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**Working Paper**

## Corporate market power and monetary policy transmission in Asia

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## **ADB Working Paper Series**

### **CORPORATE MARKET POWER AND MONETARY POLICY TRANSMISSION IN ASIA**

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**Abstract**

This paper empirically examines the effect of corporate market power on monetary policy transmission in Asia. Using panel local projections based on a firm-level dataset for 11 advanced and emerging Asian economies, we find that after a monetary policy tightening, the real sales of firms with low market power significantly decline, while real sales of firms with high market power respond little. Moreover, we find that the average responses of firms' real sales to monetary policy shocks are driven by firms with low markups. Our findings indicate that rising market power impairs the effective transmission of monetary policy. We discuss the implications in terms of balancing the need for industrial policies that promote innovation-led productivity against effective competition policy to compress heterogeneity in market power dynamics and enhance the monetary policy transmission mechanism.

**Keywords:** corporate market power, monetary policy transmission, Asia

**JEL Classification:** E52, D43

# 1 Introduction

Market power has been a long-standing concern for many policymakers and academic researchers, as it greatly matters for economic welfare and resource allocation (e.g., De Loecker et al., 2020). This is further enhanced by growing evidence that corporate market power has increased globally in recent years (e.g., Akcigit et al., 2021; De Loecker & Eeckhout, 2018; De Loecker & Warzynski, 2012; Diez et al., 2021). Although the trajectory of corporate markup levels in Asia has been somewhat more muted than the global average, it has risen sharply in the last few years (De Loecker and Eeckhout, 2018; also see Figure 1).

Despite the literature paying a great deal of attention to the macroeconomic implications of rising market power, there is little known about the role of market structure and corporate market power in the transmission of monetary policy. Several studies have documented the potential impact of market power in monetary policy transmission from a theoretical perspective (e.g., Hahn, 2022; Haldane et al., 2018; Syverson, 2018), indicating that rising market power can reduce the effectiveness of the monetary policy. However, there is less empirical work on this issue, particularly from an international or cross-country perspective. This paper aims to fill this gap in the literature by empirically investigating how market power affects monetary policy transmission, using a firm-level dataset for 11 advanced and emerging economies in Asia.

Following De Loecker and Warzynski (2012) and Diez et al. (2021), we first estimate firms' markup series for 11 Asian economies, using the ORBIS dataset. The main advantage of the ORBIS dataset is that it comprises harmonized cross-country financial information for public and private companies over multiple years. We then estimate the responses of the real sales of high and low markup firms in Asia to monetary policy shocks.

To overcome potential concerns about endogeneity, we derive a series of identified monetary policy shocks for each of the 11 Asian economies, following the approach of Christiano et al. (1999). Using this approach, we orthogonalize monetary policy rate changes against the central bank's responses to current and lagged macroeconomic conditions by assuming a Taylor-type rule to extract the exogenous component. The estimated residuals therefore can be regarded as exogenous monetary policy shocks, and the ba-

sis for the impulse response function analysis. We then convert the estimated monetary policy shock series into an annual frequency to match the firm-level data.

The impact of monetary policy shocks on firms' real sales growth is examined by estimating panel local projections (Jorda, 2005). Before turning to directly estimating firms' heterogeneous responses according to corporate market power levels, we estimate the average effect of monetary policy on firms' real sales, controlling for various firm characteristics, macroeconomic fundamentals, and global factors. After a monetary policy tightening shock, firms' real sales fall, in accordance with priors and economic intuition, also providing a useful benchmark for our subsequent results.

To investigate the role of firms' market power on monetary policy transmission, we divide the firms into groups based on their markup levels and estimate separate impulse responses for each group. Specifically, we divide the firms into two groups: high market power (top 25th percentile of the markup distribution) and low market power (bottom 25th percentile of the markup distribution) firms. The estimation results indicate clear evidence of heterogeneous responses of real sales to monetary policy shock across high and low markup firms. Real sales of low-markup firms significantly decline while real sales of high-markup firms only show an insignificant decline at the beginning and exhibit little response thereafter. Moreover, by comparing with the benchmark average effects, low-markup firms have larger responses regarding their real sales, indicating that the average responses of firms' real sales are driven by the low-markup firms. These results are robust to a set of sensitivity checks including alternative monetary policy measures, alternative markup definitions, and concerns about additional factors that may affect the estimates. Overall, we find strong heterogeneity in the response of real sales of firms to monetary policy shocks according to markup levels, with a rising markup dampening the effectiveness of monetary policy.

This study is mainly related to two strands of literature. First, we contribute to studies that aim to evaluate the effect of monetary policy and its transmission at the firm level. Early papers in the literature highlighted the role of liquidity constraints for monetary policy transmission, providing evidence of the stronger responsiveness of smaller firms (e.g., Gertler & Gilchrist, 1994; Kashyap et al., 1994). Recent studies decompose factors contributing to financial frictions in markets (e.g., firm age, leverage, default risks, liquidity)

and the implications for monetary policy transmission (e.g., Anderson & Cesa-Bianchi, 2020; Cloyne et al., 2018; Ippolito et al., 2018; Jeenas, 2018, 2019; Ottonello & Winberry, 2020).

Second, this study complements the relatively scarce literature on the role of market power on monetary policy transmission. Recent studies have discussed the changing market structure and its implications for monetary policy. Syverson (2018) points out that firms with market power have less incentive to change their output levels in the presence of monetary policy shocks. Haldane et al. (2018) indicate that the rise in market power may alter the shape of the Phillips curve and could provide additional incentives to generate inflation. Konczal and Lusiani (2022) empirically show that rising market power can be an important driver of recent inflation in the United States (US). Hahn (2022) theoretically shows that rising market power makes aggregate productivity more procyclical and causes a rise in monetary non-neutrality. Furceri et al. (2021) are the closest to our study, using firm-level data of the US and advanced countries, empirically investigating the effect of market power on monetary policy transmission. Other work by Cloyne et al. (2018), however, indicates that the heterogeneity in firms' markup does not drive the heterogeneous effect of monetary policy, also based on firm-level data of the US. This paper further sheds light on the nexus between corporate market power and monetary policy transmission by providing new empirical evidence for firms in Asian economies.

The remainder of this paper is structured as follows. Section 2 describes the data and outlines the empirical methodology. Section 3 presents the empirical results with robustness checks. Section 4 concludes.

## 2 Data and methodology

In this section, we describe the firm-level data, as well as the monetary policy shocks. Since most of the firm-level variables are by now standard in the literature, we focus on the main variables of interest, namely the markup and the monetary policy shocks. Finally, we present the econometric framework used to produce the empirical results.

