Historical Wage Phillips Curves

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Motivation

- The **wage inflation-unemployment trade-off** claims that changes in monetary policy push these in opposite directions (Mankiw 2001);
- Recent evidence points to a **weaker medium-run trade-off** (Barnichon and Mesters 2020) and a **flatter Phillips curve** (Galí and Gambetti 2020);
- **Low price inflation** is one potential explanation (Blanchard 2016).

- **Policy debate**. A **weaker** wage inflation-unemployment tradeoff:
  - calls into question the inflation targeting framework (FED);
  - requires the monetary authority to work harder to stabilize inflation (Del Negro et al. 2020).

- **Have we experienced this before?**

Research Questions

Research Questions:

1. **How large is the wage inflation-unemployment trade-off?**
2. **Has it been stable over the last 150 years?**
3. **Is this relation weakened by a low price inflation environment?**

Contributions:

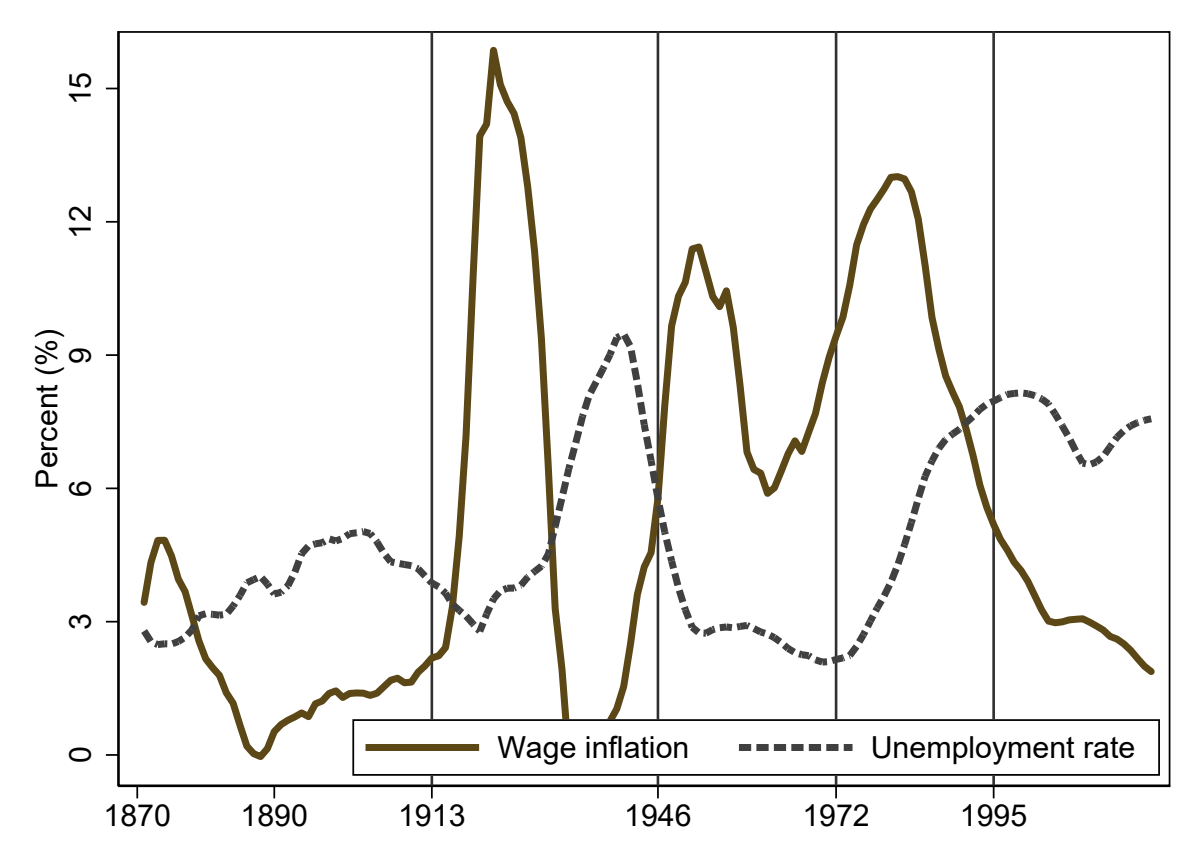
1. collection of annual historical data on wages and unemployment - 17 advanced economies between 1870 and 2018;
2. show that the wage inflation-unemployment trade-off varied over time;
3. argue that changes in the price inflation environment might explain the observed time-varying relation;
4. demonstrate that these findings are robust when accounting for simultaneity bias and model misspecification.

