REVIEW ON EMPIRICAL PART

I. Identification of monetary policy shocks

1. What's the problem when we examine the impact of monetary policy on real output using the following regression

$$\Delta Y_t = \alpha_y + \sum_{p=0}^{T} \beta_p R_{t-p} + \epsilon_t^y.$$

where ΔY_t denotes the growth rate of real GDP. R_t denotes the risk-free interest rate.

In practice, central banks adjust monetary policy (e.g. R_t) endogenously in response to both current and expected future variations in economic fundamentals (e.g. real GDP). For example, the monetary policy rule could be given by,

$$R_t = \alpha_r + \sum_{p=0}^{T} \gamma_p E_t \Delta Y_{t+p} + \epsilon_t^m.$$

In this case, R_t contains an endogenous component $\sum_{p=0}^{T} \gamma_p E_t \Delta Y_{t+p}$ that is related to the output residual ϵ_t^y, biasing the estimate of β_p. Since γ_p is usually positive, this endogeneity problem is likely to bias β_p upward.

2. How central bank announcements overcome this endogeneity problem?

Changes in financial asset prices (e.g. changes in 3 month fed funds future as most used) around FOMC monetary policy announcements could be used to identify the exogenous components of monetary policy (i.e. monetary policy shocks ϵ_t^m). The underlying assumption is that financial asset prices reflect expectations, including the endogenous response of monetary policy to variations in economic fundamentals $\sum_{p=0}^{T} \gamma_p E_t \Delta Y_{t+p}$. In this case, changes in financial asset prices around FOMC monetary policy announcements (e.g. from 10 minutes before to 20 minutes after FOMC) should only refect the exogenous component of monetary policy announced during the FOMC.

3. What's the problem of the above assumption?

Financial asset prices only reflect public expectations. Central banks may have private information, which may become public through the FOMC monetary policy announcements. In other words, the central bank's expectation on future output, $E_t \Delta Y_{t+p}$, in monetary policy

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rule has two components,

$$E_t \Delta Y_{t+p} = u_{public,t} + u_{private,t}$$

where $u_{public,t}$ denotes public expectations, formed before FOMC. $u_{private,t}$ denotes private information from the central bank, which becomes public after the FOMC. Thus changes in financial asset prices around FOMC monetary policy announcements may still contain the endogeous (information) component of $\sum_{p=0}^{T} \gamma_p u_{private,t}$.

Jarocinski and Karadi (2020) isolate monetary policy shocks ϵ_t^m from information shocks $u_{private,t}$.

4. How does Jarocinski and Karadi (2020) identify monetary policy shocks ϵ_t^m? What's the identification assumption?

They explore the comovements between interest rates and stock prices around policy announcements. The identification assumption is that, a monetary policy shock ϵ_t^m leads to negative comovements between interst rates and stock prices; a information shock $u_{private,t}$ leads to positive comovements between interest rates and stock prices.

5. How does Lu, Tang and Zhang (2023) identify monetary policy shocks ϵ_t^m? Do they calculate the price changes between the close price on the day of the announcement (T) and the opening price on the following trading day (T + 1), or between the opening price on the day of the announcement (T) and the opening price on the following trading day (T + 1)? Why?

They identify monetary policy shocks by calculating the 5-year treasury bond futures price changes around the PBOC announcements. They calculate the price changes between the opening price on the day of announcement (T) and the opening price on the following trading day (T + 1). Because one might have concerns that there exists information release and the targeted financial market has reactions in advance during the day that the authority publishes the news after the closing of the financial market.

II. Reallocation effect of monetary policy

1. Che, Ren and Zha (2018) found that monetary contraction causes nonstate banks to grant more shadow bank loans relative to state banks, and these additional shadow bank loans offset the decline in traditional bank loans and hamper the effectiveness of monetary policy on total bank credit. How does Che, Ren and Zha (2018) identify monetary policy shocks in the empirical exercise?

Che, Ren and Zha (2018) identify monetary policy shocks ϵ_{mt} by estimating a monetary supply rule using Chinese quarterly data,

$$g_{mt} = \gamma_0 + \gamma_m g_{m,t-1} + \gamma_\pi(\pi_{t-1} - \pi^*) + \gamma_{x,t}(g_{x,t-1} - g^*_{x,t-1}) + \epsilon_{mt}.$$

where g_{mt} is the M2 growth, consistent with M2 as the intermediate target of China's monetary policy. π_t is the CPI inflation, and $g_{x,t}$ is the GDP growth rate. $g^*_{x,t}$ is the GDP growth target set by the State Conucil as a lower bound for monetary policy.