## 2.1 Firm-level data

We obtain firm-level variables from the ORBIS database, an annual global panel dataset with over 300 million companies, compiled by Bureau van Dijk. The main advantage of this dataset for our analysis is the availability of harmonized cross-country financial information for public and private companies across multiple periods, allowing us to investigate the responses of firms to monetary policy shocks in a consistent manner. We clean the ORBIS dataset following the procedures of De Loecker et al. (2020) and Diez et al. (2021), including dealing with basic reporting errors and quality checks. In addition, we drop agriculture, mining, finance, insurance, and real estate industries as well as sectors with high government ownership (e.g., administration), following Cloyne et al. (2018) and Durante et al. (2022). Finally, we restrict our sample to firms that report 9 consecutive years and exclude firms with fewer than 3 employees. After the data cleaning procedure, 27,621 observations for 3,069 firms remain, over the period 2013–2021 across 11 advanced and emerging Asian economies<sup>1</sup>.

To obtain the real value of the firm-level data and properly compute the markup for the main analysis, following Diez et al. (2021), we deflate variables in the level form using gross output deflators. The key advantage of using gross output deflators lies in their better coverage across countries, industries, and time, especially for the cross-country feature of our firm-level data. The gross output deflator is attained from the International Monetary Fund (IMF) and national statistics. Specifically, we deflate the following variables: firms' total sales, total assets, total liabilities, operating revenue, total costs, and tangible fixed assets. Table 1 shows the summary statistics of the main firm-level variables used in the empirical analysis.

The factors that influence firms' performance, other than the measures of market power and monetary policy shocks, are based on the standard corporate finance literature. Specifically, in addition to the variables described above, we control for leverage (the ratio of total liabilities to total assets), tangibility (the ratio of tangible fixed assets to total assets), and profitability (return on assets). We also include measures of macroe-

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<sup>1</sup>Advanced Asian economies include Hong Kong, China; Japan; the Republic of Korea; Singapore; and Taipei, China. Emerging Asian economies include the People's Republic of China; India; Indonesia; Malaysia; the Philippines; and Viet Nam.



conomic fundamentals, including real GDP, inflation, stock prices, and real effective exchange rates; and global financial conditions, including the VIX index, which have been attained from the IMF, BIS, and Bloomberg.

Table 1: Summary Statistics

Variable	Observations	Mean	SD	Min	Max
Sales	27,621	12.24	1.85	7.35	17.00
Assets	27,621	12.71	1.91	7.91	17.66
Liability	27,621	11.76	2.12	6.51	17.16
Operating revenue	27,621	13.07	2.93	7.51	19.89
Costs	27,621	11.76	1.95	6.60	16.58
Tangible fixed assets	27,621	10.96	2.33	4.17	16.31
Employment	27,621	7.08	1.70	3.26	11.08
Leverage	27,621	0.45	0.50	0.07	0.96
Tangibility	27,621	0.27	0.20	0.003	0.83
Profitability	27,621	5.29	8.07	-27.69	29.40
Lerner index	27,621	0.33	0.20	-2.05	0.99
GDP	99	12.48	1.85	5.98	16.22
Inflation	99	1.88	1.32	-1.14	9.40
Exchange rate	99	4.79	0.33	4.24	5.87
Stock prices	99	4.59	0.58	4.09	9.74
VIX	9	2.79	0.25	2.41	3.38

*Notes:* The table shows summary statistics for the main firm-level variables used in the empirical analysis. “Sales” is the log of total sales deflated by producer prices. “Assets” is the log of total assets deflated by producer prices. “Liability” is the log of total liabilities deflated by producer prices. “Operating revenue” is the log of annual operating revenue deflated by producer prices. “Costs” is the log of total costs deflated by producer prices. “Tangible fixed assets” is the log of tangible fixed assets deflated by producer prices. “Employment” is the log of the number of employees. “Leverage” is the ratio of total liabilities to total assets. “Tangibility” is the ratio of tangible fixed assets to total assets. “Profitability” is measured by the return on assets. “Tangibility” is the ratio of net property, plant, and equipment to total assets. Lerner index is computed as firm’s operating revenues minus operating costs divided by operating revenues (Peress, 2010). GDP refers to the log of real GDP, obtained from the IMF. Inflation is the inflation rate, obtained from the IMF. Exchange rate is the log of real effective exchange rate, obtained from the BIS. Stock prices are measured by the log of the stock price index, obtained from Bloomberg. VIX is the log of the VIX index, obtained from the Bloomberg.

## 2.2 Markups

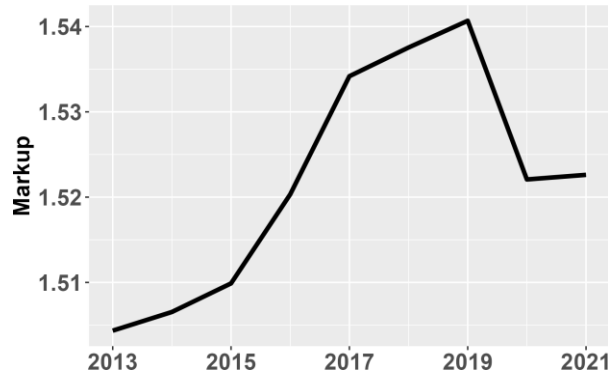
Following the literature, we define the firm’s markup as the ratio of the price to the marginal cost. However, the markup estimation is not as straightforward as its definition

since most firm-level databases (including ORBIS) do not include the firm price and the marginal cost variables. Hence, in this paper, we follow the estimation methodology of Diez et al. (2021), which built on De Loecker and Warzynski (2012), who derive the following expression for the markup ( $Markup_{i,t}$ ) from the firm's cost-minimization problem:

$$Markup_{i,t} = \frac{P_{i,t}}{MC_{i,t}} = \frac{\frac{\partial F(\cdot)}{\partial V_{i,t}} V_{i,t}}{F_{i,t}(\cdot)} \bigg/ \frac{P_{i,t}^{V_{i,t}} V_{i,t}}{P_{i,t} Q_{i,t}} = \frac{\vartheta_{i,t}^V}{\alpha_{i,t}^V} \quad (1)$$

where  $P_{i,t}$  refers to the output price,  $MC_{i,t}$  refers to marginal cost,  $F_{i,t}(\cdot)$  refers to the firm's production function, and  $V_{i,t}$  is the flexible input. The firm markup is therefore estimated as the ratio of the output elasticity of the variable input ( $\vartheta_{i,t}^V$ ) to the firm's expenditure share of that input ( $\alpha_{i,t}^V$ ). While the firm's expenditure share can be directly computed from sales and input information of the ORBIS dataset, the output elasticity cannot be directly observed, requiring the estimation of a production function. Here, we estimate a Cobb-Douglas production function following Diez et al. (2021)<sup>2</sup> and finally compute the firm's markup. Figure 1 reports the estimated average markup pooling all Asian economies in our sample, based on Eq.(1) and weighted by the share of firms' costs of inputs. Although there is a break in 2020, we observe rising markups from 2013 to 2021.