Data

Unemployment Rate: percentage of unemployed workers in the labor force.

Wage Inflation: change in nominal average earnings from all employees.

See a **strong negative comovement** between both variables.



This figure plots a time-varying estimate of the mean wage inflation (solid olive line) and mean unemployment rate (dashed black line) using a 10-year rolling window.

Wage inflation-unemployment trade-off estimation

Challenges:

1. **Simultaneity Bias** (Endogeneity) → correlation with error term: e.g. wage markup shocks (Galí and Gambetti 2020) or optimal monetary policy (McLeay and Tenreyro 2020);
2. **Model Misspecification** → reduced form Phillips curve assumes a linear relation.

Solutions:

1. estimation of the **Phillips curve** using **instrumental variables** → **monetary policy shocks** *(trilemma)*, lagged unemployment rate (Coibion and Gorodnichenko 2015) and control for oil price inflation;
2. estimate a semi-parametric **Phillips Multiplier** (Barnichon and Mesters 2020).

Identification - monetary policy shocks

Following Jordà, Schularick, and Taylor (2019), I explore the *trilemma* of international finance:

- countries with **fixed exchange rates** and **open capital accounts** are forced to track their base country interest rate movements;
- use the base country interest rate movements as a **predictor** for the **change in the short-run interest rate** of each pegged country:

$$\Delta r_{i,t} = \alpha_i + \delta z_{i,t} + \zeta \mathbf{W}_{i,t} + \varepsilon_{t+h} \tag{1}$$

$$\textit{Trilemma}: \quad z_{i,t} \equiv k_{i,t}(\Delta r_{b(i,t),t} - \Delta \hat{r}_{b(i,t),t})$$

- obtain **monetary policy shocks**, i.e. exogenous changes to the short term interest rate, $\Delta \hat{r}_{i,t}$ as predicted values from Equation 1.

Historical wage Phillips curves

Wage Phillips Curves

Panel version of the New Keynesian **wage Phillips curve** in Galí (2011):

$$\pi^{w}_{i,t} = \phi(u_{i,t} - u^{n}_{i}) + \gamma\pi^{p}_{i,t-1} + (1-\gamma)\pi_{i}$$

- u^{n}_{i} is not observable $\rightarrow$ estimate PC using a 2SLS approach:

$$\pi^{w}_{i,t} = \phi\hat{u}_{i,t} + \gamma\pi^{p}_{i,t-1} + c\pi^{o}_{t} + \mu_{i} + \epsilon_{i,t}$$

- where $\hat{u}_{i,t}$ comes from the **first-stage**:

$$u_{i,t} = \delta_{1}(\Delta\hat{r}_{i,t}) + \delta_{2}u_{i,t-1} + \gamma\pi^{p}_{i,t-1} + c\pi^{o}_{t} + \mu_{i} + \varepsilon_{i,t}$$

