FINM 35000: Topics in Economics
Week 5: Monetary Policy and Inflation

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Lecture Overview

▶ Start with a short discussion about standard errors

▶ Last week we covered the basics of monetary policy

▶ This week we will focus on three guiding questions:

1. What is the relationship between monetary policy and asset prices?

   ▶ We are going to focus mostly on papers that use NLP to quantify this

2. What determines inflation other than monetary policy?

3. Why are inflation expectations important?

▶ This lecture will be mostly based on papers, since the answers to these questions are best illustrated with evidence

Standard Errors

OLS Overview

▶ Consider a regression with N observations and K predictors:

$$Y_i = \underbrace{X_i}_{1 \times K} \underbrace{\beta}_{K \times 1} + \varepsilon_i$$

▶ OLS estimator is:

$$\hat{\beta} = \left(\frac{1}{N} \sum_{1=1}^{N} X_i' X_i \right)^{-1} \left(\frac{1}{N} \sum_{1=1}^{N} X_i' Y_i \right)$$

▶ Standard error refers to the estimated standard deviations of the elements of $\hat{\beta}$ (or the square root of the diagonal elements of the covariance matrix of $\hat{\beta}$)

Heteroskedasticity vs. Homoskedasticity

- ▶ Homoskedasticity: $\mathrm{Var}[\varepsilon_i | X_i = x] = \sigma_\varepsilon^2 \quad \forall x$
  - ▶ In words, this means that the accuracy of the model is not dependent on the value of X
- ▶ The "default" OLS standard errors assume homoskedasticity
  - ▶ Univariate: $\hat{\sigma}^2(\hat{\beta}) = \frac{\hat{\sigma}_\varepsilon^2}{N \times \hat{\sigma}_X^2}$
- ▶ In reality, homoskedasticity likely does not hold in most cases, so we use heteroskedasticity robust standard errors:
  - ▶ Univariate: $\hat{\sigma}^2(\hat{\beta}) = \frac{1}{N} \frac{\frac{1}{N} \sum_{i=1}^{N} (X_i - \bar{X})^2 \hat{\varepsilon}_i^2}{\left[\frac{1}{N} \sum_{i=1}^{N} (X_i - \bar{X})^2\right]^2}$
- ▶ Summary: default estimator assumes errors are i.i.d., robust estimator allows for errors to not be drawn from the same distribution, but still assumes independence

Clustering

▶ Homoskedasticity and heteroskedasticity are assumptions about the diagonal elements of the covariance matrix of residuals

▶ Both estimators above assumed that errors were uncorrelated across observations (i.e. the off-diagonal elements are 0)

▶ Clustering allows us to relax this assumption by specifying groups within which the errors might be correlated

▶ In other words, instead of assuming that all off-diagonal elements of the error covariance matrix are zero, we assume that some are non-zero

  ▶ E.g. we might assume that the i, j element is non-zero if i and j are in the same industry

▶ Univariate case:

$$\hat{\sigma}^2(\hat{\beta}) = \frac{\sum_i \sum_j (X_i - \bar{X})(X_j - \bar{X})\hat{\varepsilon}_i \hat{\varepsilon}_j \mathbb{1}\{i, j \text{ in same cluster}\}}{\left[\frac{1}{N}\sum_{i=1}^{N}(X_i - \bar{X})^2\right]^2}$$

Clustering vs. Fixed Effects

▶ Recall: we use fixed effects when we are concerned that there is unobserved heterogeneity **across** groups. For example:

$$SCORE_i = \alpha + \beta CLASSSIZE_i + \varepsilon_i,$$

but what if schools with smaller classes also had higher-achieving students to begin with?

$$SCORE_i = \alpha + \beta CLASSSIZE_i + \gamma_{School(i)} + \varepsilon_i$$

▶ We use clustering when we are concerned about the errors not being i.i.d. **within** a group (in this example maybe students within a school help each other, so one high-achieving student improves the other students' scores)

    ▶ Clustering by school would address this concern

Monetary Policy and Asset Prices

Why Does Monetary Policy Affect Asset Prices?

▶ Recall our pricing equation from week 1:

$$
\begin{aligned}
p_t &= \mathbb{E}_t[m_{t+1}x_{t+1}] \\
&= \text{Cov}_t(m_{t+1}, x_{t+1}) + \mathbb{E}_t[m_{t+1}]\mathbb{E}_t[x_{t+1}] \\
&= \text{Cov}_t(m_{t+1}, x_{t+1}) + \frac{\mathbb{E}_t[x_{t+1}]}{R_f},
\end{aligned}
$$

where $m_{t+1} = \beta \frac{u'(c_{t+1})}{u'(c_t)}$

▶ Monetary policy directly influences R_f (the risk-free rate)
  ▶ Higher rates mean lower prices, all else equal
▶ Monetary policy affects x_{t+1} (cash flows) by changing the cost of financing investment
  ▶ Higher rates generally lead to lower cash flows (although there are certain industries where this is not the case)

Do Asset Prices Affect Monetary Policy?

▶ According to the Fed's dual mandate (recall from last time that this is price stability and maximum sustainable employment), asset prices should not matter for monetary policy

▶ In practice, policy makers do pay attention to asset prices. Why?

    ▶ Perhaps it is because of the concern that financial market turmoil might spill over into inflation and employment

    ▶ The Fed has also been criticized for this. For example, in 2016 when the Fed was considering rate increases, former Fed governor Kevin Warsh said,: "They look to me asset price dependent, more than they look data dependent. When the stock market falls like it did in the beginning of this year, they say: 'Oh, we'd better not do anything."'

What is the "Fed Put"?

