total effects of monetary policy, as the information effect may be a stronger channel of monetary policy in areas outside of the equity market, such as household consumption and business investment decisions.[15]

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15 In the Australian context, Kirchner (2020) shows that tightening of monetary policy leads to decreases in consumer confidence and has no discernible effect on business confidence – which suggests that the information effect does not seem to be having a strong influence in these domains either.

This research is silent on whether the findings can be extrapolated beyond the variables examined directly. I leave this for future research to explore.

Second, the evidence of an information effect from Governor speeches should be interpreted with caution. It is unclear if the information from Governor speeches would have been revealed at a later time had it not been contained in the speech. If the information would eventually be revealed in the absence of the Governor's speech, we would observe an increase in the OIS curve, equity prices and forecasted earnings when the information gets revealed. This would suggest that any information effect from central bank communication is simply shifting the timing of news. To better understand this channel, future research should attempt to disentangle whether Governor speeches create news or simply shift the timing of news. Moreover, even if the results suggest there is some space for 'jawboning' in monetary policy communication, it is likely unwise to consistently exploit this relationship. Such a strategy is subject to the Lucas critique, as continued 'jawboning' would likely erode the credibility of the central bank (which the information effect is predicated on) if the communicated state of the economy does not match the realised state. This idea is similar to Stein (1989), where agents understand that the central bank has incentive to mislead the public and therefore do not place weight on certain forms of central bank communication.

Third, though over the sample the estimates show little evidence of structural breaks, it is possible that changes in the monetary policy regime could lead to the information effect being a larger channel of monetary policy. For example, the constructed monetary policy surprise series could be interpreted as a level shift in the OIS curve. This may not necessarily be how monetary policy announcements are internalised in the OIS market in the future. This may especially be the case in the current situation where the RBA's cash rate target is close to the zero lower bound and the RBA has also implemented a yield curve target for the 3-year government bond rate.

Lastly, it is worth remembering that although I find evidence that the standard channels of monetary policy dominate the response to policy changes on average, this does not preclude the possibility of the information effect existing. It is merely that whatever the information effect, it is sufficiently small that it doesn't affect our standard understanding that increases in interest rates are contractionary and decreases are expansionary.

Though unrelated to optimal policy, another limitation of this paper is that it does not attempt to quantify the role of risk premia in the response of equity prices. It is relatively simple to conclude the zero coupon rate changes when there are surprise changes in monetary policy and I also show that expectations of earnings growth decline in response to surprise monetary tightening. However, as premia are unobserved and must be estimated, I cannot completely disentangle and attribute the relative contributions of each component of equity prices in determining the response of equity prices to monetary policy. Though identifying the changes in premia are unlikely to change the conclusions of this paper, a more complete model of equity prices around monetary policy announcements (such as a dividend discount model) would be useful in better understanding how monetary policy propagates through equity markets.

10.   Conclusion

The effects of monetary policy remains a core question at the heart of macroeconomics. Despite standard macroeconomic models predicting a monetary easing as having an expansionary effect, recent work has challenged this notion by identifying so-called 'information effects', where a monetary easing could have a contractionary effect.

This paper explores whether the information effect exists in Australian equity markets. Using high-frequency financial market and weekly forecasts for identification, I document the effect of monetary policy on Australian equity prices and equity earnings forecasts. The results suggest that, to the extent that it exists, the information effect of monetary policy does not play a large role in the response of equity markets following monetary policy announcements. Rather, monetary policy announcements in Australia have the standard effects on equity markets. I show that monetary tightening leads to declines in equity prices. Furthermore, I show that this decline in equity prices is at least in part driven by declines in equity earnings forecasts. But when considering other forms of central bank communication I provide some evidence that an information effect may be present. Consistent with the information effect, monetary tightening caused by speeches delivered by the RBA Governor are followed by increases in equity prices and upward revisions in forecasted earnings.

Taken together, the results suggests that the information effect of monetary policy is, at least in equity markets, unlikely to have been an important channel in the transmission of Australian monetary policy. But the information effect could be present under certain conditions and when using specific communication tools.