Figure 1: Average Markups for Asian Economies



*Notes:* The figure plots average markups weighted by firms' expenditure on inputs. The markups are computed based on Eq.(1). The sample economies include the People's Republic of China (PRC); Hong Kong, China; India; Indonesia; Republic of Korea; Malaysia; the Philippines; Singapore; Taipei, China; and Viet Nam.

<sup>2</sup>Details on estimating firm markups can refer to Diez et al. (2021).

## 2.3 Monetary policy shocks

The goal of this paper is to investigate how markups affect the effectiveness of the monetary policy on firms' output. As such, we face the usual identification problem of the causal effects of monetary policy. As the variation in central bank policy rate usually reflects the current or expected future economic conditions, we need to identify policy rate innovations that are orthogonal to monetary policy responses to economic performances. In this study, we rely on recursive structural restrictions as proposed by Christiano et al. (1999) to identify monetary policy shocks. The idea of this methodology is to orthogonalize policy rate changes against the central bank's responses to current and lagged macroeconomic conditions by assuming a Taylor-type rule to extract the exogenous component. The estimated residuals thus represent a measure of exogenous monetary policy shocks.

An additional consideration relates to identifying appropriate monetary policy rate series that can be used for the analysis. The short-term rate in Japan has been close to the zero-lower bound (ZLB) since the Bank of Japan introduced the zero interest rate policy in 1999. Thus, during the sample period of this study, the short-term rate in Japan is likely to reflect the monetary policy stance less accurately. To deal with the potential bias due to the ZLB constrained policy rate, we instead use the shadow policy rate series estimated by Krippner (2013) for Japan, which reflects both conventional and unconventional monetary policy stances. For the rest of the sample economies, we use 3-month interbank rates as the main policy rate variables. As the 3-month interbank rates in these economies never touched the ZLB over our sample periods, we avoid the possible complication related to the impact of ZLB constrained policy rates.

A 3-variable structural VAR (SVAR) model is used to identify the monetary policy shocks for a given Asian economy. The SVAR can be denoted as follows in its general specification given as:

$$Y_t = A(L)Y_{t-1} + \mu_t \quad (2)$$

where  $Y_t$  refers to a vector of our selected endogenous variables, including the log of real GDP, inflation rate, and the policy rate;  $A(L)$  is a matrix of polynomials in the lag operator  $L$ ; and  $\mu_t$  is a vector of disturbances. The SVAR includes four lags, which are selected

using the Akaike information criterion (AIC). The identification strategy is based on a block recursive restriction (Christiano et al., 1999), which results in the following matrix  $A$  to fit a just-identified model:

$$A = \begin{pmatrix} \cdot & a_{1,1} & 0 & \cdots & 0 \\ \cdot & a_{2,1} & a_{2,2} & \cdots & 0 \\ & \vdots & \vdots & \ddots & \vdots \\ m,n & \vdots & \vdots & \ddots & \vdots \\ & a_{m,1} & a_{m,2} & \cdots & a_{m,n} \end{pmatrix} \quad (3)$$

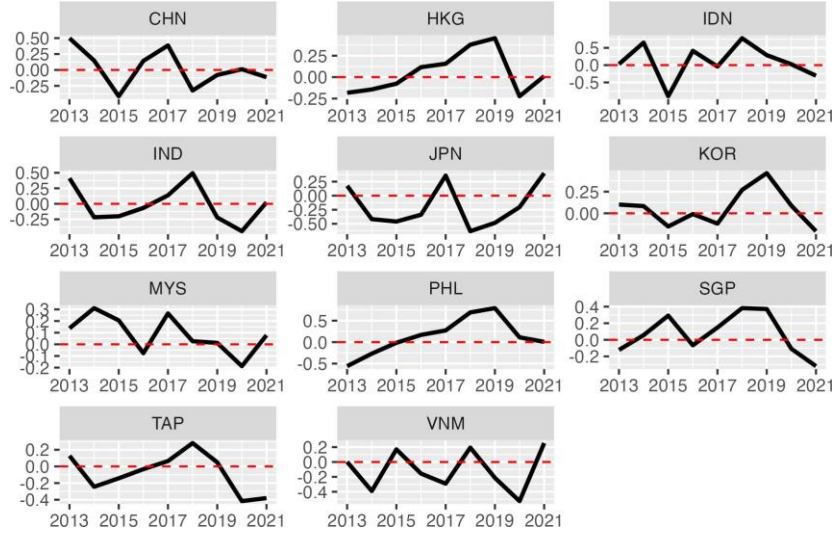
The ordering of the variables imposed in the recursive form implies that the variables at the top (such as  $a_{1,1}$ ) will not be affected by the contemporaneous shocks to the lower variables (such as  $a_{m,1}$ ) while the lower variables will be affected by the contemporaneous shocks to the upper variables. Following Christiano et al. (1999), we then place real GDP at the top in the ordering, which implies that it will only be affected by contemporaneous shocks to itself. Following real GDP, we place the inflation rate, which implies that the inflation will be affected by real GDP and itself, but not by contemporaneous shocks to the policy rate. Finally, we place the policy rate variable in the last place in the ordering, which is based on the assumption that the central bank's monetary policy will reflect wider economic conditions.

To mitigate the potential bias from short sample periods, we estimate Eq.(3) with longer sample of 2000:Q1–2022:Q1 to obtain the monetary policy residuals. We then convert the quarterly series of residuals into an annual time series by averaging the shocks within the periods and restricting the sample period to match the firm-level data. Figure 2 plots the monetary policy shock series at an annual frequency.

## 2.4 Econometric methodology

In this section, we introduce the econometric methodology used in this study to investigate the dynamic causal effects of monetary policy on firms' real sales. Based on the derived monetary policy shock series together with the dataset described in the previous section, we estimate a set of panel local projections. Following Jorda (2005), the basic local projection framework can be specified as follows:

Figure 2: Monetary Policy Shock Series



*Notes:* The figure plots the monetary policy shock series at an annual frequency. The indicators CHN, HKG, IND, IDN, KOR, MYS, PHL, SGP, TAP, and VNM represent the People's Republic of China (PRC); Hong Kong, China; India; Indonesia; Republic of Korea; Malaysia; the Philippines; Singapore; Taipei, China; and Viet Nam, respectively.

$$\Delta Sales_{i,c,t+h} = \delta_i^h + \eta_{c,s,t+h}^h + \theta^h Shock_{c,t} + \gamma^h X_{i,c,t} + \varepsilon_{i,c,t+h} \quad (4)$$

where  $c$  and  $s$  refer to the economy and sector, respectively;  $\Delta Sales_{i,c,t+h}$  is the change in the log of firm's real sales from  $t$  to  $t + h$ , representing the growth rate of sales;  $Shock_{c,t}$  refers to exogenous monetary policy shocks;  $\delta_i$  denotes firm fixed effects, controlling for the time-invariant characteristics of the firm;  $X_{i,c,t}$  is a vector of controls including lags of the dependent variable and monetary policy shocks, time-varying firm characteristics (e.g., assets, liabilities, leverage, tangibility, profitability, and size), as well as macroeconomic fundamentals and global factors (e.g., real GDP, inflation, stock prices, effective exchange rate, and VIX index);  $\eta_{c,s,t+h}$  represents economy-sector-time fixed effects that capture differences in how economies and sectors respond to monetary policy shocks<sup>3</sup>;  $\theta^h$  refers to the percentage change in response to a 1 percentage point monetary policy shock at each horizon (year)  $h$ , where  $h = 0, 1, \dots, 4$ . Finally,  $\varepsilon_{i,c,t+h}$  denotes disturbances. Based on the AIC, we set the lag length to two.