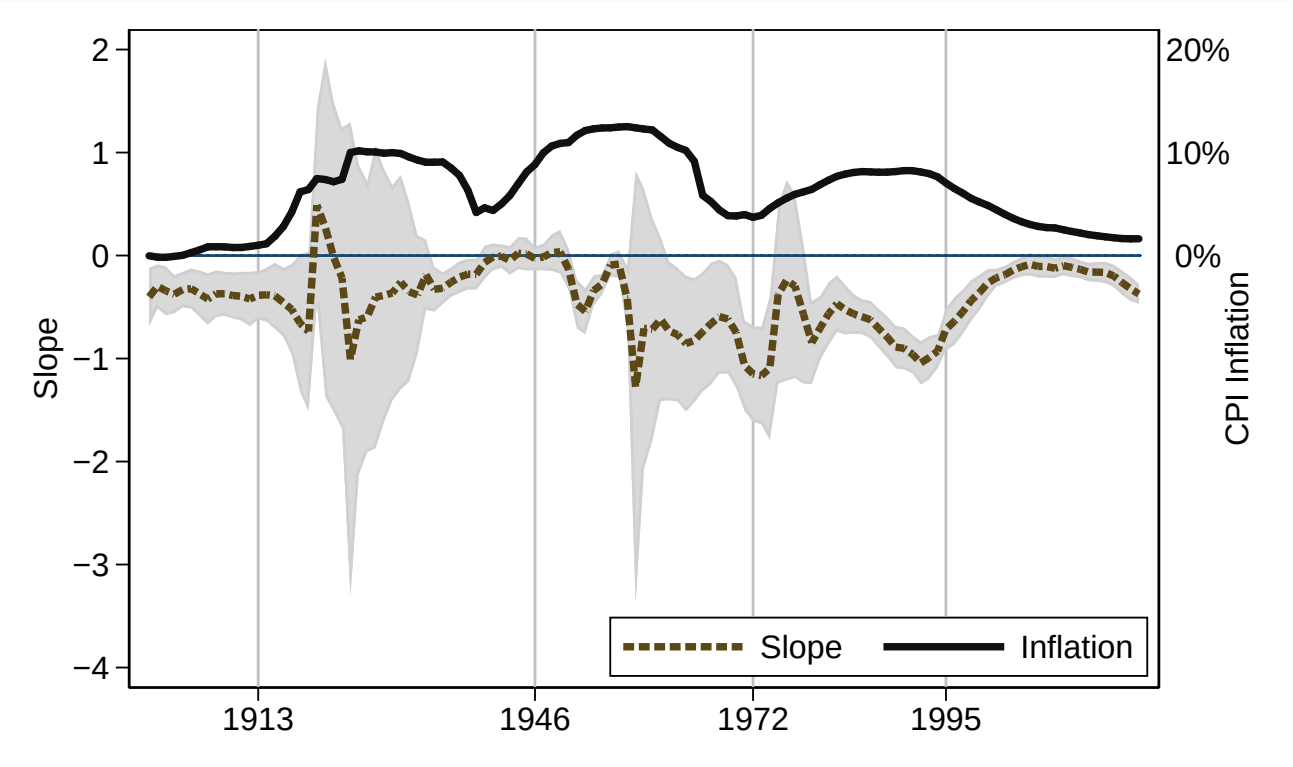
- The classical assumption that all parameters are time-invariant might not hold for very long samples $\rightarrow$ **look at time-varying estimates**.

Time-Varying Phillips Curve: 20-year Rolling Window

- Flatter slope during the Gold Standard and the Inflation Targeting periods - coincident with lower price inflation;
- **Mechanism:**

▸ Slope

$\pi^p \downarrow \rightarrow$ *frequency of price adjustment* $\downarrow \rightarrow$ *price stickiness* $\uparrow \rightarrow$ *Slope* $\downarrow$



This figure plots a time-varying estimate of the slope of the wage Phillips curve(ϕ). It is computed based on a rolling IV regression with a 20-year window and displays a 90% confidence band. The dependent variable was truncated at the top 1% and bottom 1%.

Low Inflation ($|\pi^p| < 2$) Bends the Phillips Curve

Estimate : $\pi^w_{i,t} = \phi \hat{u}_{i,t} + \kappa^{LI} \hat{u}_{i,t} I_{LI,t} + \delta^{LI} I_{LI,t} + \gamma \pi^p_{i,t-1} + c\pi^o_t + \mu_i + \varepsilon_{i,t}$

	OLS	IV
Unemployment (ϕ)	-0.366***	-0.430***
	(0.08)	(0.07)
Interaction (κ^{LI})	0.155**	0.242***
	(0.07)	(0.07)
Low Inflation (δ^{LI})	-2.721***	-3.219***
	(0.53)	(0.50)
Lagged Inflation (γ)	0.577***	0.608***
	(0.05)	(0.05)
Oil inflation (c)	0.027***	0.024***
	(0.00)	(0.00)
R^2	0.502	0.521
F-Stat		670
Observations	1809	1321

