U.S Monetary Policy and inflation in the Great Recession

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THE AIM OF THE ANALYSIS

- In this paper we analysed the *missing transmission mechanism* between the U.S. expansive Monetary Policy and Inflation during the Great Recession in the framework of Sylos Labini's mark-up theory (1958).
- Specifically, we used the advanced mark-up model by Basevi, Cavazzuti, D'Adda, Onofri (1978).
- We tested the hypothesis of this theoretical model with a VAR.

THE MARK-UP THEORY

BASEVI, CAVAZZUTI, D'ADDA, ONOFRI (1978)

$$p = [1 + q(u)] \times \left\{ \left[\frac{1}{\pi}(u) \times w \right] + [1 + s] + [\beta \times p_m \times r] + [k \times i] \right\} \times [1 + t]$$

↓ mark-up ↓ production-cost ↓ import. raw material-cost ↓ capital-cost

- **Demand - Pull Inflation:**

  a) The capacity utilization (u), determined by the aggregate demand, influences the mark-up (q), with a consequent variation in the selling prices (p).

- **Cost - Push Inflation**:

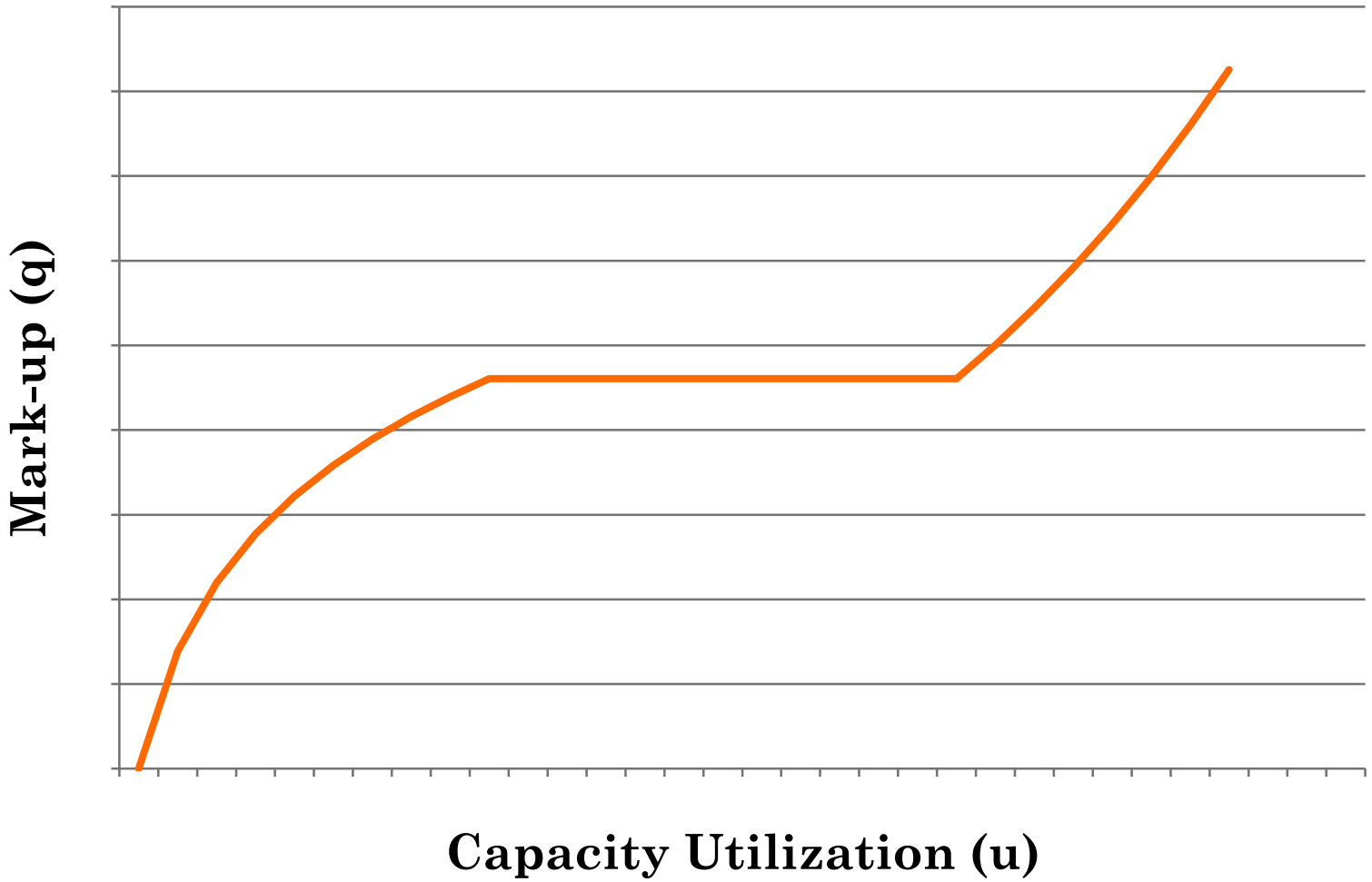
  a) The productivity level (π) and the capacity utilization (u) influence the production cost and the selling prices (p).

  b) The prices of the imported raw materials (pm) and the foreign exchange rate (r) influence the selling prices (p).

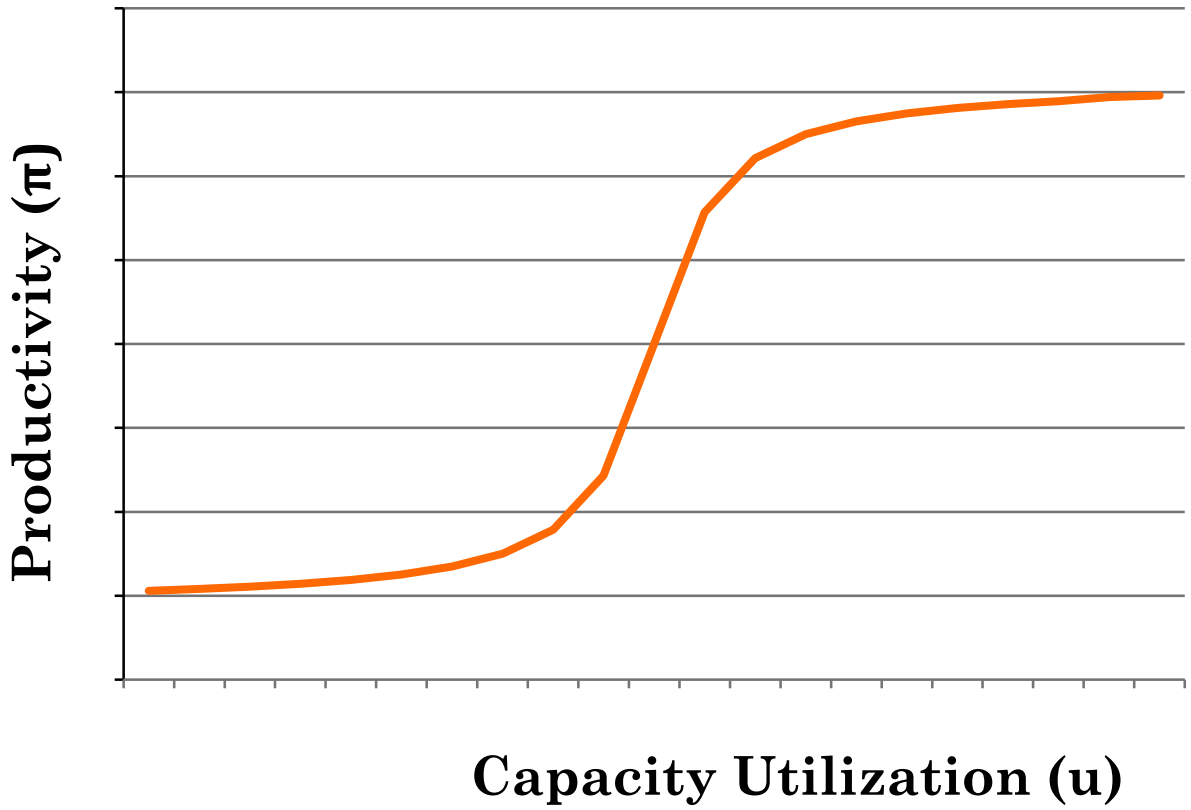
  c) The interest rate (i) directly influences the selling prices (p).