As a result, the PBC expands money supply aggressively when actual GDP growth is below the target, but do not respond as much when actual GDP growth is above the target. Such asymmetric policy responses imply that the policy rule is regime-switching in $\gamma_{x,t}$:

$$\gamma_{x,t} = \gamma_{x,a} \quad if \quad g_{x,t-1} - g^*_{x,t-1} \geq 0, \gamma_{x,t} = \gamma_{x,b} \quad if \quad g_{x,t-1} - g^*_{x,t-1} < 0.$$

The above regime-switching policy rule is estimated with the maximum likelihood approach.

2. Ottonello and Winberry (2020) explored how firm default risk affects its investment response to monetary policy. What specification do they use? How do they measure a firm's default risk in their specification? How do they include these measures in their specification? Why?

Ottonello and Winberry (2020) used the following specification,

$$\delta \log k_{jt+1} = \alpha_j + \alpha_{st} + \beta(x_{jt-1} - \mathrm{E}[x_{jt}])\epsilon^m_t + \Gamma Z_{jt-1} + e_{jt}.$$

In the above specification, k_{jt+1} is the book value of the capital stock of firm j at the end of period t, α_j is a firm j fixed effect, α_{st} is a sector s by quarter t fixed effect, ϵ^m_t is the quarterly monetary policy shock, Z_{jt-1} are firm-specific control variables.

x_{jt} is the measure of the firm's default risk. Ottonello and Winberry (2020) use a firm's leverage ratio or distance to default to measure the firm's default risk.

They include these measures x_{jt-1} as the deviation of x_{jt-1} from the average value of x_{jt} for a given firm over the sample. They use the within-firm variation of firm default risk to ensure that their results are not driven by permanent heterogeneity in responsiveness across firms.

3. Cloyne, Ferreira and Surico (2020) explored heterogeneity across housing tenure groups in the response of expenditure to a monetary policy shock. One potential concern is that the results could be driven by endogenous changes in group composition in response to a monetary policy shock. How the authors address this concern?

This concern is address in three ways. First, the authors show that the time series of the tenure shares are slow-moving while the variation in monetary policy occurs at a much higher frequency. Second, they provide formal evidence that compositional change is unlikely to

be driving their results by showing that the monetary policy shocks do not significantly affect the shares of households in each housing tenure group. Third, they show that they show that their findings are not affected by using the propensity score method.

III. Issues on credit (mis)allocation

1. What's the problem when we examine the real effect of credit supply using the following regression

$$Y_{i,t} = \alpha + \beta L_{i,t-1} + \epsilon_{i,t}.$$

where $Y_{i,t}$ denotes the performance of individual i in period t (e.g. output, employment, etc.). $L_{i,t}$ denotes the credit received by individual i in period $t-1$.

In practice, individuals that have more investment opportunities and perform better are likely to have higher credit demand. In this case, $L_{i,t-1}$ may reflect endogenous movements in credit demand, instead of credit supply. Using lagged credit supply cannot address this problem when investment opportunity shocks are persistent. This endogeneity problem is likely to bias β upward.

2. How does Cong, Gao, Ponticelli and Yang(2019) isolate exogenous components of credit supply based on loan-level data with firm-level data on manufacturing firms? What are the identification assumptions?

Cong, Gao, Ponticelli and Yang(2019) construct the firm-level credit supply measure as follows,

$$\delta\tilde{L}_{icjt} = \sum_{b \in O_i} \omega_{bi,t=0} \times \delta log L_{b-cj,t},$$

where b indexes banks, i firms, c cities, j sectors, and t time. The variable $\delta log L_{b-cj,t}$ is the change in the logarithm of the aggregate loan balance of bank b between year $t-1$ and year t to all borrowers, excluding those located in the same city as firm i and those operating in the same sector as firm i. $\omega_{bi,t=0}$ is the ratio of outstanding loans of bank b to firm i divided by total outstanding loans to firm i from all banks with which firm i has a credit relationship (the set O_i).

There are two identification assumptions. One is that bank-firm relationships are persistent over time. Second is that cross-sectional differences in aggregate lending across banks during the sample period are driven by differential bank-specific characteristics, but uncorrelated with unobserved firm-specific characteristics that affect credit demand and real outcome during the same period.