▶ Some people believe that when markets (specifically US equity markets) drop, the Fed will step in by cutting rates (or increasing QE) in order to stabilize them

▶ Note: this is not a stated policy of the Fed!

▶ Why is it called the "Fed Put"? Because the fact that this occurs acts as insurance against very bad equity market outcomes, in a similar manner to holding put options

▶ When has the Fed appeared to be stepping in to stabilize equity markets? Two examples:

  ▶ Black Monday crash of autumn 1987: the Dow Jones fell by 508 points (22.6%) due to hostilities in the Persian Gulf, fear of higher interest rates, and the introduction of electronic/program trading. The Fed intervened by affirming its readiness to serve as a source of liquidity to support the economic and financial system

  ▶ The Fed attempted to scale back its accommodative policies in 2010, which caused a market decline. Subsequently, the Fed introduced QE2.

Empirical Papers Related to Monetary Policy and Asset Prices

Cieslak and Vissing-Jorgensen (2021): Overview

- Observation: "Since the mid-1990s, negative stock returns comove with downgrades to the Fed's growth expectations and predict policy accommodation"
- Question 1: is there evidence that policy makers pay attention to the stock market?
  - They find evidence that the Fed does pay attention to the stock market by analyzing the text of FOMC documents
- Question 2: is this consistent with the Fed's mandate?
  - They find that the Fed does not react to stock market fluctuations beyond the effect they have on growth

Cieslak and Vissing-Jorgensen (2021): Motivating Facts

- ▶ Fact 1: Low stock returns predict policy accommodation
  - ▶ From 1994-2008, a 10% stock market decline predicts a reduction in the Fed Funds rate target of 32bps at the next meeting and 127bps after a year (but there is no opposite effect for positive returns)
- ▶ Fact 2: Updates to the Fed's growth expectations comove asymmetrically with stock returns
  - ▶ From 1994-2012, a 10% lower intermeeting stock return is associated with a reduction of the total expected growth rate (from the Greenbook) over the next four quarters of slightly below 1 percentage point for real GDP growth and with an increase of 0.47 percentage points in the expected unemployment rate three quarters out
- ▶ Fact 3: Fed policy reacts to growth expectations downgrades
  - ▶ Most of the explanatory power of the stock market for target changes can be rationalized by its correlation with the Greenbook growth update

Cieslak and Vissing-Jorgensen (2021): Why is Text Data Useful?

- The purpose of using text data is to distinguish between two possible interpretations of the facts above:
  - Interpretation 1: the Fed views the stock market as uninformative, but it is correlated with variables that drive the Fed's decision making (which explains the high explanatory power)
  - Interpretation 2: the Fed perceives stock returns as informative (either because they are a driver of the economy or a predictor of macro variables such as growth)
- The authors use the text of Fed minutes and transcripts to test whether the Fed pays attention to the stock market, which enables them to distinguish between the two interpretations

Cieslak and Vissing-Jorgensen (2021): Attention to the Stock Market

▶ Using the text of the minutes and the transcripts, the authors count the occurrence of stock market-related phrases (e.g. equity price, stock market, s&p 500 index)

▶ They manually read the paragraphs containing these mentions to classify the tone (positive, negative, neutral or unclear)

▶ They find that negative returns predict more negative stock market mentions and that negative stock market mentions predict Fed Funds rate changes

▶ They also categorize whether stock market mentions are: consistent with stock markets having a causal effect on output (38%), consistent with stock markets reflecting economic conditions (8%), (3) describing other determinants of stock valuation (11%) and (4) descriptive (38%)

Cieslak and Vissing-Jorgensen (2021): Is the Fed Reacting Too Strongly to the Stock Market?

▶ Look at whether the Fed's growth and inflation expectations update more with the stock market than the expectations of price sector forecasters or more than what the predictability of the stock market for realized output growth and inflation would suggest

▶ The Survey of Professional Forecasters' sensitivity to the stock market is about the same as the Fed's

▶ The actual relationship between stock returns and future growth is similar to the relationship between stock returns and Fed growth expectations, indicating that the Fed is not overreacting

Ai et al. (2022): Overview

► Research question: what is the monetary policy risk premium (i.e. the compensation investors require to hold assets exposed to monetary policy risk)?

► This is a statement about the cross-section, whereas much evidence about the effect of monetary policy on asset prices looks at more aggregated assets like the S&P 500 or the VIX

► This paper develops a novel measure of monetary policy exposure using option prices

Ai et al. (2022): Measuring Firm-Level Exposure to Monetary Policy Announcements I

▶ Key observation: FOMC announcements reduce uncertainty about monetary policy and the macroeconomy, which should lead to reductions in option-implied variance. This effect should be stronger for firms that are more sensitive to monetary policy announcement surprises

▶ Step 1: establish that option-implied variance actually does decrease on FOMC announcement days

Table 1

Implied variance around FOMC announcement days. This table reports the implied variance changes from one day before FOMC announcement to FOMC announcement days. In Panel A, we report changes in VIX^2 (monthly percentage squared units) around FOMC announcement days and their time-series statistics when testing whether the change is significantly different from zero. In Panel B, we report the cross-sectional average of changes in the firm-level option-implied variance (monthly percentage squared units) around FOMC announcement days and their time-series statistics. The firm-level implied variance uses the seven-day maturity variance. Our full sample period is from January 1996 to December 2017 with 176 FOMC announcement days. This period contains 6652 common stocks with traded options. Among these 6652 firms in our sample, 5446 firms have at least one observed option-implied variance on these 176 FOMC announcement days.