<sup>3</sup>The economy-sector-time fixed effects also control for structural breaks due to COVID-19 pandemic.

To investigate the role of firm market power on the monetary policy transmission mechanism, we divide firms into groups according to their markup levels and estimate separate impulse responses for each group. Specifically, we divide firms into two groups: high market power (top 25 percentile of the distribution) and low market power (bottom 25 percentile of the distribution) firms. Regarding estimating local projections, we incorporate a dummy variable  $Dummy_{i \in m}$  that takes a value of 1 for firms whereby their markup falls within a certain level  $m \in M$  of the markup distribution. Following Cloyne et al. (2018), we extend the basic local projection as follows:

$$\Delta Sales_{i,c,t+h} = \delta_i^h + \eta_{c,s,t+h}^h + \sum_{m \in M} \beta_m^h Dummy_{i \in m} Shock_{c,t} + \gamma^h X_{i,c,t} + \varepsilon_{i,c,t+h}, \quad (5)$$

where the notation is as in Eq.(4).

### 3 Empirical results

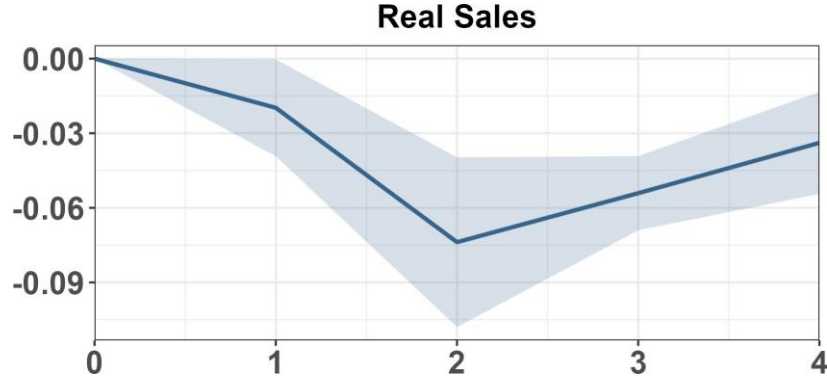
#### 3.1 Impulse responses – Average effects

Prior to the estimation of the impulse responses across different firm groups according to their markup distributions, we first present the average effect of monetary policy on firms' real sales. The purpose is to provide a baseline for our estimated monetary policy shocks for low and high markup firms and also to assess our baseline relative to findings in the literature. We begin by estimating the impulse responses of firms' real sales to monetary policy shocks based on Eq.(4), controlling for firm characteristics, macroeconomic fundamentals, and global factors.

Figure 3 reports the estimated impulse responses to a contractionary shock of 1 percentage point over a period of up to four years. Following a monetary policy tightening, firms' real sales decline steadily with a peak effect apparent at around the second year after the shock, at a value of around -0.08 percentage points. Overall, the impulse responses are directionally in alignment with expectations and they are statistically different from zero at the 95% confidence interval level. These impulse responses are in line with the

aggregate output responses to monetary policy shocks as described in the literature (e.g., Christiano et al., 1999), pointing toward the validity of our estimated monetary policy shocks.

Figure 3: Impulse Responses of Real Sales to Monetary Policy Shocks



*Notes:* The figure plots impulse responses of real sales to a 1 percentage point contractionary monetary policy shock at an annual frequency. 95% confidence bands in shaded areas are reported. The vertical axis unit is one percentage point, and the unit of the horizontal axis refers to one year.

### 3.2 Impulse responses along the markup distribution

In this part of the analysis, we allow the responses of firms' real sales to monetary policy shocks to vary across firms' markup distributions. We divide the sample into two groups depending on whether a firm is of high market power (top 25th percentile of the markup distribution) or it is of low market power (bottom 25th percentile of the markup distribution).

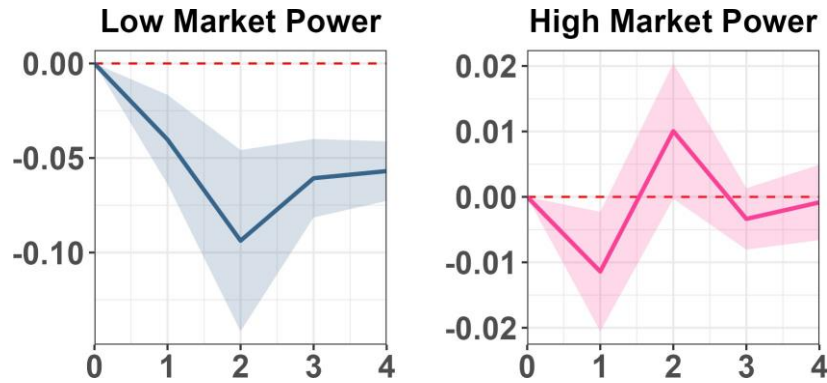
Figure 4 shows the heterogeneous impulse responses of real sales to contractionary monetary policy shocks across the two firm groups, namely the low market power (left panel) and the high market power (right panel). Comparing these two panels reveals the marginal contribution of firms' markup, controlling for other factors that may affect monetary policy transmission. The results indicate clear evidence of heterogeneous responses of real sales to monetary policy shocks across the two types of firms. Real sales of firms with low market power significantly decline by around 0.09 percentage points at the peak and persist thereafter. On the other hand, real sales of firms with high market power only



show a short-term decline of 0.01 percentage points around one year after the monetary policy shocks and exhibit little response thereafter. Moreover, by comparing to the benchmark results in Figure 3, firms with low market power have larger responses, suggesting that the average responses of firms' real sales are driven by the low-markup firms.

The estimated heterogeneous effects of monetary policy on firms' real sales are in line with macroeconomic theory (e.g. Gali, 2015). For a firm with no market power, its marginal revenue remains the same at all output (e.g., real sales) levels. When there is a monetary policy tightening, increased capital costs shift marginal costs to a higher position, leading to a lower output level. On the other hand, firms with market power face downward-sloping marginal revenues, indicating that more outputs are correlated with lower marginal revenues. Therefore, after a monetary policy tightening, the real sales of firms with market power respond less compared to those with no market power, implying heterogeneity in the monetary policy transmission.