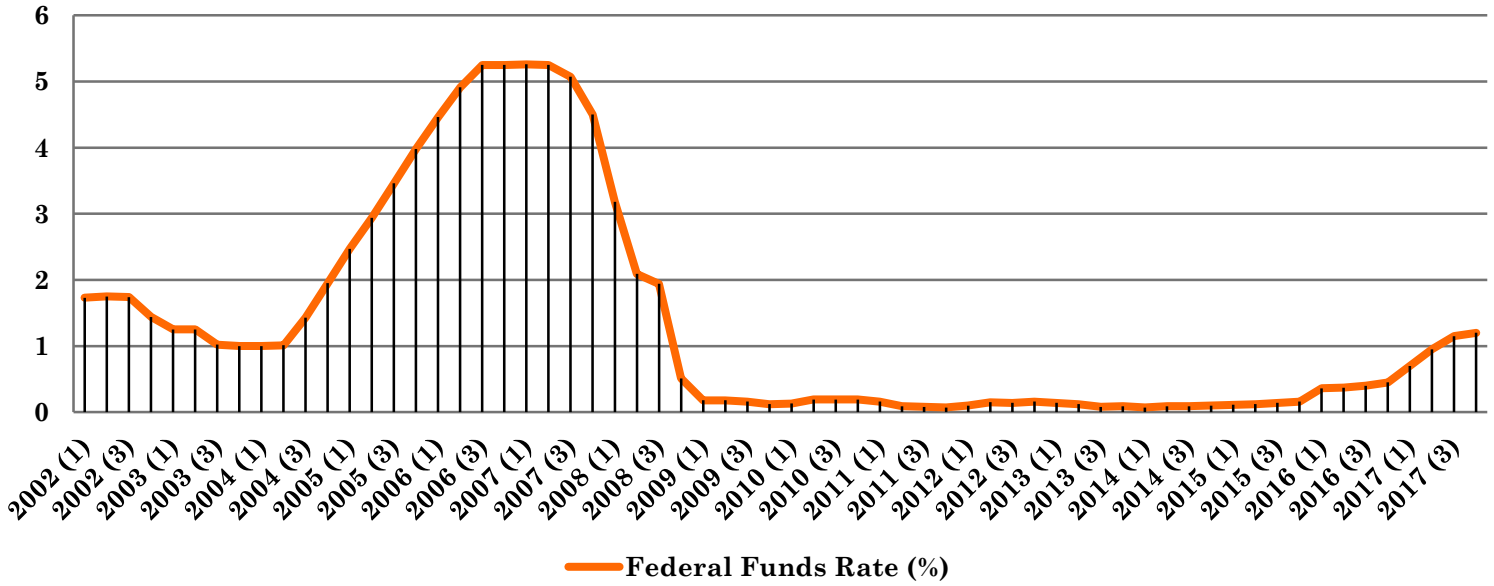
  d) The interest rate (i) influences the production level, it also affects the productivity and the capacity utilization and finally it indirectly **a**ffects on the selling prices.