Phillips Multiplier

Methodology

The **Phillips multiplier** allows us to compute the medium-run wage inflation-unemployment trade-off (Barnichon and Mesters 2020):

$$\sum_{j=0}^{h} \pi^{w}_{i,t+j} = \alpha_{i,h} + \mathcal{P}_h \sum_{j=0}^{h} \hat{u}_{i,t+j} + \zeta_h \mathbf{W}_{i,t} + \epsilon_{t+h}$$

where $\mathcal{P}_h \equiv \beta^{wage}_h / \beta^{unemp}_h$, **impulse responses** to a 1 ppt increase in unemployment caused by a monetary policy shock:

$$\sum_{j=0}^{h} X_{i,t+j} = \alpha_{i,h} + \beta^{X}_h \hat{u}_{i,t} + \zeta_h \mathbf{W}_{i,t} + \epsilon_{t+j}$$

and where $\hat{u}_{i,t}$ is instrumented with the **monetary policy shocks** $\Delta\hat{r}_{i,t}$. First stage:

$$u_{i,t} = \alpha_i + \delta(\Delta\hat{r}_{i,t}) + \zeta \mathbf{W}_{i,t} + \varepsilon_{i,t}$$

Phillips Multiplier

- Large trade-off in the long-run $\rightarrow$ **transitory policy-induced change in unemployment** has a **persistent effect on wage inflation**;
- equivalently, Central Banks could **lower unemployment permanently** only at the cost of **ever increasing inflation**.

	Impact	1-Year	2-Years	3-Years	4-Years	5-Years
Multiplier $(\mathcal{P}_h)$	-0.31	-0.82***	-1.18***	-1.25***	-1.41***	-1.81***
	(0.33)	(0.28)	(0.27)	(0.28)	(0.32)	(0.43)
F-Stat	40	46	31	18	10	7
Observations	1321	1317	1311	1306	1300	1294

Notes: This Table displays the Phillips Multiplier estimations using the exogenous changes in the short term interest rate as instrument. The sample is annual data from 1870 to 2018 for all 17 countries in the main sample. It reports the Olea and Pflueger (2013) effective F-Statistic. The dependent variable was truncated at the top 1% and bottom 1%.

Dynamics - Impulse Responses

- The cumulative response of unemployment stops increasing after year 3 while the wage inflation response is always decreasing.

This figure plots the impulse response functions of the unemployment rate and wage inflation to a 1 ppt increase in unemployment caused by exogenous changes in the short term interest rate. The Olea and Pflueger (2013) effective F statistic is about 42.

State Dependent Phillips Multiplier

▸ Dynamics

$$\sum_{j=0}^{h} \pi^{w}_{i,t+j} = I_t \left[\alpha^{L}_{i,h} + \mathcal{P}^{L}_{h} \sum_{j=0}^{h} \hat{u}_{i,t+j} + \zeta^{L}_{h} \mathbf{W}_{i,t} \right] + (1 - I_t) \left[\alpha^{H}_{i,h} + \mathcal{P}^{H}_{h} \sum_{j=0}^{h} \hat{u}_{i,t+j} + \zeta^{H}_{h} \mathbf{W}_{i,t} \right] + \epsilon_{t+h}$$

	Impact	1-Year	2-Years	3-Years
Multiplier $(\mathcal{P}_h)$	-0.31	-0.82***	-1.18***	-1.25***
$\mathcal{P}^{L}_{h}$	-0.44	-0.51	-0.49	-0.55
	(0.35)	(0.39)	(0.38)	(0.35)
$\mathcal{P}^{H}_{h}$	-0.22	-1.06***	-1.93***	-2.51**
	(0.48)	(0.37)	(0.47)	(1.02)
AR p-value	0.67	0.31	0.06	0.07
F-Stat^{L}	24.1	24.0	17.9	13.3
F-Stat^{H}	24.6	24.4	13.0	4.9
Observations	1321	1317	1311	1306

Notes: This Table displays the Phillips Multiplier estimations using the exogenous changes in the short term interest rate as instrument. The sample is annual data from 1870 to 2018 for all 17 countries. It reports the Anderson and Rubin (1949) p-values for the test that the multiplier estimates differ across states which is robust to weak instruments, coherent to what the F-Statistics display. The dependent variable was truncated at the top 1% and bottom 1%.