Appendix A: Data Description

	Source	Start date	End date	Missing data
Table A1: Data Sources and Samples				
Cash rate target	RBA	2001:M4	2020:M5	
Overnight index swap	Refinitiv	2001:M4	2020:M5	2001:M12–2002:M8
ASX 200 index	Refinitiv	2001:M4	2020:M5	
Equity earnings forecasts	Thomson Reuters, Refinitiv	2006:M2	2020:M2	
RBA communication dates	Bloomberg	2001:M4	2020:M5	
Unemployment, GDP growth, CPI forecasts	Bloomberg	2001:M4	2020:M2	
Unemployment, GDP growth, CPI first release	Bloomberg, ABS	2001:M4	2020:M2	
Equity risk premium	RBA	2001:M4	2020:M5	
10-year AGS yield	RBA	2001:M4	2020:M5	

A.1 Overnight index swap window

Due to incomplete data, occasionally the window around the monetary policy event needs to be modified. This is especially in the case of speeches which often occur outside normal business hours.

If data are unavailable 30 minutes prior to the event the following rules are applied in order:

- if the event occurred after the first available observation of the day and 30 minutes prior to the event is before the time of the first available observation of the day, then the first available of the day is used; else

- the data point that occurs immediately before 30 minutes prior to the event is used.

If data are unavailable 90 minutes following the event the following rules are applied in order:

- if the event occurs before the last available observation of the day and 90 minutes following the event is after the last available observation of the day, then the last available observation of the day is used; else

- if the event occurs before the first available observation of the day, then the observation 60 minutes after the first available observation of the day is used; else

- if the event occurs after the last available observation of the day, then the observation 60 minutes following the first available observation of the next day is used.

A.2 Economic news and Governor speeches

Following the release of economic news there is not necessarily a Governor speech in the time immediately after. To account for this, I only include economic news events that have a Governor speech within 14 days of the release of economic news.

Appendix B: Regression Output

Table B1: Baseline Results

	ASX 200 index		One-year-ahead earnings growth		Long-term earnings growth	
	Monetary policy surprise	Cash rate	Monetary policy surprise	Cash rate	Monetary policy surprise	Cash rate
Constant	0.007	0.018	0.154	0.171	0.056	0.070**
	(0.035)	(0.018)	(0.096)	(0.104)	(0.045)	(0.030)
Monetary policy surprise	−2.988***		−1.919**		0.021	
	(0.434)		(0.864)		(0.234)	
Cash rate		0.043		0.433		0.431***
		(0.086)		(0.416)		(0.078)
No of obs	199	207	156	156	155	155
R^2	0.168	0.000	0.034	0.013	0.000	0.019

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

Table B2: Monetary Policy Surprises and Economic News

	Unemployment rate	CPI	GDP
Constant	0.003	−0.004	−0.004
	(0.004)	(0.008)	(0.007)
Economic news	6.175	−0.980	2.342
	(3.738)	(3.926)	(1.830)
No of obs	197	72	71
R^2	0.017	0.001	0.006

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: ABS; Author's calculations; Bloomberg; RBA; Refinitiv

Table B3: All Monetary Policy Surprises

	ASX 200	Earnings forecasts	
		One-year-ahead	Long-term
Board meeting announcement	−3.202***	−2.145***	−0.007
	(0.642)	(0.681)	(0.306)
Board minutes	−2.822	−10.148***	5.762
	(5.133)	(3.056)	(5.317)
SMP	−3.022	−4.467	−5.230
	(2.896)	(3.852)	(5.595)
Speech by Governor	10.362**	7.928	1.237
	(4.742)	(6.144)	(3.653)
No of obs	595	477	475
R^2	0.082	0.039	0.004

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: Author's calculations; Bloomberg; RBA; Refinitiv; Thomson Reuters

Table B4: Governor Speeches and News

	Unemployment rate	CPI	GDP
Constant	0.003	−0.004	−0.004
	(0.004)	(0.008)	(0.007)
Economic news	6.175	−0.980	2.342
	(3.738)	(3.926)	(1.830)
No of obs	197	72	71
R^2	0.017	0.001	0.006