The connection between Mark-up and Capacity Utilization



The connection between Productivity and Capacity Utilization

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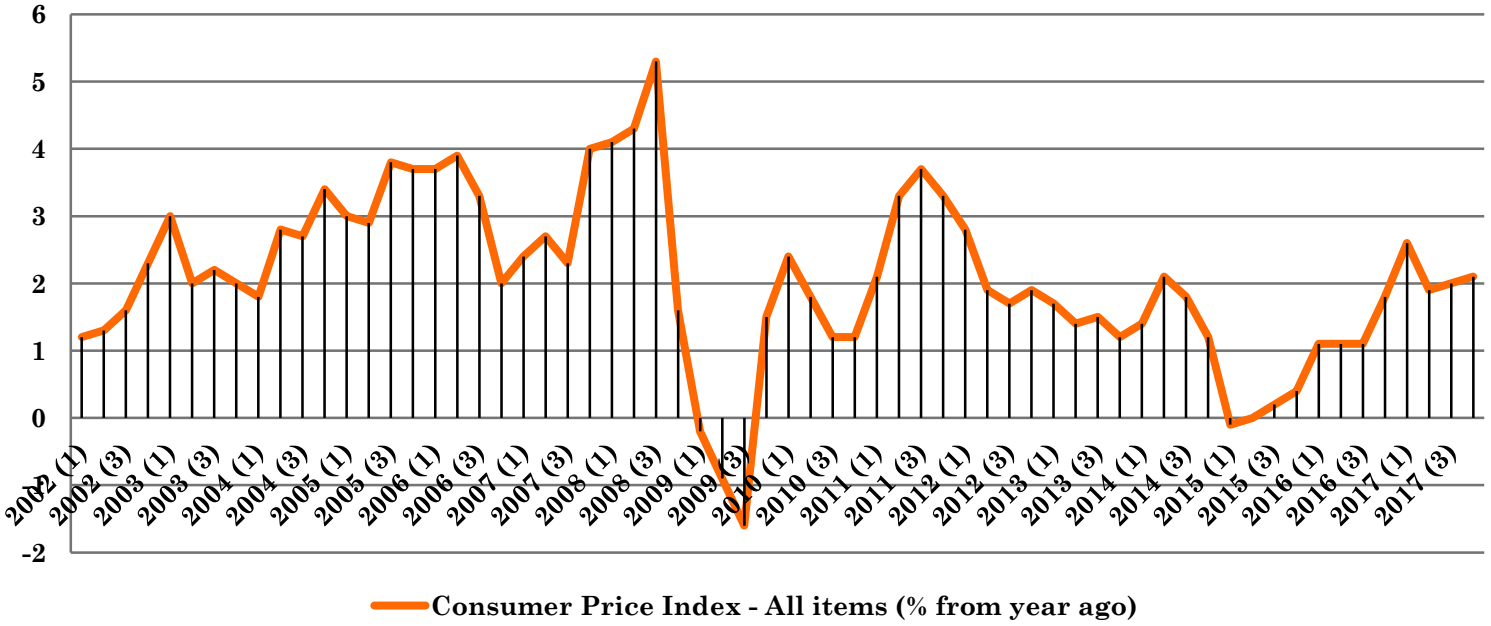
Federal Funds Rate (%)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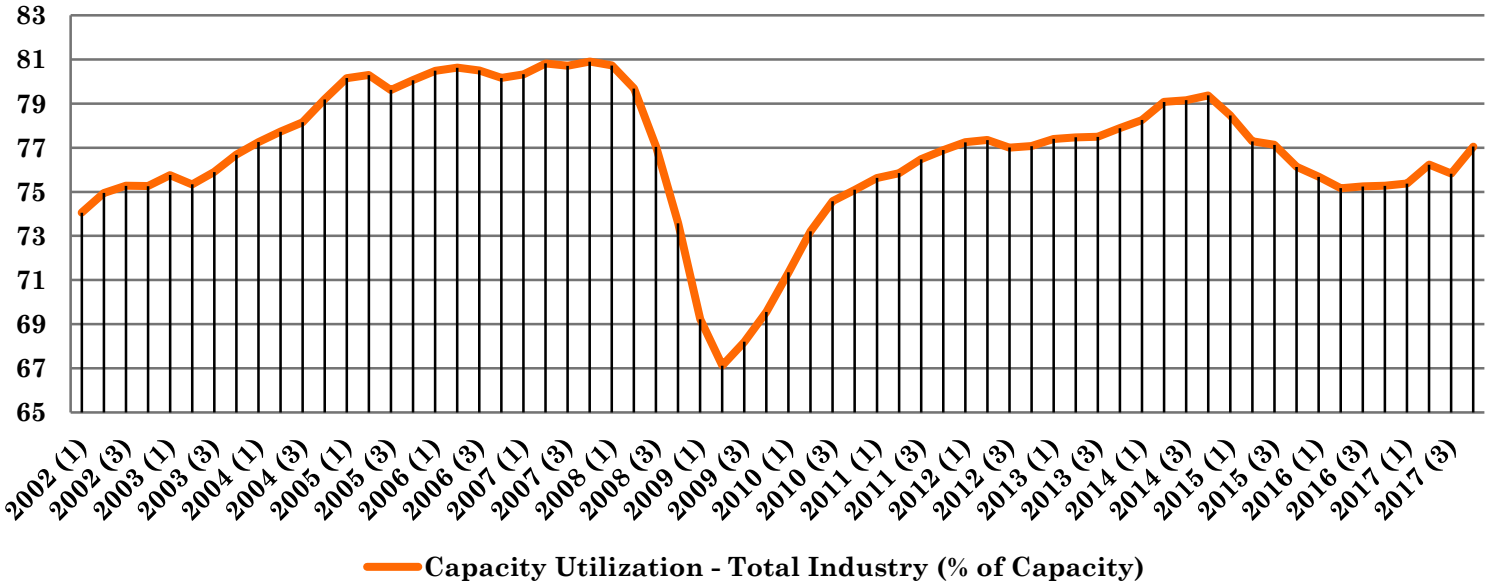
Consumer Price Index - All items (% from year ago)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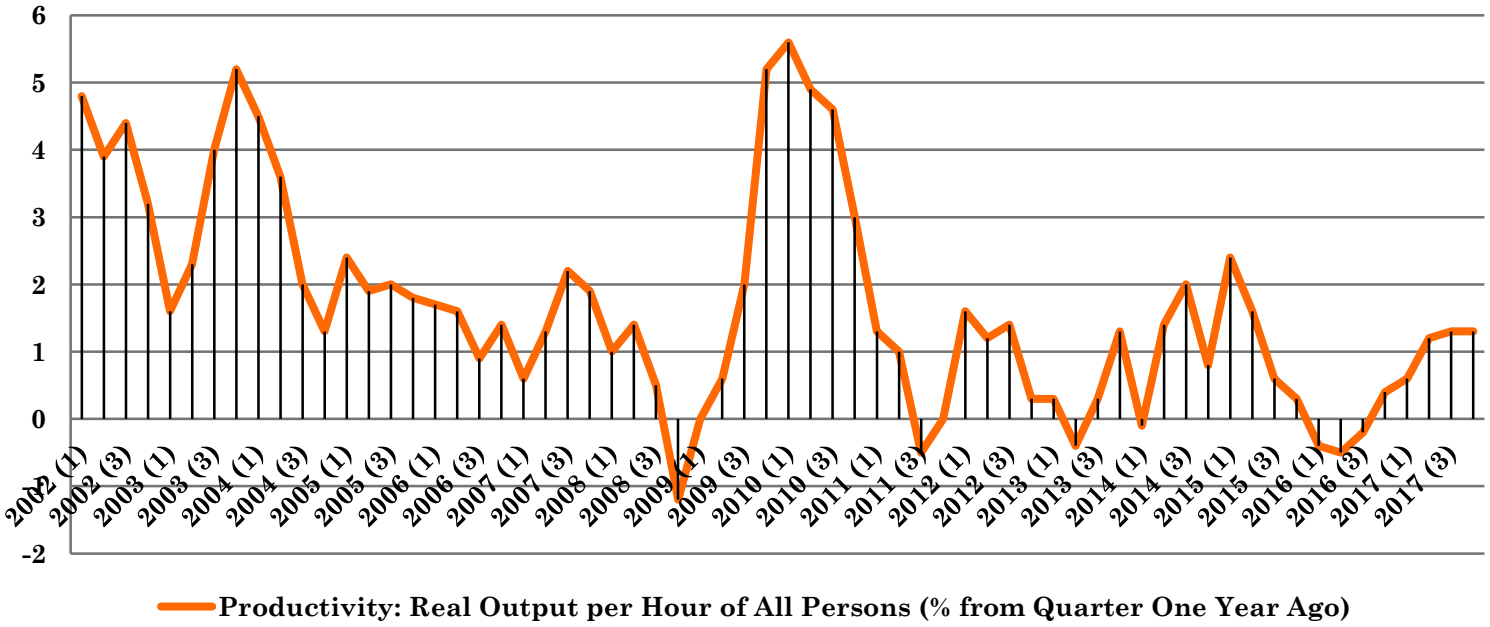
Capacity Utilization - Total Industry (% of Capacity)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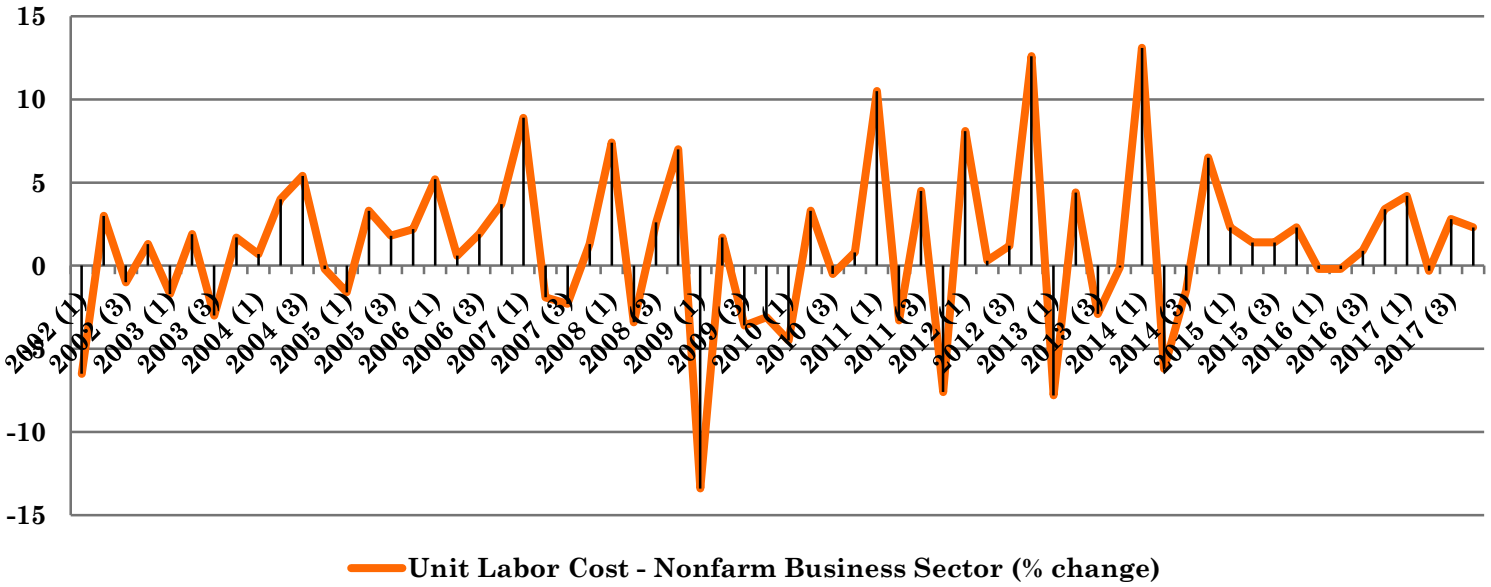
Productivity: Real Output per Hour of All Persons (% from Quarter One Year Ago)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Unit Labor Cost - Nonfarm Business Sector (% change)


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Wages (% from year ago)

Hypothesis:
the two sides of the Monetary Policy

- During the Great Recession, there is a collapse of production, and the cut in Capacity Utilization. The cut in the Capacity Utilization causes a further diminished production through the contraction of the economies of scale, generating a vicious circle.
- During the recovery the expansive Monetary Policy helps firms restore the Capacity Utilization and the economies of scale. However the Capacity Utilization does not return to the pre-crisis level, despite a very low interest rate. These two phenomena together could offset the increase in unit labor cost with consequent compression in prices level.