Figure 4: Impulse Responses of Real Sales to Monetary Policy Shocks: High vs. Low Market Power Firms



*Notes:* The figure plots the impulse responses of real sales to a 1 percentage point contractionary monetary policy shock at an annual frequency. 95% confidence bands in shaded areas are reported. The vertical axis unit is 1 percentage point, and the unit of the horizontal axis refers to 1 year.



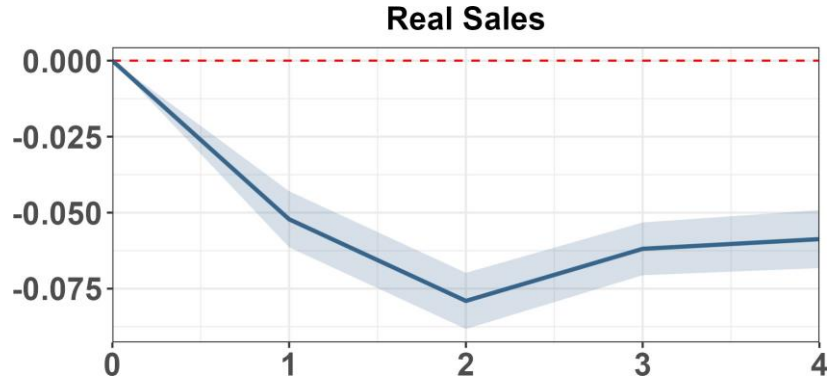
### 3.3 Robustness and extensions

#### 3.3.1 Alternative measure of monetary policy shocks

Thus far, we have followed the standard empirical literature using the short-term policy rate as the policy instrument to identify monetary policy shocks. On the other hand, one may be concerned that short-term policy rates are not an appropriate measure of the monetary policy stance, particularly for some Asian economies (e.g., De Leo et al., 2022). For this reason, we now adopt an alternative monetary policy measure, namely, the long-term rate, to further substantiate our baseline estimates. The long-term interest rate can be a useful instrument as a number of studies have shown that monetary policies typically affect the economy through long-term rates (e.g., Krishnamurthy & Vissing-Jorgensen, 2011; McGough et al., 2005). Consistent with the benchmark approach, we estimate the long-term rate shock series by adopting a Taylor-type rule and a separate recursively identified SVAR, assuming that output and inflation do not react to the long-term rate simultaneously. We attain the quarterly long-term rate series, namely, 10-year government bond yields, from the CEIC database. Finally, we convert the quarterly long-term rate shocks into an annual frequency in order to merge them with our firm-level data.

Figure 5 reports the estimated impulse responses to a contractionary long-term rate shock of 1 percentage point over a period of up to four years. Consistent with the benchmark result, firms' real sales decline steadily following a monetary policy tightening, with a peak effect of around -0.08 percentage points. Overall, the impulse responses using the alternative monetary policy measure are consistent with the benchmark estimates, indicating the robustness of our results.

Figure 5: Impulse Responses of Real Sales to Monetary Policy Shocks: Long-term Rate Shock



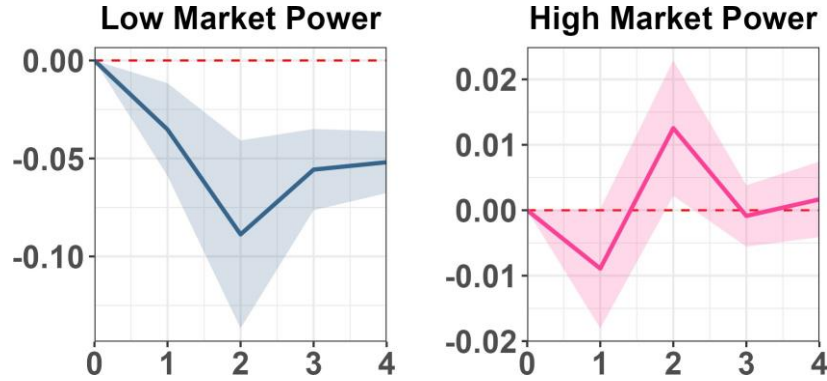
*Notes:* The figure plots the impulse responses of real sales to a 1 percentage point contractionary long-term rate shock at an annual frequency. 95% confidence bands in shaded areas are reported. The vertical axis unit is 1 percentage point, and the unit of the horizontal axis refers to 1 year.

### 3.3.2 Alternative measure of markups

Our second experiment is to examine the robustness of heterogeneous effects of monetary policy on firms' real sales. To this end, we adopt an alternative measure of the markup variable, which is the Lerner index (firms' operating revenues minus operating costs divided by operating revenues), to replace the estimated markups in our baseline results. Again, we split the sample into two groups depending on whether a firm is of high market power (top 25th percentile of the Lerner index distribution) or it is of low market power (bottom 25th percentile of the Lerner index distribution).

Figure 6 plots heterogeneous impulse responses of firms' real sales to a contractionary monetary policy shock, using the Lerner index as the markup measure. Similar to the baseline estimation, we also observe clear evidence of heterogeneous effects across high- and low-markup firms. Real sales of firms with low market power significantly decline after the shock. On the other hand, real sales of firms with high market power respond little.

Figure 6: Impulse Responses of Real Sales to Monetary Policy Shocks: High vs. Low Market Power Firms, Lerner Index



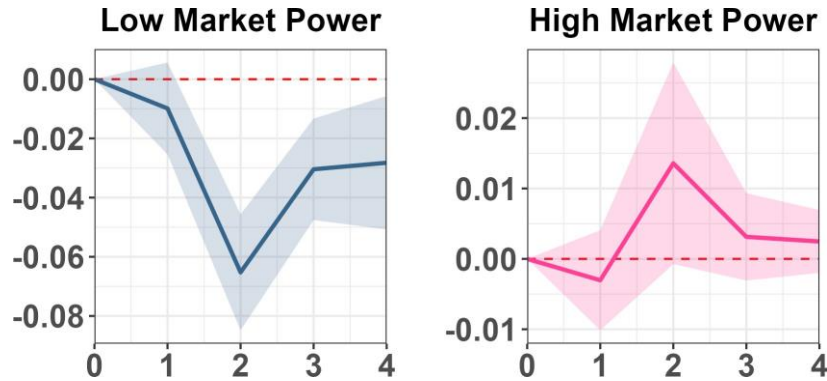
*Notes:* The figure plots the impulse responses of real sales to a 1 percentage point contractionary monetary policy shock at an annual frequency, using the Lerner index as the alternative measure of markups. 95% confidence bands in shaded areas are reported. The vertical axis unit is 1 percentage point, and the unit of the horizontal axis refers to 1 year.