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: ABS; Author's calculations; Bloomberg; RBA; Refinitiv

Table B5: ASX 200 Earnings Growth Forecasts

	Communication	Financial	Health	IT	Real estate	Energy	Industrials	Materials	Utilities	Consumer discretionary	Consumer staples
					One-year-ahead						
Constant	0.265**	0.061	−0.062	0.090	0.257	0.521	0.216	0.367	0.085	0.162***	0.051
	(0.120)	(0.060)	(0.137)	(0.098)	(0.174)	(0.351)	(0.203)	(0.378)	(0.145)	(0.029)	(0.082)
Monetary policy surprise	−0.770	−1.163	2.291	−6.855**	−0.032	0.784	2.884	−9.384***	−3.224*	−1.076***	−1.656
	(0.547)	(1.068)	(1.723)	(2.690)	(2.743)	(3.199)	(3.491)	(2.830)	(1.401)	(0.281)	(1.115)
No of obs	152	154	154	153	118	153	138	143	143	155	155
R^2	0.002	0.021	0.009	0.142	0.000	0.000	0.006	0.043	0.017	0.007	0.025
					Long-term						
Constant	−0.009	−0.010	0.001	0.171	−0.018	−0.187*	−0.087	0.146	0.039	0.021	−0.001
	(0.067)	(0.020)	(0.033)	(0.176)	(0.024)	(0.106)	(0.066)	(0.102)	(0.074)	(0.033)	(0.020)
Monetary policy surprise	−0.085	−0.113	0.302	4.404	1.481	1.208	−1.220	−0.703	0.524	−0.365	0.007
	(0.350)	(0.370)	(0.185)	(4.857)	(1.375)	(1.172)	(0.761)	(0.609)	(0.382)	(0.594)	(0.203)
No of obs	147	154	155	154	118	154	152	156	154	156	154
R^2	0.000	0.001	0.003	0.021	0.032	0.003	0.013	0.001	0.002	0.004	0.000

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

Table B6: Excluding GFC

| | ASX 200 | | Earnings forecasts | | | |
| | | | One-year-ahead | | Long-term | |
	Excl GFC	Full sample	Excl GFC	Full sample	Excl GFC	Full sample
Constant	0.010	0.007	0.182**	0.154	0.070	0.056
	(0.033)	(0.035)	(0.082)	(0.096)	(0.043)	(0.045)
Monetary policy surprise	−2.978***	−2.988***	−3.119***	−1.919**	0.253	0.021
	(0.654)	(0.434)	(1.152)	(0.864)	(0.361)	(0.234)
No of obs	192	199	149	156	148	155
R^2	0.103	0.168	0.047	0.034	0.000	0.000

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

Table B7: Positive or Negative

| | ASX 200 | Earnings forecasts | |
		One-year-ahead	Long-term
Positive	−2.097**	−2.413**	−1.418*
	(0.842)	(1.067)	(0.788)
Negative	−3.456***	−1.688	0.693**
	(0.450)	(1.375)	(0.342)
No of obs	199	156	155
R^2	0.174	0.035	0.010

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

Table B8: Change or No Change

| | ASX 200 | Earnings forecasts | |
		One-year-ahead	Long-term
Change	−3.429***	−2.233**	−0.038
	(0.576)	(0.927)	(0.265)
No change	−2.188*	−1.347	0.128
	(1.156)	(1.798)	(0.389)
No of obs	199	156	155
R^2	0.175	0.036	0.000

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

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Table B9: ASX 200 One-year-ahead Forecasts
Break-adjusted regressions

β_1	−0.637
	(0.478)
β_2	−3.729
	(2.989)
β_3	−1.791
	(1.087)
No of obs	156
R^2	0.053

Notes: Parentheses show Newey-West standard errors; *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively

Sources: Author's calculations; RBA; Refinitiv; Thomson Reuters

Appendix C: Semi-elasticity versus Elasticity

The baseline estimates for the ASX 200 index are estimated as semi-elasticities. Here, the response of the ASX 200 depends only on the absolute size of the monetary policy surprise and does not change based on the level of the interest rate. This approach is standard in the literature (e.g. Bernanke and Kuttner 2005; Bauer and Swanson 2019) and can also be derived from a Campbell and Shiller (1988) linear approximation of equity prices.