THE VAR MODEL

Sample of the period:

1° Quarter 2002 – 4° Quarter of 2017

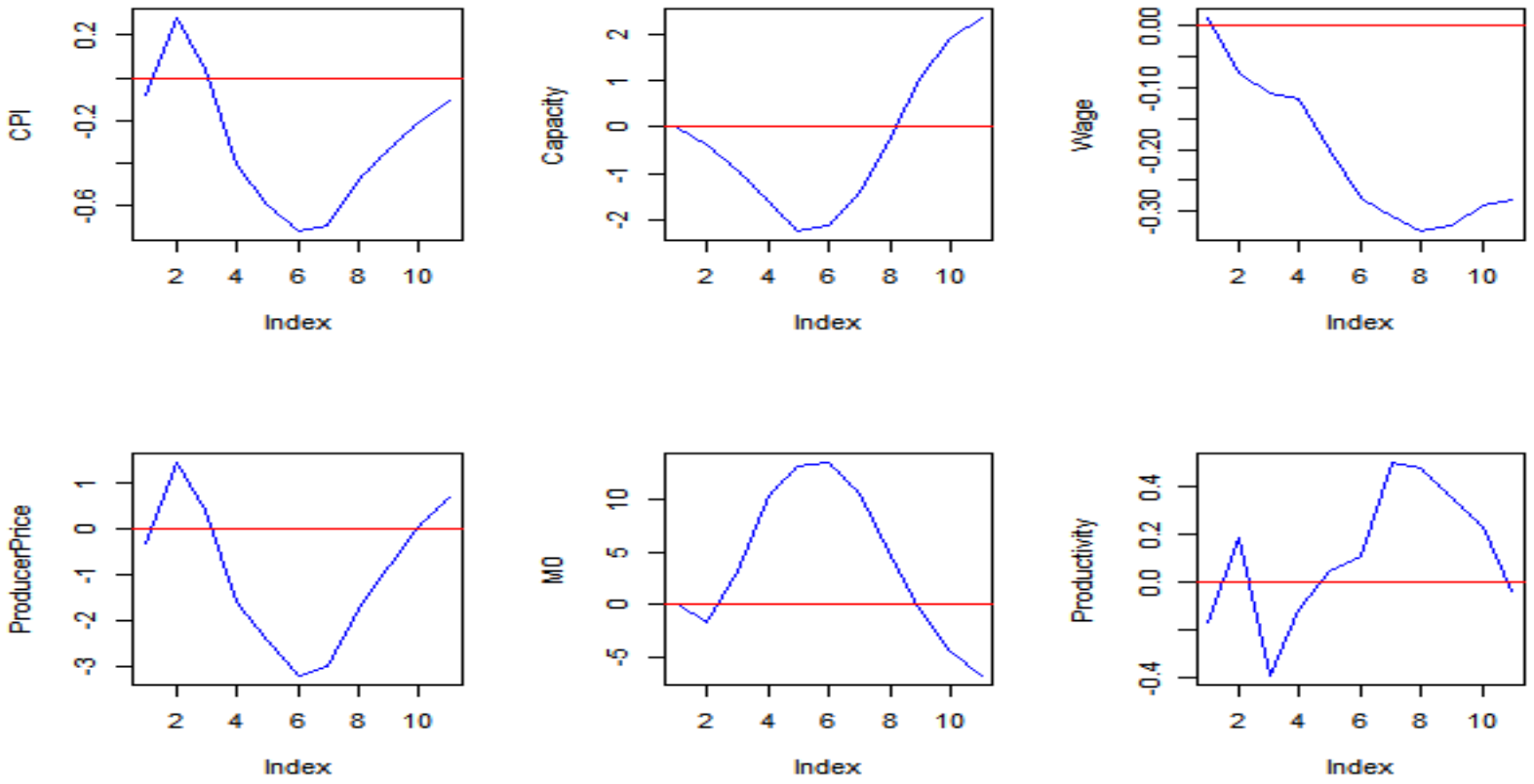
3 lags were used (1 lag = 3 months)

Variables:

1. Effective federal funds rate (%)
2. Monetary base (% from year ago)
3. Producer Price Index for All Commodities (% from year ago)
4. Average Hourly Earnings of Production and Nonsupervisory Employees (% from year ago)
5. Nonfarm Business Sector: Real Output Per Hour of All Persons (% from year ago)
6. Capacity Utilization: Total Industry (% from year ago)
7. Consumer Price Index for All Urban Consumers (% from year ago)

Source: Federal Reserve Economic Data (Fred), https://fred.stlouisfed.org/

VAR Impulse Response Function



Orthogonal Impulse Response from Fed funds shock (-2 %).

Interpretation of the Impulse Response Function

- In the first phase the VAR Impulse Response Function shows that a simulated decrease in the Federal Funds rate (e.g. – 2 %) leads to a decrease in the Producer Prices and in the CPI. During the second phase both of them start catching up to the starting level, but the CPI stays below that level.
- The Capacity Utilization decreases in the first phase and increases during the second phase.
- Furthermore the level of productivity decreases during the first period and increases during the second period, and it seems to return to the initial level at the end of the second phase.
- The fluctuations in the Capacity Utilization could also explain the drop in the wage rates.

Conclusion

- The low interest rate, if interpreted as a “cost”, in the framework of the mark-up model, could explain one of the causes of the low inflation during and after the Great Recession period.

Statistical Appendix

VAR Estimation Results

Endogenous variables: M0, Fed, Productivity, Capacity, Wage, ProducerPrice, CPI

Deterministic variables: const

Sample size: 61

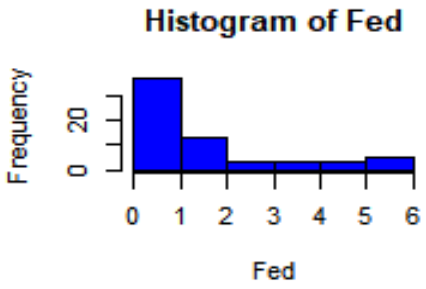
Log Likelihood: -350.642

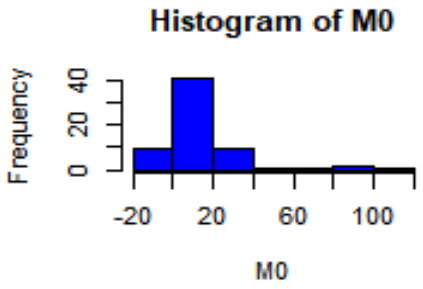
Roots of the characteristic polynomial (<1): 0.9441-0.9441-0.9386-0.9386-0.9266-0.8681-0.8681-0.8495-0.8495-0.8408-0.8408-0.7542-0.7542-0.6251-0.6251-0.6062-0.6062-0.5911-0.5093-0.5093-0.4459