	VIX^2_{t-1}	VIX^2_t	$VIX^2_{t-1} - VIX^2_t$
Panel A: VIX^2			
Mean	41.940	39.526	2.414
t-stats			(3.39)
Panel B: Average firm-level implied variance			
	IV_{t-1}	IV_t	$IV_{t-1} - IV_t$
Mean	281.165	276.210	4.954
t-stats			(4.58)

Ai et al. (2022): Measuring Firm-Level Exposure to Monetary Policy Announcements II

▶ Step 2: check that the magnitude of the implied variance reduction varies across firms
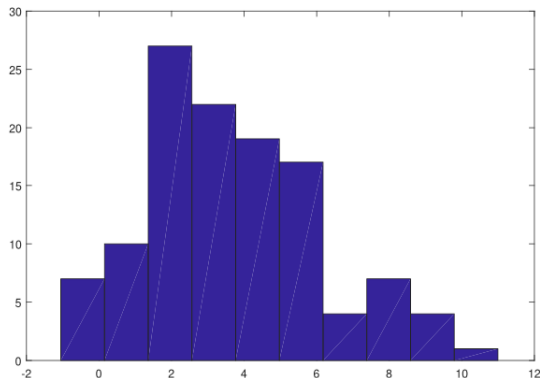

Fig. 1. Heterogeneous firm-level implied variance reduction around FOMC days. This figure plots the histogram of the time-series mean of the firm-level logarithm implied variance reduction (in %) around FOMC announcement days. For illustration purposes, we only report those firms with 160 or more observations out of the 176 FOMC announcement days in our data sample.

Ai et al. (2022): Measuring Firm-Level Exposure to Monetary Policy Announcements III

- ▶ Problem: the drop in implied variance is only available after the meeting
- ▶ Solution: construct expected implied variance, which is the difference between implied variance prior to the FOMC announcement and the median of the firm's historical implied volatility
- ▶ The expected variance reduction is given by:

$$EVR = IV_{t-2} - \textit{Median of Historical IV}$$

- ▶ They find that EVR strongly predicts actual implied variance reduction on FOMC days

Ai et al. (2022): Performance of Portfolios Based on EVR

Table 2

Portfolios sorted on expected sensitivity. We conduct a tradable strategy two days before the FOMC announcement days. We measure firm-level sensitivity to monetary policy announcements by the expected implied variance reduction (EVR) around FOMC announcements, which is the difference between the implied variance two days before the announcement (normalized to day 0) and the median value of the implied variance during day -8 and day -15. We demean EVR, sort firms based on this measure into decile portfolios with the third portfolio containing 60% of all firms and each of the remaining four portfolios containing 10%, and document the value-weighted portfolio returns. These portfolios are rebalanced two days before the next FOMC announcement day. Panel A reports the average value-weighted portfolio EVR (demeaned, monthly percentage squared units), the time-series average and Newey-West t-statistics with 12 lags of portfolio returns, and alphas from Fama-French three-factor and five-factor models (bps) on FOMC announcement days and non-FOMC announcement days. Panel B reports the daily regression results of Eq. (3), which include the coefficients of market excess return (i.e., CAPM beta), the interaction of market excess return and the FOMC dummy, the non-FOMC dummy, and the FOMC dummy, as well as the Newey-West t-statistics.

	1	2	$3-8$	9	10	$(10-1)$
Panel A: Average returns						
EVR	-192.76	-55.14	-0.63	51.83	206.37	
FOMC Return	35.95	28.56	29.01	47.04	67.35	31.40
	(1.92)	(2.35)	(3.33)	(3.45)	(3.06)	(2.67)
FF3 α	-12.49	-7.85	-0.44	9.73	15.98	28.48
	(-1.57)	(-1.98)	(-0.26)	(2.22)	(2.04)	(2.83)
FF5 α	-13.88	-8.46	0.19	9.24	13.46	27.33
	(-2.17)	(-2.24)	(0.16)	(2.20)	(1.96)	(2.76)
Non-FOMC Return	3.48	3.36	3.60	4.30	3.29	-0.19
	(1.44)	(1.73)	(2.65)	(2.36)	(1.34)	(-0.15)
Panel B: CAPM						
	1	2	$3-8$	9	10	$(10-1)$
$R^M - r_f$	1.40	1.15	0.92	1.22	1.44	0.03
$(R^M - r_f) \times$ FOMC Dummy	0.08	-0.03	-0.02	-0.07	0.14	0.05
	(0.70)	(-0.51)	(-1.05)	(-1.39)	(1.02)	(0.25)
Non-FOMC Dummy	-0.70	-0.22	0.56	0.55	-0.97	-0.27
	(-0.60)	(-0.25)	(1.96)	(0.74)	(-0.81)	(-0.20)
FOMC Dummy	-12.43	-8.08	-0.64	9.38	16.23	28.66
	(-1.73)	(-1.64)	(-0.40)	(2.06)	(2.03)	(3.14)

Handlan (2020): Overview

- ▶ Research question: how does the wording of FOMC statements impact Fed Funds futures prices?