### 3.3.3 Impulse responses conditioning on firm size

From the results shown in the previous section, we find that firms with different markup levels, regarding their real sales, respond heterogeneously to monetary policy shocks. Moreover, we also indicate that these heterogeneous reactions are driven by the heterogeneity in firms' market power. On the other hand, one may be concerned that markup distribution may depend on the size of the firm.

Given the common sense that larger firms are more likely to have higher market power, it is essential to examine whether heterogeneous responses also exist for very large firms. Figure 7 reports impulse responses of firms' real sales to a contractionary monetary policy shock, using the sample of very large firms. Consistent with the baseline results, we find clear evidence of heterogeneous effects across high- and low-markup firms even if we control for the size of firms. Real sales of firms with low market power significantly decline after the shock, while firms with high market power respond insignificantly. Although the magnitude of impulse responses of very large firms appears to be smaller than that of the average firms, the estimates suggest that the size of firms, at least by themselves, cannot fully explain the heterogeneous responses of real sales to monetary policy shocks.

Figure 7: Impulse Responses of Real Sales to Monetary Policy Shocks: High vs. Low Market Power Firms, Very large firms

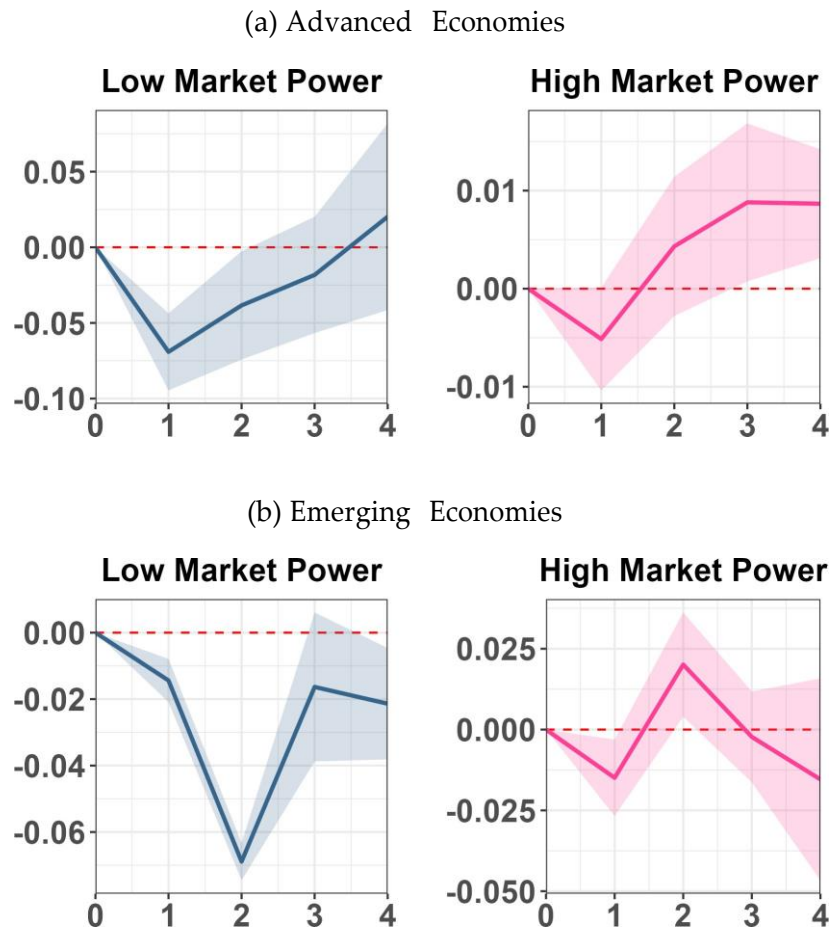


*Notes:* The figure plots the impulse responses of real sales to a 1 percentage point contractionary monetary policy shock at an annual frequency, using the sample of very large firms. 95% confidence bands in shaded areas are reported. The vertical axis unit is 1 percentage point, and the unit of the horizontal axis refers to 1 year.

### 3.3.4 Advanced vs. Emerging Asia

We further examine whether economy-specific factors across Asian economies may affect the heterogeneous effects of monetary policy shocks on firms' real sales. Though controlled for macroeconomic fundamentals and economy-fixed effects in previous estimates, we further divide the sample into advanced and emerging Asian economies. Figure 8 plots the real sale responses of high- and low-markup firms to contractionary monetary policy shocks. Interestingly, we observe that the negative responses of real sales to monetary policy tightenings are more persistent in emerging Asia than those in advanced economies, indicating that monetary policy changes may have permanent impacts on low-markup firms in emerging economies. This could be related to a higher natural rate of interest in emerging compared to advanced economies, and a greater scope for counter-cyclical monetary policy (e.g., De Leo et al., 2022). On the other hand, high-markup firms show no significant responses to monetary policy shocks for both advanced and emerging Asia.

Figure 8: Impulse Responses of Real Sales to Monetary Policy Shocks: High vs. Low Market Power Firms, Advanced vs. Emerging Economies



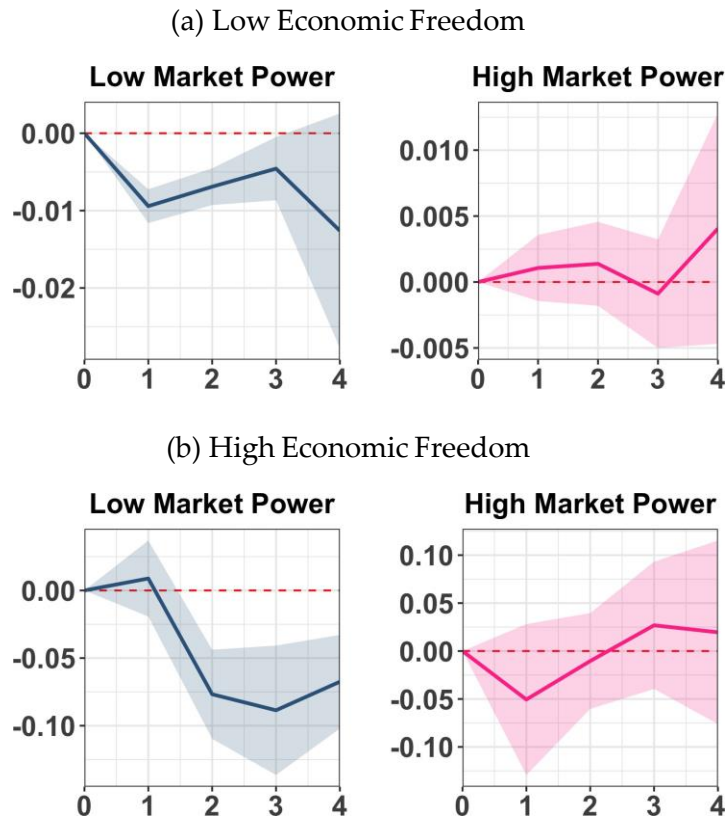
*Notes:* The figure plots the impulse responses of real sales to a 1 percentage point contractionary monetary policy shock at an annual frequency, grouped into advanced and emerging economies. 95% confidence bands in shaded areas are reported. The vertical axis unit is 1 percentage point, and the unit of the horizontal axis refers to 1 year.