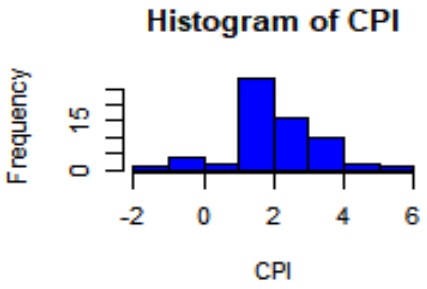
Call: VAR(y = prova, lag.max = 3)

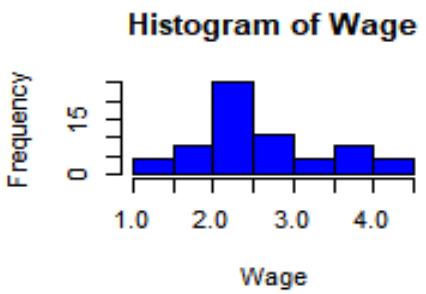
Source: Rstudio, our elaboration

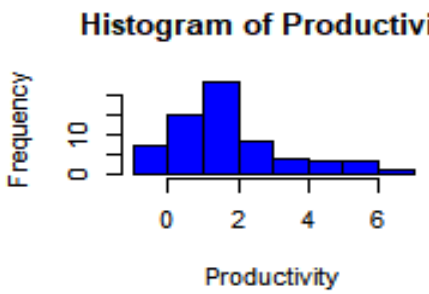
EXPLORING THE VARIABLES (2)

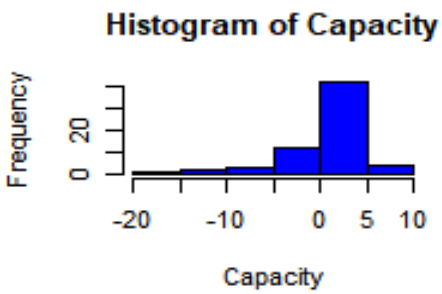


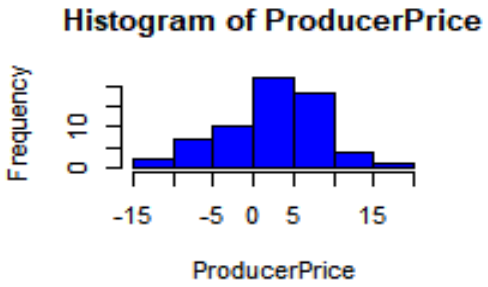






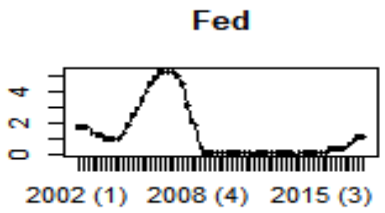


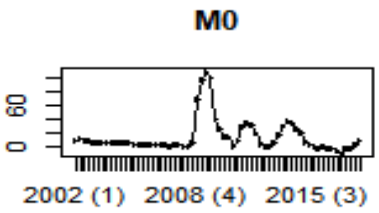


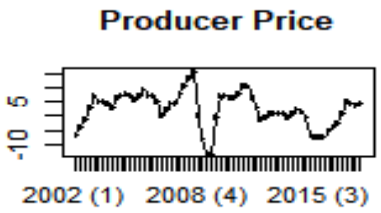


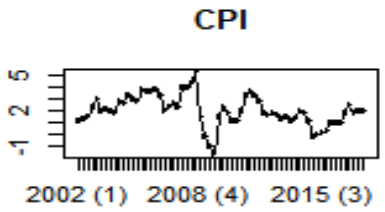
Source: Rstudio, our elaboration

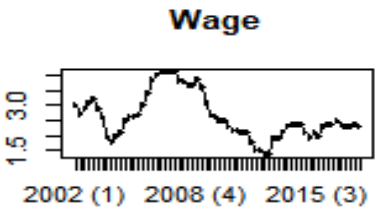
EXPLORING THE VARIABLES

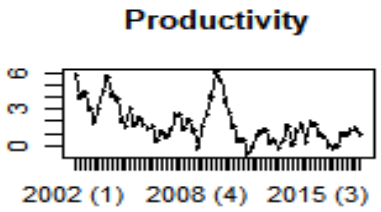


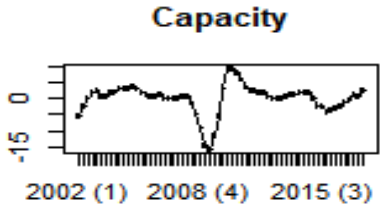












Source: Rstudio, our elaboration

M0 = M0.l1 + Fed.l1 + Productivity.l1 + Capacity.l1 + Wage.l1 + ProducerPrice.l1 + CPI.l1 + M0.l2 + Fed.l2 + Productivity.l2 + Capacity.l2 + Wage.l2 + ProducerPrice.l2 + CPI.l2 + M0.l3 + Fed.l3 + Productivity.l3 + Capacity.l3 + Wage.l3 + ProducerPrice.l3 + CPI.l3 + const	Adjusted R-squared: 0.8912
Fed = M0.l1 + Fed.l1 + Productivity.l1 + Capacity.l1 + Wage.l1 + ProducerPrice.l1 + CPI.l1 + M0.l2 + Fed.l2 + Productivity.l2 + Capacity.l2 + Wage.l2 + ProducerPrice.l2 + CPI.l2 + M0.l3 + Fed.l3 + Productivity.l3 + Capacity.l3 + Wage.l3 + ProducerPrice.l3 + CPI.l3 + const	Adjusted R-squared: 0.9793
Productivity = M0.l1 + Fed.l1 + Productivity.l1 + Capacity.l1 + Wage.l1 + ProducerPrice.l1 + CPI.l1 + M0.l2 + Fed.l2 + Productivity.l2 + Capacity.l2 + Wage.l2 + ProducerPrice.l2 + CPI.l2 + M0.l3 + Fed.l3 + Productivity.l3 + Capacity.l3 + Wage.l3 + ProducerPrice.l3 + CPI.l3 + const	Adjusted R-squared: 0.7483
Capacity = M0.l1 + Fed.l1 + Productivity.l1 + Capacity.l1 + Wage.l1 + ProducerPrice.l1 + CPI.l1 + M0.l2 + Fed.l2 + Productivity.l2 + Capacity.l2 + Wage.l2 + ProducerPrice.l2 + CPI.l2 + M0.l3 + Fed.l3 + Productivity.l3 + Capacity.l3 + Wage.l3 + ProducerPrice.l3 + CPI.l3 + const	Adjusted R-squared: 0.9592
Wage = M0.l1 + Fed.l1 + Productivity.l1 + Capacity.l1 + Wage.l1 + ProducerPrice.l1 + CPI.l1 + M0.l2 + Fed.l2 + Productivity.l2 + Capacity.l2 + Wage.l2 + ProducerPrice.l2 + CPI.l2 + M0.l3 + Fed.l3 + Productivity.l3 + Capacity.l3 + Wage.l3 + ProducerPrice.l3 + CPI.l3 + const	Adjusted R-squared: 0.957
ProducerPrice = M0.l1 + Fed.l1 + Productivity.l1 + Capacity.l1 + Wage.l1 + ProducerPrice.l1 + CPI.l1 + M0.l2 + Fed.l2 + Productivity.l2 + Capacity.l2 + Wage.l2 + ProducerPrice.l2 + CPI.l2 + M0.l3 + Fed.l3 + Productivity.l3 + Capacity.l3 + Wage.l3 + ProducerPrice.l3 + CPI.l3 + const	Adjusted R-squared: 0.8309
CPI = M0.l1 + Fed.l1 + Productivity.l1 + Capacity.l1 + Wage.l1 + ProducerPrice.l1 + CPI.l1 + M0.l2 + Fed.l2 + Productivity.l2 + Capacity.l2 + Wage.l2 + ProducerPrice.l2 + CPI.l2 + M0.l3 + Fed.l3 + Productivity.l3 + Capacity.l3 + Wage.l3 + ProducerPrice.l3 + CPI.l3 + const	Adjusted R-squared: 0.7018