- ▶ The methodology is careful to isolate the forward guidance component of the FOMC statement as opposed to the economic assessment component

- ▶ Finding 1: the wording of FOMC statements accounts for more much more variation in Fed Funds futures (FFF) prices than the actual target rate changes that were announced

- ▶ Finding 2: the impact of forward guidance on real interest rates is twice as large when using text shocks over other measures, like changes in FFF prices

- ▶ Finding 3: the text shock produces responses in output and inflation consistent with macroeconomic models, whereas changes in FFF prices do not

Handlan (2020): NLP Methodology I

▶ Key observation: using dictionary methods, the phrases "inflation went up, but employment did not" and "employment went up, but inflation did not" might be scored the same, but they have opposite meaning and the phrase "economic growth slowed, but is likely to expand at a rapid pace" might be scored as negative because of the inclusion of the bigram "growth slowed"

▶ This points to the need for a methodology that flexibly accounts for context

▶ This paper uses XLNet, which is a neural network that can be used for applications such as translation, classification and regression
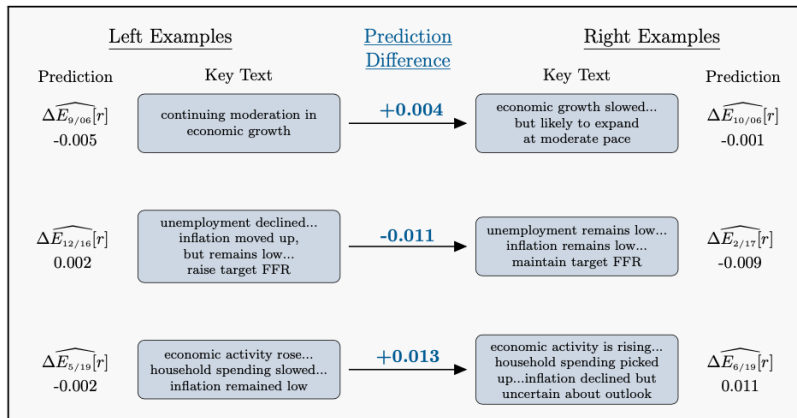
Handlan (2020): NLP Methodology II

- ▶ Basic idea of XLNet:
  - ▶ Create a 768x1 vector for each token based on co-occurrence of tokens in the corpus using a clustering algorithm. In the end, similar tokens will have similarly oriented vectors in 768-dimensional space.[1]
  - ▶ These vectors do not account for context (for example "bank" would be represented by the same vector whether it referred to a financial institution or the side of a river). XLNet modifies the vectors by considering the surrounding words.
- ▶ Using a training sample, the author uses the text of the FOMC statement to predict changes in FFF
- ▶ Finds that the out-of-sample prediction accuracy is higher when using this model than when using the actual changes in the Fed Funds Rate

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[1]Token just means a simplified version of a word. For example, "decreased" and "decreasing" would have the same token

Handlan (2020): NLP Methodology III

Figure 4: Neural Network Prediction for Different FOMC Statements

	Left Examples		Prediction Difference		Right Examples	
Prediction	Key Text				Key Text	Prediction
$\Delta \widehat{E_{9/06}}[r]$ -0.005	continuing moderation in economic growth		**+0.004** →		economic growth slowed... but likely to expand at moderate pace	$\Delta \widehat{E_{10/06}}[r]$ -0.001
$\Delta \widehat{E_{12/16}}[r]$ 0.002	unemployment declined... inflation moved up, but remains low... raise target FFR		**-0.011**		unemployment remains low... inflation remains low... maintain target FFR	$\Delta \widehat{E_{2/17}}[r]$ -0.009
$\Delta \widehat{E_{5/19}}[r]$ -0.002	economic activity rose... household spending slowed... inflation remained low		**+0.013** →		economic activity is rising... household spending picked up...inflation declined but uncertain about outlook	$\Delta \widehat{E_{6/19}}[r]$ 0.011

Handlan (2020): Constructing Text Shocks I

▶ Problem: the FOMC statement contains information about the Fed's view of the economy as well as the announced policy (including forward guidance), so it is not clear which component changes in FFF are responding to

▶ Solution: use the text of alternative FOMC statements

▶ What are alternative statements? Prior to the meeting, Fed staff prepare a set of possible statements. These are released to the public with a five year lag. See page 22 of https://www.federalreserve.gov/monetarypolicy/files/FOMC20140129tealbookb20140123.pdf for an example.

▶ Key insight: the alternative statements are prepared using the same set of economic information, so the only difference between them comes from the policy announcements

Handlan (2020): Constructing Text Shocks II

▶ The text shock is the difference between the predicted FFR expectations from the statement that was released and the average prediction from the alternative statements:

$$\text{Cleaned Text Shock}_t = \widehat{\mathbb{E}_t[r]}_{released} - \frac{1}{|Alts_t|} \sum_{i \in Alts_t} \widehat{\mathbb{E}_t[r]}_i$$

▶ The effect of the cleaned text shock on FFF changes gets larger as the horizon increases, indicating that the text shock is doing a good job of picking up forward guidance

Table 3: Forward Guidance and the Cleaned Text Shock

	$\Delta E_t[r_t]$	$\Delta E_t[r_{t+1}]$	$\Delta E_t[r_{t+2}]$	$\Delta E_t[r_{t+3}]$
Intercept	-0.01*	-0.00	-0.00	-0.01
	(0.00)	(0.00)	(0.00)	(0.01)
Cleaned Text Shock$_t$	1.88***	1.99***	2.20***	2.16***
	(0.31)	(0.33)	(0.33)	(0.38)
N	80	80	80	43
R^2	0.32	0.31	0.36	0.44
Adj. R^2	0.32	0.30	0.35	0.42

Some Other Fed NLP Papers

1. Hansen and McMahon (2016) uses LDA combined with a dictionary method
2. Doh et al. (2022) employs an approach similar to that in Handlan (2020)
3. Calomiris et al. (2022) uses a supervised learning method called support vector regression to estimate the level of market variables implied by the text of Fed communications
4. Smales and Apergis (2017) measures complexity of FOMC statements (readability and number of words)

Inflation

Background: Defining Inflation

- CPI, which is the most commonly discussed measure of inflation, uses price data for hundreds of goods and services, collected from around 8,000 households and 23,000 retailers in 75 urban areas. It also includes rents gathered from around 50,000 landlords and tenants ↪ CPI Components