### 3.3.5 Impulse responses conditioning on the degree of economic freedom

Previous literature has documented the relationship between monetary policy transmission and economic freedom, indicating that a higher degree of economic freedom may improve the effectiveness of policy transmission (e.g., Agénor & Montiel, 2015). Therefore, our next experiment is to investigate how the degree of economic freedom may affect the heterogeneity in monetary policy transmission to firms' real sales. To do so, we further split the sample depending on whether a firm is in an economy with high economic freedom (top 25th percentile of the degree of economic freedom) or it is in an economy with low economic freedom (bottom 25th percentile of the degree of economic freedom). We obtain the degree of economic freedom index from the Fraser Institute, which measures the degree of economic freedom present in five major areas: the size of government, legal system and security of property rights, sound money, freedom to trade internationally, and regulation.

Figure 9 reports the impulse responses of firms' real sales to contractionary monetary policy shocks across high- and low-markup firms, based on the degree of economic freedom. We observe that the responses of real sales for both high- and low-markup firms in high-economic-freedom countries are larger, compared to those of firms in economies with low economic freedom. This result is consistent with previous findings that a higher degree of economic freedom may improve the effectiveness of policy transmission. On the other hand, we find clear evidence of heterogeneous effects across high- and low-markup firms even after controlling for the degree of economic freedom. Real sales of firms with low market power significantly decline after the shock while firms with high market power respond insignificantly, consistent with the baseline results. Therefore, the heterogeneity in the degree of economic freedom does not drive the heterogeneity in firms' real sale responses to monetary policy shocks.

Figure 9: Impulse Responses of Real Sales to Monetary Policy Shocks: High vs. Low Market Power Firms, the Degree of Economic Freedom



*Notes:* The figure plots the impulse responses of real sales to a 1 percentage point contractionary monetary policy shock at an annual frequency, based on the degree of economic freedom. 95% confidence bands in shaded areas are reported. The vertical axis unit is 1 percentage point, and the unit of the horizontal axis refers to 1 year.

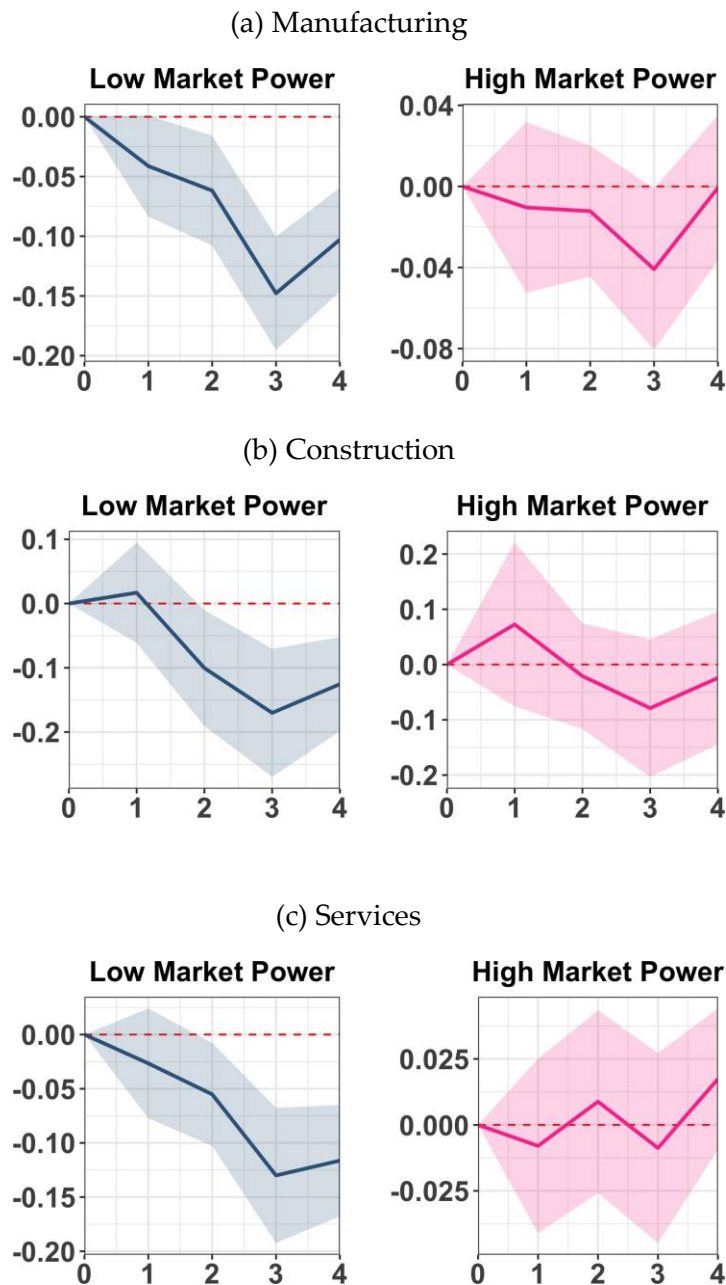
### 3.3.6 Impulse responses conditioning on sectors and industries

Recent literature has emphasized the importance of documenting the effects of monetary policy at the sectoral and industrial level (e.g., Singh et al., 2022), not only for a better knowledge of which sectors are driving the aggregate effect, but also for capturing potential distributional effects of monetary policy on firms. Therefore, we further extend our analysis by investigating whether different sectors and industries may affect the heterogeneous effects of monetary policy shocks on firms' real sales. To do so, we consider three broad sectors: manufacturing, construction, and services, following the NACE Rev.2 classification.

Figure 10 reports the impulse responses of firms' real sales to contractionary monetary policy shocks across high- and low-markup firms in manufacturing, construction, and service sectors. We observe that the responses of real sales for both high- and low-markup firms in the manufacturing and construction sectors are larger, at least for the peak effect, compared to that of firms in the service sector. This result is consistent with previous findings that durable goods investments (manufacturing and construction) respond more to monetary policy shocks compared to nondurable goods investments (services) (e.g., Barsky et al., 2007). On the other hand, we still find clear evidence of heterogeneous effects across high- and low-markup firms based on different sectors and industries, which is consistent with the baseline results. Real sales of firms with low market power significantly decline after the shock while firms with high market power respond insignificantly. Therefore, the heterogeneity in sectors and industries does not, at least on its own, drive the heterogeneity in firms' real sale responses to monetary policy shocks.