But there is a nonlinear relationship between the discount factor and equity prices (Equation (2)). That is, the effect of the same change in interest rates may have different effects depending on the initial level of the discount factor. This differential response becomes increasingly important the lower the initial level of the discount factor. To account for these dynamics, one would need to estimate an elasticity of the ASX 200 to the discount factor. I do this by dividing the scaled monetary policy surprises by the sum of the AGS 10-year nominal yield and an estimate of the equity risk premium prior to the monetary policy announcement.

Figure C1 compares the estimated effect of a 100 basis point monetary policy surprise at different levels of the discount rate. The semi-elasticity, used in the baseline results, is constant at 3.0 percentage points. While the effects when using the elasticity become larger as the discount factor decreases. When the discount factor is around 12 per cent the elasticity is roughly equivalent to the semi-elasticity. This is higher than the historical mean of the discount factor used, which is around 9.35 per cent. This suggests that in the current low interest rate environment the semi-elasticity could be underestimating the effects of monetary policy on the ASX 200 index.

Though using the elasticity may be more theoretically grounded, the estimation is not necessarily better than using a semi-elasticity. Using the elasticity requires one to first find the relevant discount factor, which includes determining a measure of the equity risk premia. This process is imprecise and adds uncertainty around the estimated parameters. Because of this I prefer the semi-elasticity results in the main text. Nonetheless, the elasticity results could be increasingly relevant in the current low interest rate environment.

Figure C1: Elasticity and Semi-elasticity

100 basis point monetary policy tightening
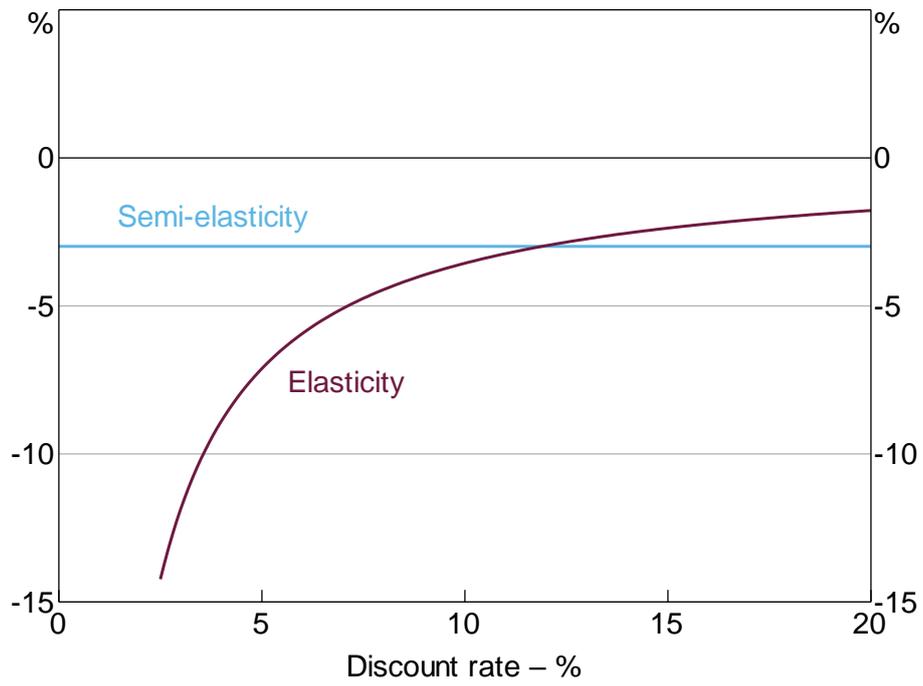
Sources: Author's calculations; RBA; Refinitiv

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