Debt-Inflation Channel: German Hyperinflation 1919-23

Emil Verner with Sergio Correia, Stephan Luck, Tom Zimmermann & M

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Hyperinflations are the laboratory of monetary economics

- Sargent (1983)
  “The Ends of Four Big Inflations”
  - Fiscal-monetary interaction
  - Political credibility is key to stop (1923)
    - Rational Expectation

- Dornbusch (1985)
  - FX focus
1. Did people anticipate (hyper)inflation in Germany 1919-23?
   a. No, they were surprised every time inflation increased.
   b. Partly. Not at first but people learned.
   c. Yes. Inflation widely anticipated from the beginning.

2. What is the main fundamental cause of inflation?
   a. High money growth  
   b. Fiscal deficit  
   c. Fiscal deficits  
   d. Exchange rate depreciation  
   e. Other shocks (e.g., war)

3. What are the main expansionary channels of inflation?
   a. Real wage declines  
   b. Redistribution to debtors

4. What are the main contractionary channels of inflation?
   a. Resource misallocation/price dispersion  
   b. Financial instability/credit crunch  
   c. Increased uncertainty  
   d. Other

5. What is the best asset to hedge against high inflation?
   a. Stocks  
   b. Bonds  
   c. Commodities  
   d. Real Estate
The Debt-Inflation Channel of the German Hyperinflation

Markus Brunnermeier (Princeton)
Sergio Correia (Fed Board)
Stephan Luck (NY Fed)
Emil Verner (MIT Sloan)
Tom Zimmermann (Uni. Cologne)

Markus’ Academy – Princeton University
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The views expressed here do not necessarily represent those of the Federal Reserve Bank of New York or the Federal Reserve Board.
Motivation

- How does inflation transmit to the real economy?

- What is the role of a debt-inflation channel through firm financing frictions?
  - Inflation $\rightarrow$ wealth redistribution to net nominal debtors
    $\rightarrow$ real effects by relaxing financing constraints
    Keynes (1923), Fisher (1933)

- How important is this financial channel relative to the New Keynesian channel through price/wage rigidity?

- This paper: Use the German inflation of 1919-1923 to study how a “big” inflation transmits to the real economy through the debt-inflation channel
The German Inflation, 1919-1923

“Hyperinflations are the laboratory of monetary economics.” – Dornbusch (1985)

• Canonical event in monetary history
  • Depreciation: 4.2 marks/dollar → 4.2 trillion/dollar
  • Studied by generations to understand the fundamental causes of inflation + macroeconomic and distributional effects

• Features of the empirical setting:
  1. Inflation was unanticipated
  2. Massive inflation puts debt-inflation channel into sharp relief
  3. Newly digitized micro data → disentangle mechanisms
Key Findings

1. Debt-inflation channel: aggregate evidence
   - Inflation led to a large **fall in leverage** (50%) and interest expense share (60%)
   - Large **decline in bankruptcies** (70%)
Key Findings

1. Debt-inflation channel: aggregate evidence
   • Inflation led to a large fall in leverage (50%) and interest expense share (60%)
   • Large decline in bankruptcies (70%)

2. Debt-inflation channel: firm-level evidence
   • Redistributed: High-leverage firms see relative increase in book and market equity values, along with fall in interest expenses
   • Real effects: High leverage firms boost employment
Key Findings

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2. Debt-inflation channel: firm-level evidence
   - **Redistribution**: High-leverage firms see relative increase in book and market equity values, along with fall in interest expenses
   - **Real effects**: High leverage firms boost employment

3. Nominal rigidities channel
   - **Frequency of wage and price adjustment increasing** with inflation
   - Debt-inflation channel is active even with flexible prices
Conceptual Framework
Conceptual Framework

• How does inflation from money-financed spending transmit to real activity?
  • Model with nominal debt, default, firm financing constraint, and wage rigidity (menu cost)

1. Unexpected inflation
   - Decline in bankruptcies

2. Debt-inflation channel
   - Relaxing financing constraint
   - Increase in output

3. Nominal rigidity channel
   - Low inflation: boost output, reduce real wage
   - High inflation: wages become flexible, and inflation only affects through the financial channel
Conceptual Framework

• How does inflation from money-financed spending transmit to real activity?
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1. **Unexpected inflation** $\rightarrow$ decline in bankruptcies

2. **Debt-inflation channel:** Relaxing financing constraint $\rightarrow$ increase in output
  • Especially for firms with long-term debt
    (Kiyotaki and Moore 1997, Cordoba and Ripoll 2004, Gomes, Jermann, and Schmid 2016)

3. **Nominal rigidity channel:**
   • **Low inflation:** boosts output by reducing real wage
   • **High inflation:** wages become flexible, and inflation only has real effects through the financial channel
Historical Background
Background on Weimar Germany’s Inflation

• Roots of inflation: WWI
  • Gold standard abandoned in August 1914
  • Deficit financed war spending

• Two phases of the post-war inflation (1919-1923):
  1. High inflation: WWI Armistice to June 1922
  2. Hyperinflation: July 1922 to November 1923
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• Key factors:
  • Fiscal: Reparations, large deficits; “Tanzi effect”
  • Political economy: Lack of political will to raise taxes and cut spending
  • Monetary: Reichsbank accommodated spending by discounting government securities
  • Balance of payments: FX depreciation fueled inflation (departure from PPP)
Inflation Expectations