Conclusion

- Historical data points to a **time-varying Phillips curve** that nevertheless remains a useful tool for Central Banks;
- the **wage inflation - unemployment trade-off is weaker** in periods of **low price inflation**;

- **Policy implication: in a low price inflation environment** the trade-off is smaller and thus, the **central bank's ability to steer inflation** with policy-induced unemployment movements **is smaller**.

Appendix

Slope

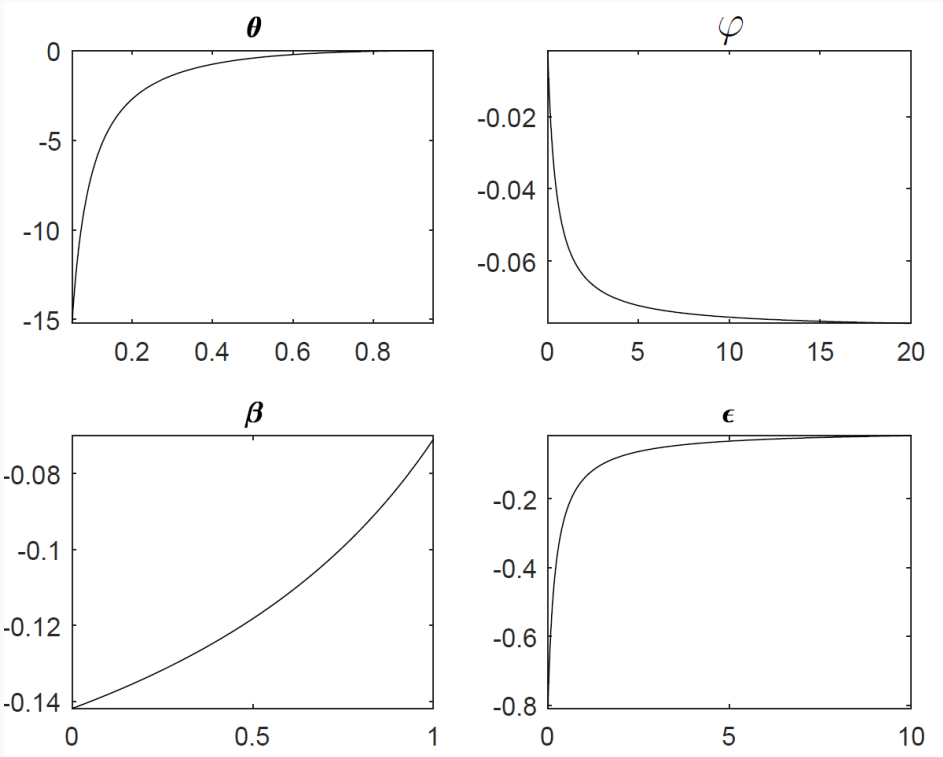
Back

Wage Phillips curve:

$$\pi^{w}_{i,t} = \phi(u_{i,t} - u^{n}_{i}) + \gamma\pi^{p}_{i,t-1} + (1-\gamma)\pi_{i}$$

with:

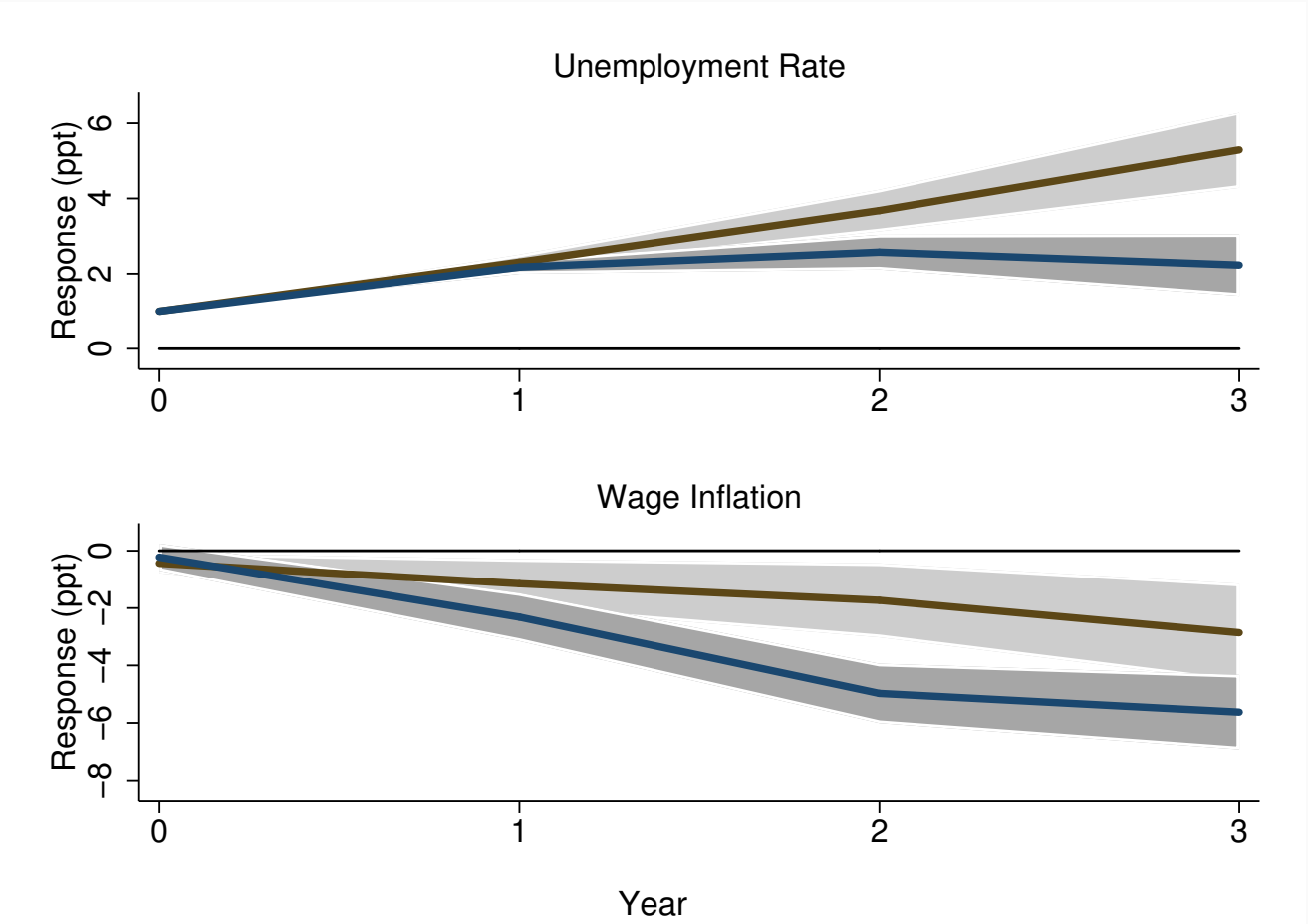
$$\phi \equiv -\frac{\varphi(1-\theta)(1-\beta\theta)}{\theta(1+\epsilon\varphi)} < 0$$



Relation between the slope and the remaining parameters. Calvo wage stickiness parameter: $\theta = 0.75$. Curvature of labor disutility $\varphi = 5$. Discount factor: $\beta = 0.99$. $\epsilon = 2.15$.

Dynamics - Impulse Responses

Back



This figure plots the impulse response functions of the unemployment rate and wage inflation to a 1 ppt increase in unemployment caused by exogenous changes in the short term interest rate in times of low price inflation (olive line) and high price inflation (blue line).