THE ROLE OF THE INTEREST RATE

Variable X	Variable Y	Lags	P-value
Fed	Wage	1	0.035088 *
Fed	Producer Price	1	0.009715 **
Fed	M0	2	0.04640 *
Fed	Productivity	2	0.013372 *
Fed	Producer Price	2	0.000871 ***
Fed	CPI	2	0.01456 *
Fed	M0	3	0.04129 *
Fed	Productivity	3	0.002867 **
Fed	Capacity	3	0.0259 *
Fed	Producer Price	3	0.042282 *

Source: Rstudio, our elaboration.

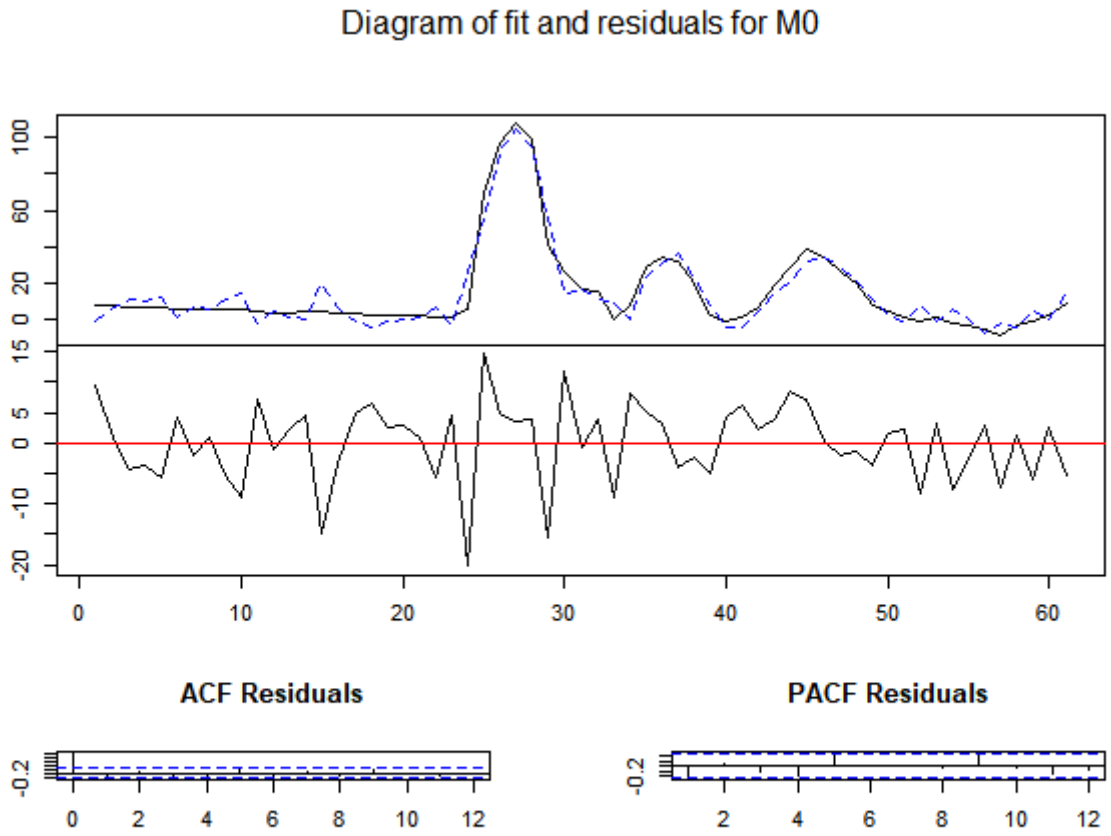


Diagram of fit and residuals for M0
100
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-10
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ACF Residuals
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PACF Residuals
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10
12

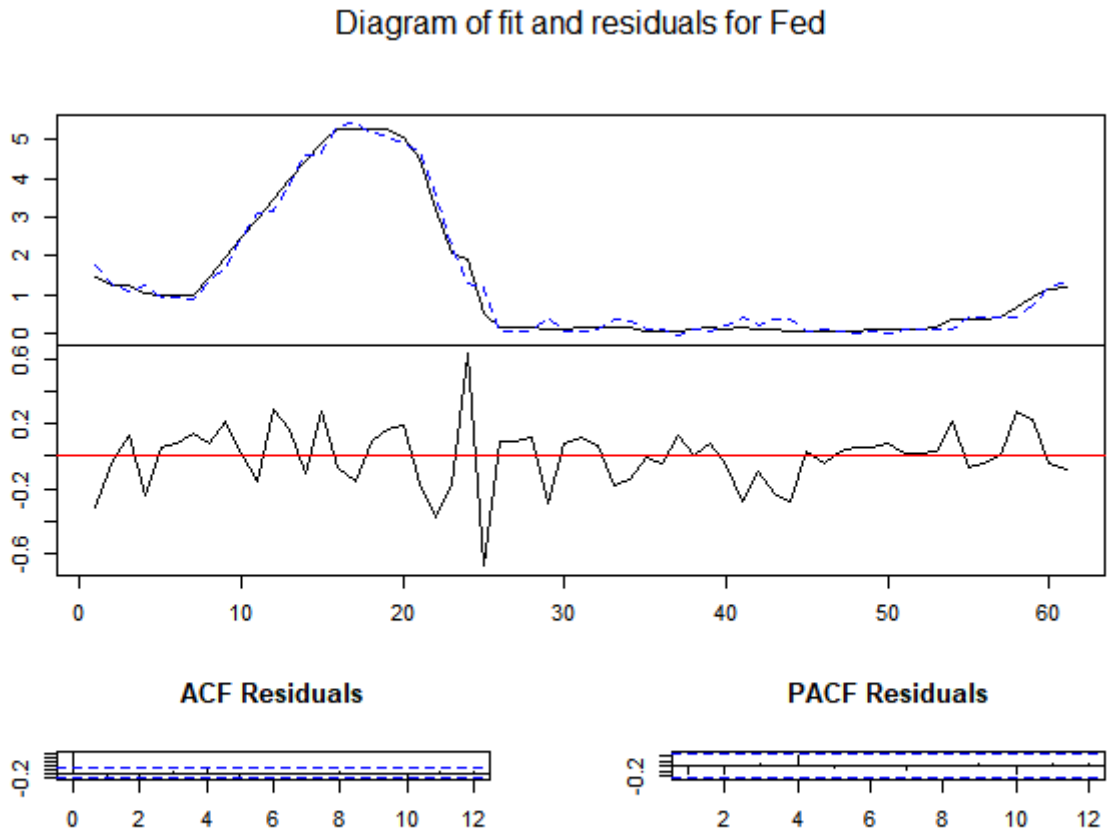
Diagram of fit and residuals for Fed
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ACF Residuals
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PACF Residuals
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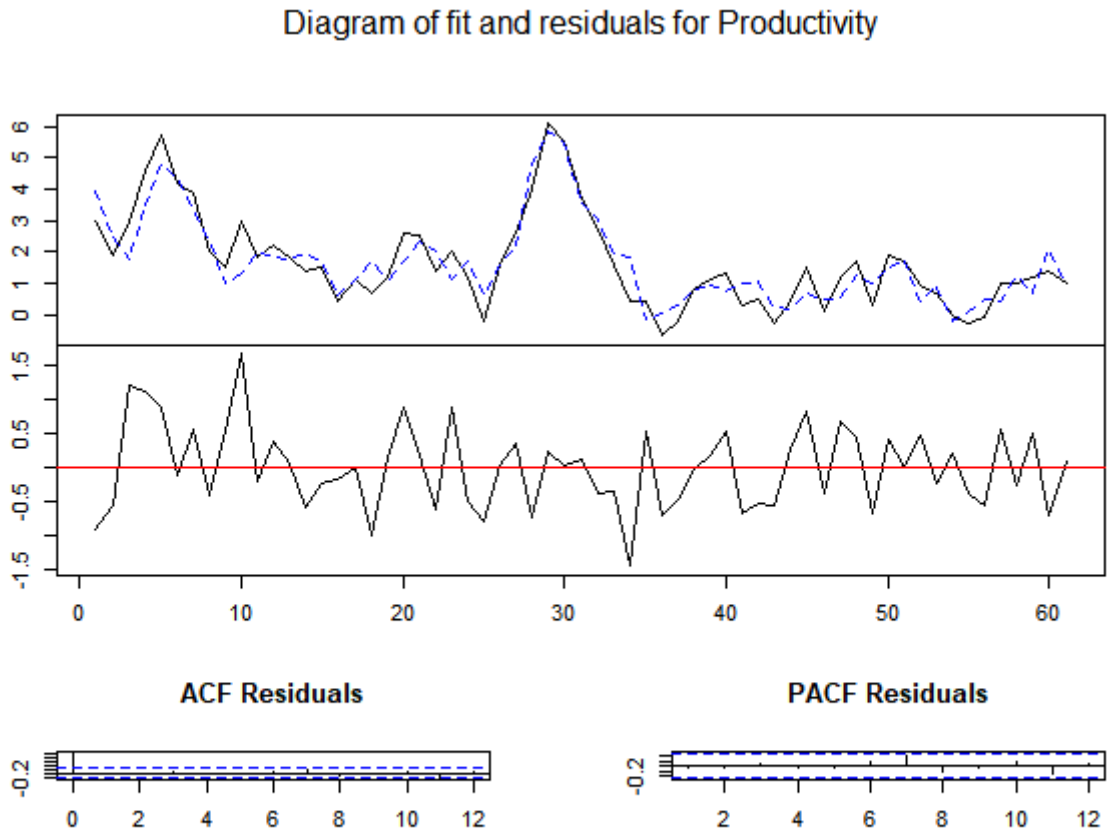
Diagram of fit and residuals for Productivity
ACF Residuals
PACF Residuals