- Note on housing: house prices don't directly enter CPI, but instead, "owner's equivalent rent of primary residence" does. This is intended to separate the value of the shelter the house provides from the value the house has as an investment

- Because food and energy prices are very volatile, we often focus on core inflation, which excludes both these components

CPI vs. PCE: Measurement Differences

▶ Four main differences:

1. Formula: CPI uses a Laspeyres formula, PCE uses a Fisher-Ideal formula (more on this on the next slide)
2. Weight: weights for CPI are based on the Consumer Expenditure Survey, weights for PCE are derived from business surveys
3. Scope: CPI measures change in out-of-pocket expenditures for urban households, PCE measures change in goods and services consumed by all households, as well as non-profits serving households
4. Other: different seasonal adjustment, different price data, etc.

Laspeyres (CPI) vs. Fisher-Ideal (PCE)

- Laspeyres:
    - $P^L = \sum_{g \in \text{Goods}} \frac{Q_{g,base} * P_{g,curr}}{Q_{g,base} * P_{g,base}}$
    - Biased toward overstating inflation because does not account for possibility that consumers substitute away from goods whose prices rise
- Paasche:
    - $P^P = \sum_{g \in \text{Goods}} \frac{Q_{g,curr} * P_{g,curr}}{Q_{g,curr} * P_{g,base}}$
    - Biased toward understating inflation
- Fisher-Ideal:
    - $P^F = \sqrt{P^L * P^P}$
    - Geometric average because:
        - a. Satisfies time reversal test (switch base year and current year and get same result)
        - b. Satisfies factor reversal test (switch prices and quantities and get same result)

CPI vs. PCE: Quantifying Measurement Differences

Drivers of the Difference Between Headline PCE and CPI Inflation
Percentage points monthly rate
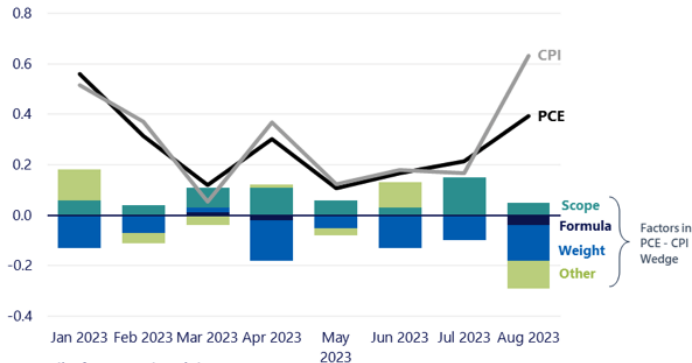
Council of Economic Advisers
Source: Bureau of Economic Analysis.
As of September 29, 2023 at 8:30am.

CPI vs. PCE: Time Series

Headline CPI and PCE Inflation Since 2000

Year-on-year percent

CPI

PCE

Council of Economic Advisers

Source: Bureau of Economic Analysis; CEA calculations.

As of September 29, 2023 at 8:30am.

What Drives Inflation Other Than Monetary Policy?

- ▶ The macro term "inflation" is made up of the prices of individual goods and services. In economics, what drives prices? Supply and demand.

- ▶ To put it very simply, prices will go up when demand exceeds supply

- ▶ Monetary policy is a specific force that affects demand (low interest rates make it cheaper to borrow, which increases demand), but there are many other forces that can effect supply and demand and therefore inflation. Examples:
    1. Supply side constraints (including supply chain issues driven by geopolitical factors)
    2. Intentional restriction of supply by monopolies or cartels (such as OPEC)
    3. Fiscal policy (taxes, stimulus checks, etc.)

- ▶ We will look at papers that illustrate each of these examples

The Importance of Inflation Expectations

▶ Expectations of high inflation can be self fulfilling. How?
  ▶ Some prices (as well as salaries) are adjusted only infrequently, so producers will set their prices based on their expectations of how their input prices will change until they next adjust their prices
  ▶ In theory, if individuals believe prices will go up in the future, they might purchase durable goods now, leading to an increase in prices of those goods (I haven't found good empirical evidence of this)

▶ Linking inflation back to monetary policy, the Fed's inflation target can help "anchor" inflation expectations

Santacreu and LaBelle (2022): Overview

Supply Side Constraints

- ▶ Research question: what is the effect of supply chain disruptions on inflation during the COVID-19 pandemic?
- ▶ Identification challenge: it is difficult to estimate the causal impact of these disruptions in time series data because of omitted variables
- ▶ Solution: use cross-industry variation in sourcing patterns across countries
- ▶ Finding: exposure to global supply chain disruptions played a significant role in US cross-industry PPI inflation