• Average inflation during 1870-1914: 0.7%

• Before June 1922: Expectations of mark appreciation (Kindleberger 1985)
  • Speculation on the mark
  • Bank credit available

• After June 1922: Expectations of mark depreciation
  • Flight from the mark
  • Credit supply dries up
Booming Economy until the End of 1922

- Strong growth and low unemployment until the end of 1922
  - Germany avoids 1920-21 “Depression”

- Contraction in 1923: Ruhr crisis, hyperinflation, and stabilization
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“That business in Germany was booming during most of the inflation period is a universally admitted fact.”

– Graham (1930)
Data
Newly Digitized Firm-Level Data

- **Saling’s Boersenjahrbuch:**
  - Balance sheets + income statements
  - ≈ 700 firms per year
  - Bond data

- **Challenge:** Inflation distorts accounting, especially in 1923

- **Solutions:**
  - Revalued “goldmark” balance sheets (legally required by January 1, 1924)
  - Employment (≈ 300 firms)
  - Stock prices from *Berliner Börsen Zeitung*
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Stock price data validation (nonfinancials and bank stocks)
Aggregate Evidence on the Debt-Inflation Channel
Fall in Firms’ Leverage and Interest Expenses

...But Salaries Remain a Constant Share of Total Expenses

(a) Fall in leverage from 1919 to 1924

(b) Interest and salaries as share of total expenses
Inflation and Bankruptcies

- Reduction in leverage and interest costs reduced likelihood of financial distress
Increasing Frequency of Wage and Price Adjustment

(a) Declining interval between wage increases

(b) Declining interval between price increases
Increasing Frequency of Wage and Price Adjustment

(a) Declining interval between wage increases
(b) Declining interval between price increases

- Consistent with menu cost models (Alvarez et al 2019)
- Implication: Limited scope for expansionary effect through nominal rigidity channel (Golosov and Lucas 2007)
Firm-Level Evidence on the Debt-Inflation Channel
Firm-Level Analysis

• Is the debt-inflation channel present in the cross-section of firms?
  • Does debt-inflation merely redistribute wealth or does it affect real activity?

• Firm-level measures of exposure to the debt-inflation channel, as of 1918-19
  • $\frac{Liabilities}{Assets} = 1 - \frac{\text{BookEquity}}{\text{Assets}}$
  • $\frac{Debt}{Assets}$

• Advantages of firm-level analysis:
  • Identification: Control for time-varying industry-specific shocks + firm characteristics
  • Quantify extent of redistribution
  • Estimate real effect on employment
Employment Dynamics across High and Low Leverage Firms

Terciles of Liabilities/Assets

Employment index, 1918=100

- Low leverage firms
- Intermediate leverage firms
- High leverage firms
Employment Dynamics across High and Low Leverage Firms

$\ln( Employment_{it} ) = \alpha_i + \gamma_{st} + \sum_{k \neq 1918} \beta_k \left( \frac{ Liabilities_i }{ Assets_i } \right) 1_{k=t} + \epsilon_{it}$
Employment Dynamics across High and Low Leverage Firms

\[ \ln(\text{Employment}_{it}) = \alpha_i + \gamma_{st} + \sum_{k \neq 1918} \beta_k \left( \frac{\text{Liabilities}}{\text{Assets}} \right)_i 1_{k=t} + \epsilon_{it} \]
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Leverage and Interest Expenses

Interest Expense Share_{it} = \alpha_i + \gamma_{st} + \sum_{k \neq 1918} \beta_k \left( \frac{\text{Liabilities}}{\text{Assets}} \right)_{i, t} 1_{k=t} + \epsilon_{it},
High Leverage Firms Have Higher Stock Returns during the Inflation

High-minus-low return = 12.8% (s.e. = 4.6%)
Redistribution from debt to equity holders, in contrast to limited evidence from moderate inflation in 1970s (Summers 1981; French, Ruback, Schwert 1983; Modigliani–Cohn 1984)
• 51% of firms have long-term bond financing in 1918-19

• Median repayment end year: 1940
Stronger Effects for Firms with More Long-Term Debt

Estimate effect separately by quartile of LT debt share:

\[ Y_{it} = \alpha^q_i + \gamma^q_{st} + \beta^q (\text{Debt}/\text{Assets})_{i,1918-19} \times 1_{t \geq 1920} + \epsilon^q_{it} \]
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### Conclusion

- Aggregate and firm-level evidence of debt-inflation from the German inflation
  - Redistribution toward net debtor firms → real effects
  - Key frictions: long-term nominal debt and financing constraints

- Aggregate effects?
  - PE aggregation: 14% employment increase (75% of total) → debt-inflation is expansionary even with flexible prices
  - Reduction in credit supply → next paper

- External validity?  
  - Relevant channels may differ during smaller inflations
  - Monetary policy response
  - Structure of debt contracts matters (fixed/floating, long-term/short-term, domestic/FX)
Thank you!