Figure 10: Impulse Responses of Real Sales to Monetary Policy Shocks: High vs. Low Market Power Firms, Sectors and Industries



*Notes:* The figure plots the impulse responses of real sales to a 1 percentage point contractionary monetary policy shock at an annual frequency, based on sectors and industries, namely manufacturing, construction, and services. 95% confidence bands in shaded areas are reported. The vertical axis unit is 1 percentage point, and the unit of the horizontal axis refers to 1 year.

### 3.3.7 Leverage and firms' financial frictions

Thus far, we find that these heterogeneous responses of real sales to monetary policy shocks do not come from the heterogeneity in the size of firms, economy-specific factors, the degree of economic freedom, and sectors, but from differences in firms' markup levels. On the other hand, some potential factors may also drive these heterogeneous reactions. To address the concern that may weaken the importance of firm market power for monetary policy transmission, it is particularly necessary to examine the existence of other channels, which are explored in this subsection.

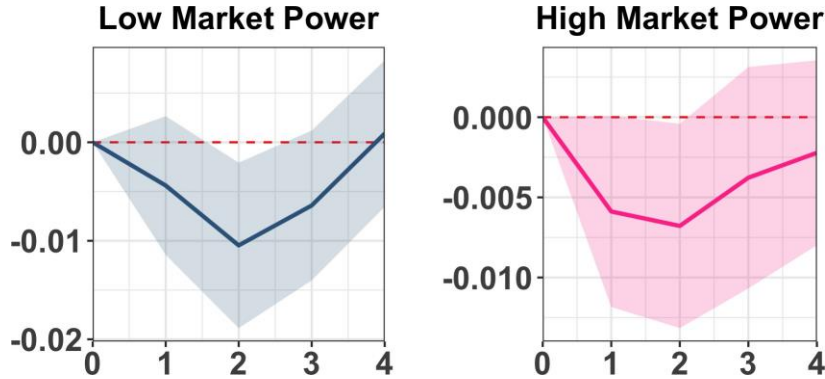
A confounding factor could be the heterogeneity in firms' financial frictions. A large body of literature has indicated that firms with tight financial constraints should respond more to monetary policy shocks (e.g., Cloyne et al., 2018; Ottonello & Winberry, 2020). Therefore, if the differences in firms' financial frictions drive the heterogeneity in firms' real sale responses, we should observe significant heterogeneous effects of monetary policy shocks on the level of firm's financial frictions across low and high-markup firms. As we can not directly measure the financial frictions, we use the level of firm leverage as the main indicator, following Alter and Elekdag (2020)<sup>4</sup>.

Figure 11 reports the impulse responses of firm leverage to contractionary monetary policy shocks across low and high-markup firms. The results indicate that a contractionary monetary policy shock has the typical effects on a firm's leverage described in previous literature, i.e. firms reduce their leverage when they face higher interest rates. In essence, we can observe that the leverage responses are broadly similar across two types of firms, implying that there is no significant heterogeneity in leverage changes while firms respond heterogeneously in their real sales to monetary policy shocks. This is important as the result indicates that the financial frictions may not be, at least on their own, the driving factor to explain the key finding of heterogeneity in firms' real sales responses to monetary policy shocks.

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<sup>4</sup>Some studies also use the firm size as the proxy to capture the financial frictions (e.g., Gertler & Gilchrist, 1994).

Figure 11: Impulse Responses of Leverage to Monetary Policy Shocks: High vs. Low Market Power Firms



*Notes:* The figure plots the impulse responses of leverage to a 1 percentage point contractionary monetary policy shock at an annual frequency. 95% confidence bands in shaded areas are reported. The vertical axis unit is 1 percentage point, and the unit of the horizontal axis refers to 1 year.

In summary, we confirm a strong heterogeneity driven by the markup levels in firms' real sale responses to monetary policy shocks even after using alternative monetary policy measures, alternative markup measures, and conditioning on various firm-level and economy-specific factors, suggesting the robustness of our baseline results.

## 4 Conclusion

Using firm-level data for Asian economies, this paper provides strong empirical support that firms' market power, as measured by the distribution of mark-ups in the top quartile, worsens the effectiveness of monetary policy transmission. Firm mark-ups in Asia have been increasing since 2013, driven by advances in technology-based production and sectoral productivity. In an environment where firms face less competitive pressures in the setting of prices, our empirical work indicates that these financial frictions are compounded by an impairment in the monetary policy transmission mechanism.

Overall, a tightening monetary policy shock has the expected dampening effect on firms' real sales, implying an effective transmission of monetary policy. However, this only holds for firms that have low market power, i.e. firms that are in competitive markets with elastic demand for their products and services. For these firms, a tightening in

monetary policy dampens real sales, thereby enabling the central bank to affect the business cycle. In particular, a one percentage point rise in monetary policy leads to a drop in real sales of around 0.09 percentage points after 2 years, with the negative effect dampening somewhat thereafter but exhibiting persistence and statistical significance over the time horizon. For firms with high market power, however, the effect of monetary policy is significant only for the first year at a magnitude much lower than firms with low market power (by a factor of around 5). Moreover, the response to the monetary policy shock becomes insignificant after the first year. Where market power is high, the monetary policy transmission mechanism is disrupted. The results are robust to several robustness tests. We also find no material difference in the result for emerging versus advanced economies in Asia. In the case of the former, however, the elasticity of real sales is more pronounced and more persistent. This could be related to a higher natural rate of interest in emerging compared to advanced economies, and a greater scope for countercyclical monetary policy. Additionally, we find the heterogeneity in the degree of economic freedom and sectors and industries does not eliminate our heterogeneous effects of monetary policy concerning firms' market power. Finally, we show that firms' financial frictions do not drive the heterogeneity in firms' responses to monetary policy shocks, at least on their own.

Our paper has implications for monetary policy makers and financial supervisors. Policy makers need to be aware that rising market power has made monetary policies less effective as dominant firms have fewer incentives to adjust their output when the cost of inputs changes, and they are also more immune to shifts in external financing conditions. It should also be noted that excessive growth in corporate market power could lead to higher inflation in economic downturns, with high-markup firms turning negative shocks into higher prices, thereby further impairing effective monetary policy transmission.

Maximizing the effective implementation of monetary policy would require a more level playing field as regards competition. Policy makers and competition authorities should closely monitor financial stability risks and negative economic repercussions related to the abuse of dominant position through merger control. However, competition policy should be aimed at fostering an efficient market mechanism across all sectors of the economy and competitive price setting behavior by firms. This would help to compress heterogeneity in market power dynamics, and therefore enhance the effectiveness

of monetary policy transmission. This needs to be balanced against the need for policies that continue to encourage innovation and productivity, underscoring the importance of policy coordination including also fiscal, industrial, and competition policies.

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