Santacreu and LaBelle (2022): Measuring Supply Constraints

Supply Side Constraints

▶ Two ways to measure supply disruptions: backlogs (new orders that have not yet been completed) and delivery times (how long does it take for a manufacturer to receive inputs from suppliers)
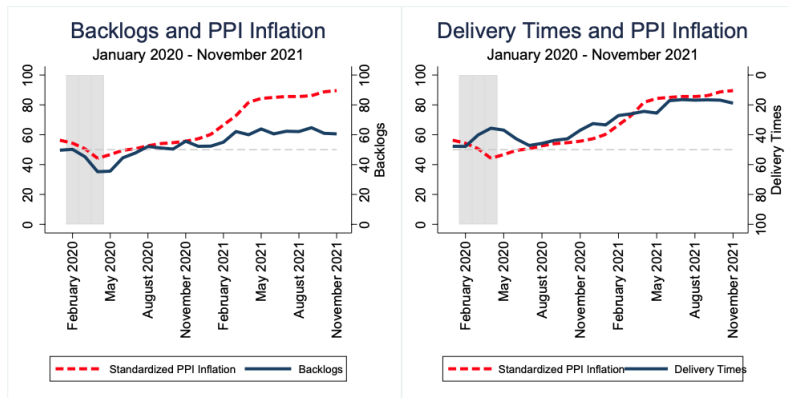
Figure 3: Delivery Times and Backlogs over time
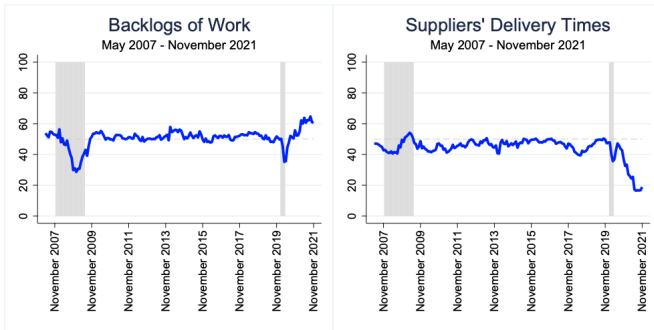
Santacreu and LaBelle (2022): Supply Constraints and Inflation
Supply Side Constraints

Figure 4: Backlogs, Delivery Times and PPI Inflation

Source: IHS Markit, BLS and author calculations

Santacreu and LaBelle (2022): Measuring Exposure to Supply Constraints I
Supply Side Constraints

- For each industry in the US, compute a measure of global value chain (GVC) participation as the share of gross exports that has been produced with foreign value added in 2018. In other words, how much of this industry's exports rely on intermediate imports from other countries?

- The first variable of interest is industry i's exposure to foreign bottlenecks at time t:

$$E_{it}^f = \sum_{j=1}^{N} \frac{\text{FVA}_i^j}{\text{GE}_i} B_t^j,$$

where $\frac{\text{FVA}_i^j}{\text{GE}_i}$ is the share of gross exports from industry i that are composed of value added from country j and B_t^j are the supply chain bottlenecks in country j
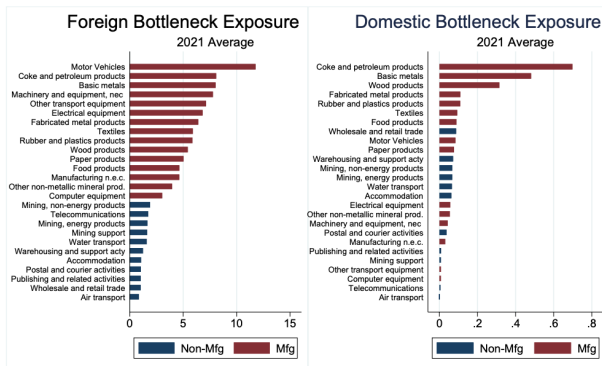
Santacreu and LaBelle (2022): Measuring Exposure to Supply Constraints II

Supply Side Constraints

▶ The second variable of interest is the exposure to domestic bottlenecks:

$$E_{it}^d = \frac{\text{DVA}_i^{US}}{\text{GE}_i} B_t$$

Figure 6: Foreign and Domestic Exposure

Santacreu and LaBelle (2022): Empirical Strategy

Supply Side Constraints

▶ Question: does domestic and foreign exposure to supply chain disruptions contribute to US PPI inflation?

$$\pi_{it}^{PPI} = \alpha_0 + \alpha_1 E_{it}^f + \alpha_2 E_{it}^d + I_i + u_{it},$$

where π_{it}^{PPI} represents the year-over-year PPI increase in industry i at time t and I_i captures industry fixed effects

▶ Reminder that the industry fixed effects mean that they are looking at the effect within an industry over time

Santacreu and LaBelle (2022): Results

Supply Side Constraints

Table 1: Exposure to Supply Chain Disruptions and PPI Inflation: Backlogs vs Delivery Times (January-November 2021)

	Backlogs	Delivery time (inverse)
Domestic exposure	0.00569	0.00314
	(0.00364)	(0.00269)
Foreign exposure	0.239***	0.255***
	(0.0711)	(0.0703)
Cons	-0.598***	2.272***
	(0.115)	(0.565)
Industry FE	YES	YES
N	286	165
R^2	0.752	0.756

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Känzig (2021): Overview

Intentional Restriction of Supply

- ▶ Research question: how do oil supply shocks affect oil prices and macroeconomic variables?
- ▶ Negative oil supply shock has consequences for both oil markets and the US macroeconomy:
    1. Immediate increase in oil prices, a gradual fall in oil production, and an increase in inventories
    2. Lower economic activity, higher prices and inflation expectations, and a stronger dollar

Känzig (2021): Background on OPEC
Intentional Restriction of Supply

- OPEC accounts for about 44% of global oil production, meaning that its announcements can have a significant effect on prices
- OPEC claims to exist in order to "stabilize global oil markets to secure an efficient, economic, and regular supply of petroleum to consumers, a steady income to producers, and a fair return on capital for those investing in the petroleum industry", but others claim it is a cartel that serves to reduce competition and raise profits
- The OPEC conference meets several times a year to set production policy (notably a production ceiling for the organization and quotas for each of its members)

Känzig (2021): OPEC Announcement Example

Intentional Restriction of Supply

Having reviewed the oil market outlook, including the overall demand/ supply expectations for the year 2007, in particular the first and second quarters, as well as the outlook for the oil market in the medium term, the Conference observed that market fundamentals clearly indicate that there is more than ample crude supply, high stock levels and increasing spare capacity. (…)

In view of the above, the Conference decided to reduce OPEC production by a further 500,000 b/d, with effect from 1 February 2007, in order to balance supply and demand.