3. Chen, Gao, Higgins, Waggoner and Zha (2023) study how a fiscal expansion via infrastructure investment influences the dynamic impacts of monetary stimulus on

credit allocation. They estimate the following regression,

$$b_{i,t} = c_i + \rho b_{i,t-1} + \sum_{k=0}^{l}[b_k g^o_{t-k}\epsilon_{m,t-k} + d_k\epsilon_{m,t-k}] + c_\chi \chi^o_t + c_z z_{i,t-1} + \eta_{i,t}.$$

where $b_{i,t}$ denotes the borrowing of firm i in period t. $g^o_{i,t}$ denotes the infrastructure investment gorwth absent monetary policy shocks in period t. $\epsilon_{m,t}$ denotes monetary policy shocks. χ^o_t denotes aggregate control variables that are driven by nonmonetary aggregate factors. $z_{i,t}$ denotes firm-specific characteristics. What's the problem of using the observed infrastructure investment growth g_t as proxy for g^o_t? How will it bias the estimate of the coefficient b_k? How do the authors identify g^o_t?

There is an endogeneity problem because the fluctuation in infrastructure investment g_t is driven in part by monetary policy shocks $\epsilon_{m,t}$. Specifically, substituting g_t for g^o_t in the regression, we have,

$$b_{i,t} = c_i + \rho b_{i,t-1} + \sum_{k=0}^{l}[b_k g_{t-k}\epsilon_{m,t-k} + d_k\epsilon_{m,t-k}] + c_\chi \chi^o_t + c_z z_{i,t-1} + \tilde{\eta}_{i,t}.$$

where $\tilde{\eta}_{i,t} = \eta_{i,t} - \sum_{k=0}^{l} b_k g^m_{t-k}\epsilon_{m,t-k}$, with g^m_{t-k} denoting the fluctuation in infrastructure investment that driven by monetary policy shocks. The presence of $\sum_{k=0}^{l} b_k g^m_{t-k}\epsilon_{m,t-k}$ will bias the estimated coefficient b_k toward zero.

The authors identify g^o_t using a two-stage approach. Specifically, they first identiy exogenous monetary policy shocks ϵ_{mt} using the following equation:

$$g_{mt} = \gamma_0 + \gamma_m g_{m,t-1} + \gamma_\pi(\pi_{t-1} - \pi^*) + \gamma_{x,t}(g_{x,t-1} - g^*_{x,t-1}) + \epsilon_{mt}.$$

where g_{mt} is the M2 growth, consistent with M2 as the intermediate target of China's monetary policy. π_t is the CPI inflation, and $g_{x,t}$ is the GDP growth rate. $g^*_{x,t}$ is the GDP growth target set by the State Conucil as a lower bound for monetary policy.

They then estimate the unrestricted system of simultaneous equations

$$A_0 x_t + b_{m,0} logM_t = c + \sum_{k=1}^{l} A_k x_{t-k} + \sum_{k=1}^{l} b_{m,k} logM_{t-k} + \xi_t,$$

where x_t is a vector of GDP growth, inflation and infrastructure spending, and M_t is given by the first-stage equation.

g^o_t is then identified as the difference between actual infrastructure spending and the series of infrastructure spending driven by monetary policy shocks, which could be generated using the estimated equations with $\xi_t = 0$.

IV. Fiscal policy and corporate investment

1. Chen, Jiang, Liu, Serrato and Xu (2023) study how tax policy affects corporate investment by exploring China's 2009 VAT reform using a difference in difference design. One concern is that the stimulus in corporate investment following the VAT reform may be driven by the 2009 macroeconomic stimulus package. How do the authors address this concern?

First, the authors show that they obtain very similar effect when they excluse SOEs, firms with strong links to industries that benefited the most from the stimulus package, or public listed firms from the estimation.

Second, the authors use the fact that the tax treatment of investment in structures was not affected by the reform. They find small effects on the extensive margin and no impact on the intensive margin for investment on structures.

2. Onder, Restrepo-Tamayo, Ruiz-Sanchez, and Villamizar-Villegas (2024) investigate the impact of fiscal expansions on firm investment by exploiting firms with multiple banking relationships. What's the challenge for identification? How do the authors address this probelm?

The challenge for identification is that the banking sector optimally balances its portfolio mix between government securities and corporate lending. The authors address this problem using the fact that primary dealer banks have privileged access to participate in government bond auctions and the fact that both whether a bank is a primary dealer, and for a primary dealer bank wins the auction, are exogenous to the bank's choice. Specifically, the authors compare the lending behavior of banks that barely met and missed the criteria of being a primary dealer, as well as barely winners and losers at government auctions.