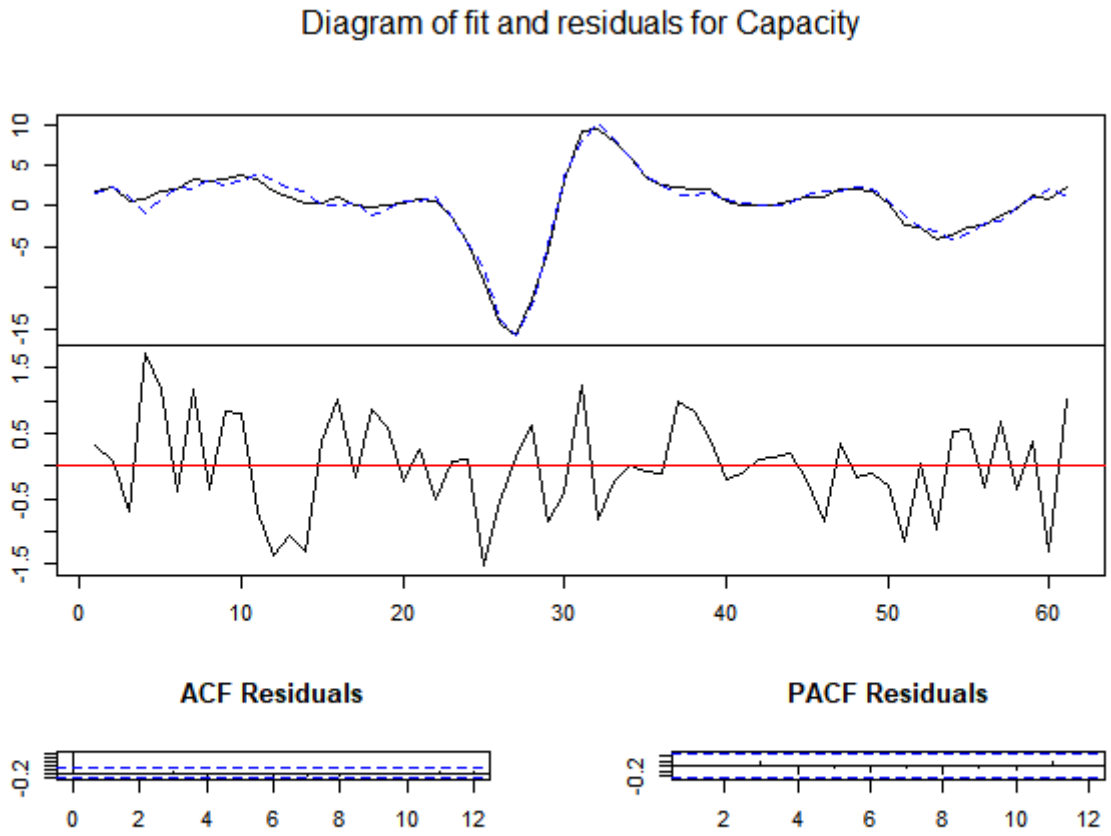
Diagram of fit and residuals for Capacity
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ACF Residuals
PACF Residuals
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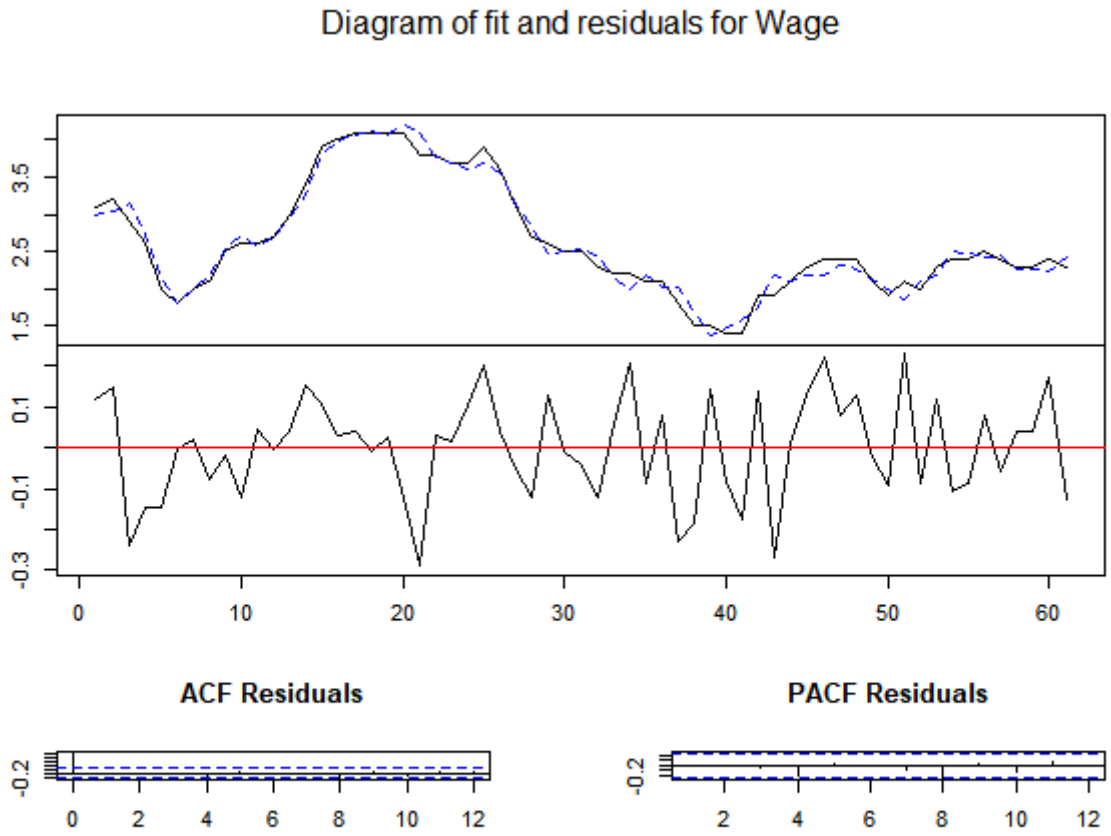
Diagram of fit and residuals for Wage
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ACF Residuals
PACF Residuals
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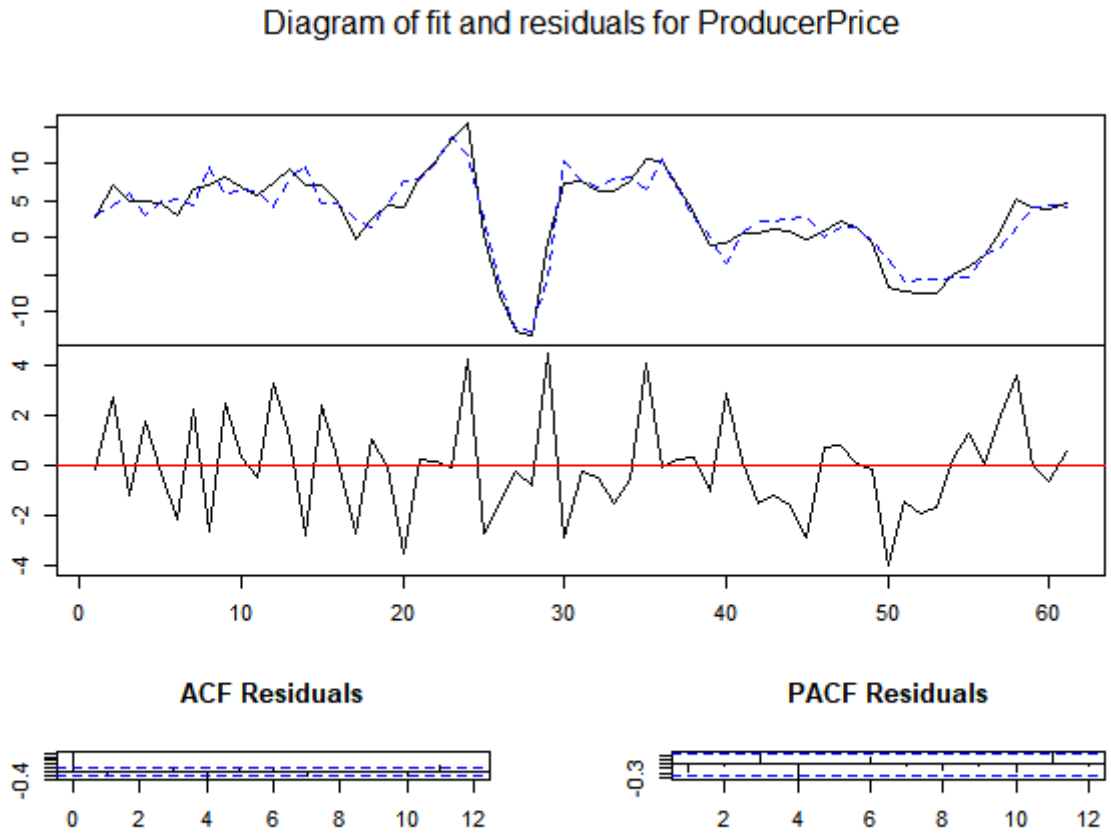
Diagram of fit and residuals for ProducerPrice
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-4
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60
ACF Residuals
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PACF Residuals
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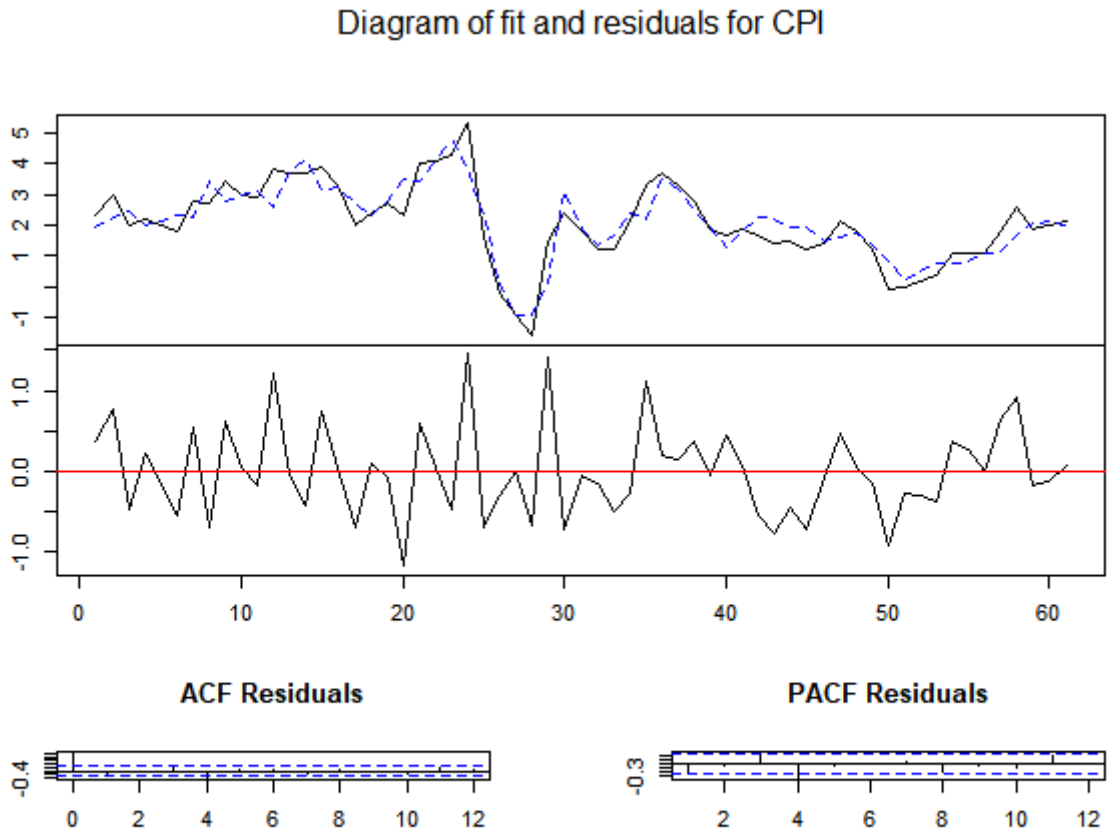
Diagram of fit and residuals for CPI
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4
5
-1.0
0.0
1.0
0
10
20
30
40
50
60
ACF Residuals
-0.4
0
2
4
6
8
10
12
PACF Residuals
-0.3
2
4
6
8
10
12

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