Känzig (2021): Measuring Oil Supply Surprises
Intentional Restriction of Supply

▶ Cannot consider the production ceiling decisions as shocks because they are correlated with global economic conditions

▶ Instead, use high frequency price movements in oil futures around the announcement. This eliminates the above concern because any relevant global economic conditions were known prior to the announcement, so should already be reflected in prices

▶ Key assumption: the announcements do not contain any new information about oil demand, global economic activity or geopolitical developments (this is justified by looking at how these announcements are covered by the media and the author specifically controls for it as a robustness check)

Känzig (2021): Oil Supply Surprises Over Time
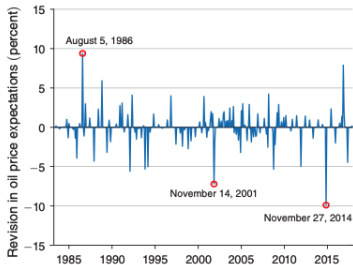Intentional Restriction of Supply

FIGURE 1. THE OIL SUPPLY SURPRISE SERIES

- ▶ August 5, 1986: OPEC agreed on new production quotas after years of disagreement and lack of compliance
- ▶ November 14, 2001: OPEC pledged to cut production but only if other oil producers cut their production as well
- ▶ November 27, 2014: OPEC announced that it was leaving oil production levels unchanged when markets expected them to lower it

Känzig (2021): Empirical Strategy
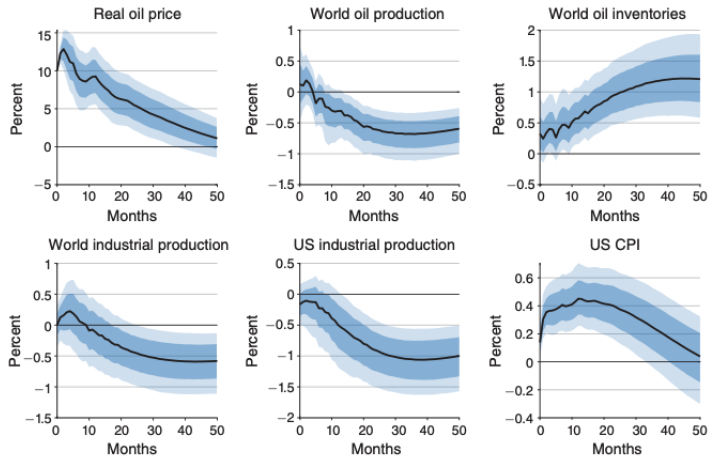Intentional Restriction of Supply

▶ Consider the following VAR(p) model:

$$\boldsymbol{y}_t = \boldsymbol{b} + \boldsymbol{B}_1 \boldsymbol{y}_{t-1} + ... + \boldsymbol{B}_p \boldsymbol{y}_{t-p} + \boldsymbol{u}_t,$$

where $\boldsymbol{y}_t$ is a vector containing the price of oil, world oil production, world oil inventories, world industrial production, US industrial production and US CPI

▶ The oil surprise series is used as an external instrument, which must be correlated with the shock of interest (oil supply news), but not with other shocks

Känzig (2021): Impulse Responses

Intentional Restriction of Supply

First-stage regression: F: 22.67, robust F: 10.55, R^2: 4.22%, Adjusted R^2: 4.04%

FIGURE 3. IMPULSE RESPONSES TO AN OIL SUPPLY NEWS SHOCK

Känzig (2021): Impulse Responses for Inflation Components
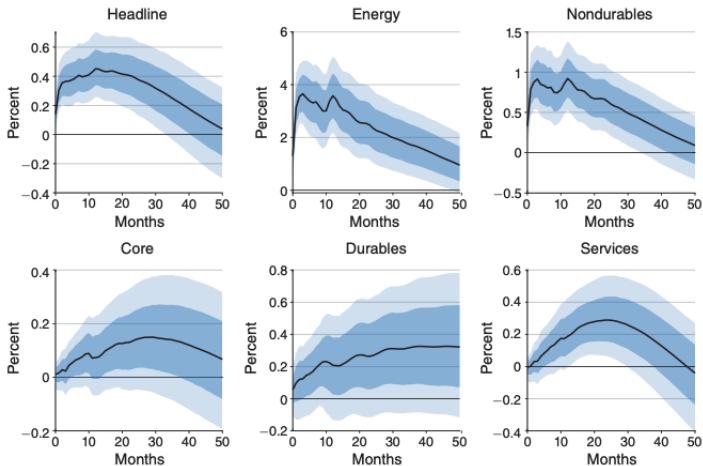
Intentional Restriction of Supply

FIGURE 8. CONSUMER PRICES

Coibion et al. (2021): Overview
Fiscal Policy

▶ Research question: are household inflation expectations sensitive to fiscal considerations?

▶ This paper conducts a randomized control trial on U.S. households to address this question by providing randomly chosen subsets of households with information treatments about the fiscal outlook and then observing how they revise their expectations about future inflation as well as taxes and government spending

▶ They find that information about the current debt or deficit levels has little impact on inflation expectations but that news about future debt leads them to anticipate higher inflation, both in the short run and long run

Coibion et al. (2021): Survey Design

Fiscal Policy

- ▶ December 2018 survey of households with 32,669 responses from 29,348 unique households (out of a sample of 92,390)

- ▶ The survey contained questions about demographics (including political leaning, employment status, past spending behavior), about perceptions and expectations of inflation and about how long it would take to pay down the national debt if all income was used for debt payments

- ▶ Participants were assigned at random to either the control group or one of six treatment groups, which the authors chose to test for different ways in which fiscal policy might affect subjective expectations

- ▶ After treatment, respondents were again asked about their inflation forecasts in 12 months as well as cumulatively over the next 10 years, as well as expected percentage change in several fiscal indicators over the next 10 years

Coibion et al. (2021): Treatment Groups
Fiscal Policy

1. The Federal deficit for the fiscal year 2018 was $779 billion or 3.9 percent relative to the level of income as reported by the Treasury

2. The level of Federal debt in 2018 was 21.2 trillion dollars or 103.4 percent of current income as reported by the Treasury

3. The interest rate on U.S. government debt in 2018 was 2.3 percent as reported by the Congressional Budget Office

4. The budget balance of the U.S. Federal government is projected to deteriorate so that the national debt will increase by more than 10 trillion dollars by 2028 as reported by the Congressional Budget Office

5. Prices in the U.S. economy will increase by a little over 2.0 percent per year on average over the next 10 years so that the level of prices in 2028 will increase by a little over 20 percent relative to the current level as projected by the Congressional Budget Office

6. The total debt of the U.S. Federal Government in 10 years will be more than 30 trillion, or 107 percent of the projected level of income as projected by the Congressional Budget Office

Coibion et al. (2021): Empirical Strategy
Fiscal Policy

▶ To quantify how information treatments affect inflation expectations, the authors regress posterior (after treatment) inflation expectations on prior beliefs, allowing the coefficients to vary across treatment groups:
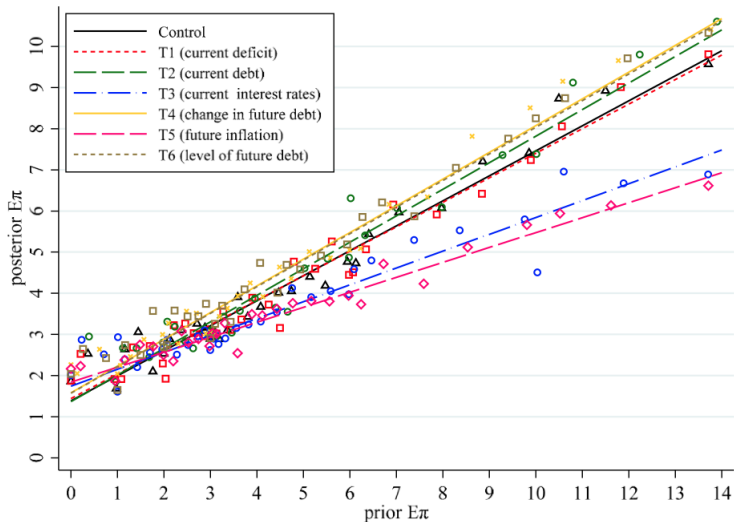
$$E_j^{post}[\pi] = const + \alpha E_j^{pre}[\pi] + \sum_{k=1}^{6} \beta_k T_j^{(k)} + \sum_{k=1}^{6} \gamma_k T_j^{(k)} \times E_j^{pre}[\pi] + \varepsilon_j,$$

where j indexes respondents, $E_j[\pi]$ is a measure of inflation expectations, $T_j^{(k)}$ is an indicator variable equal to one if individual j is provided with treatment k

Coibion et al. (2021): Results

Fiscal Policy

Figure 6. Treatment effects on short-run inflation expectations.

Coibion et al. (2021): Results Explained
Fiscal Policy

- ▶ The inflation treatment (T5) leads to large revisions toward the provided signal (2%). The interest rate signal (T3) has a similar effect

- ▶ The current deficit and government debt treatments (T1 and T2) are statistically indistinguishable from the control group

- ▶ The projected government debt treatments (T4 and T6) lead to an upward shift in expectations

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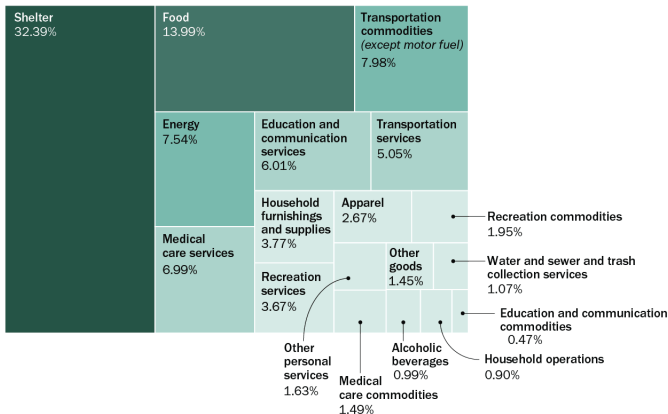
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Appendix

Components of CPI

What goes into the consumer price index?

Relative importance of different expenditure categories, November 2021

Shelter
32.39%

Food
13.99%

Transportation commodities
(except motor fuel)
7.98%

Energy
7.54%

Education and communication services
6.01%

Transportation services
5.05%

Household furnishings and supplies
3.77%

Apparel
2.67%

Recreation commodities
1.95%

Medical care services
6.99%

Other goods
1.45%

Water and sewer and trash collection services
1.07%

Recreation services
3.67%

Education and communication commodities
0.47%

Household operations
0.90%

Other personal services
1.63%

Medical care commodities
1.49%

Alcoholic beverages
0.99%

Source: U.S. Bureau of Labor Statistics

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Source: https://www.pewresearch.org/fact-tank/2022/01/24/
as-inflation-soars-a-look-at-whats-inside-the-consumer-price-index/