

# Drivers and Global Impact of U.S. Inflation 1870-2023

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# Overview

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- 2 Inflation Models for the U.S. Over Long Periods
- 3 Theoretical Framework
- 4 Monetary Regimes in the U.S. 1870-2023
- 5 U.S. Inflation Global Impact
- 6 Conclusions

# Motivation and Contributions

## Questions

The paper tries to shed light on the following:

- Why so few (none?) papers on U.S. inflation over extended periods?
- Is inflation in the long run driven by money and in the short run mainly by economic slack?
- How are these views, when true, and others related?
- Is inflation a purely, or mostly, home-determined phenomenon?
- Why are study samples chosen arbitrarily without explaining what happened before and after (if possible)?

# Motivation and Contributions

## Motivation and Contributions

### Contributions

- A theoretical framework, flexible enough to accommodate drastic monetary regime changes.
- The modeling of U.S. inflation from 1870 to date.
- A central role to global inflation throughout all of U.S. inflation history.
- Some economies sharply reflect the impact of U.S.
- Recently, the pandemic inflation-disinflation arc started in the U.S. inflation spilled over its neighbors and the euro zone.

# Dominant Inflation Models

- Most inflation models for the U.S. are based on the Phillips curve and begin in 1960 at the earliest (aside from scatter plots for longer periods).
- Why? The indisputable long-run correlation between money and the price level.
- Some think a stable money demand is an inflation model for the long-run (Benati et al. (2021)).
- Many objections. Correlation is not causality. A cash-in-advance model assumes that money causes inflation.
- A recent counterexample: Lorenzoni and Werning (2023) show that there can be inflation even in a barter economy where money is only a unit of account.
- In such case, there is long-run correlation, but not causation, between money as unit of account and the price level.

# Inflation Models with Long Samples

## Hendry's U.K. Model

- Hendry (2001) studies U.K. inflation for 1875-1991.
- He uses many explanatory variables and dummies in a single equation.
- The approach of this paper is very different in that it considers that not all possible inflation drivers are always active and none has a special role, not even money.

# Monetary Regimes

## A definition

- The term “monetary regime” is widely used with very different meanings.
- For this paper, a monetary regime is defined by the variable pursued by the monetary authority, price level v. inflation rate, and the instrument to reach its objectives.
- These choices yield different determinants and dynamics.

# Types of pricing equations and monetary regimes

## Price level determination

- Do not confuse this with the price indeterminacy problem.
- $p_t \equiv$  price level and  $x_t$  its determinant. Both are  $I(1)$ .

$$p_t = \gamma_x E_t[p_{t+1}] + h_x x_t$$

- Long-run solution under rational expectations:

$$p_t - h_x x_t = I(0)$$

- Thus, only  $x$  has permanent effects on the price level.
- The choice of  $x$  determines the monetary regime.
- Historical examples of  $x$  are  $(m - y)$ ,  $(p^* + e)$ ,  $e$ ,  $p^*$ .



# Types of pricing equations and monetary regimes

## Inflation rate determination

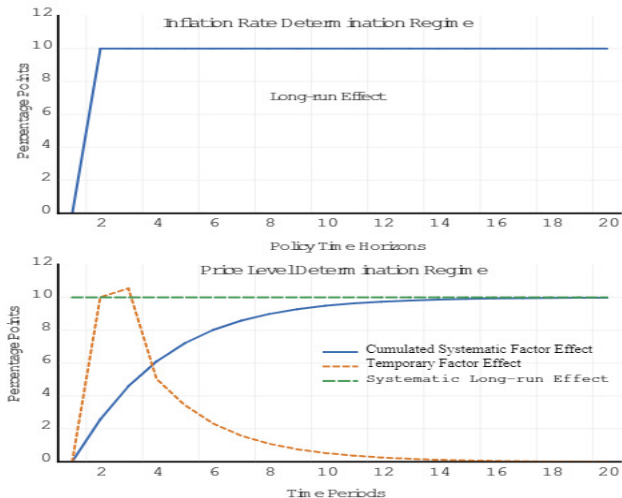
- $\Delta p_t \equiv$  inflation rate and  $(z_t - z_t^*)$  its determinant. Both are I(0).

$$\Delta p_t = \gamma_z E_t[\Delta p_{t+1}] + h_z(z_t - z_t^*)$$

- $(z_t - z_t^*)$  can be, literally, any suspected stationary variable.
- Examples are the unemployment and output gaps, money growth, exchange rate depreciation, costs shocks, etc.
- Any shock that remains beyond the policy horizon will permanently remain in the price level.

# Differences in inflation dynamics among monetary regimes

A graphical illustration



# Inflation U.S. Regimes and Drivers 1870-2023

## A summary

Periods	Monetary Regimen	Systematic Drivers	Temporary Drivers
1870-1938 Gold standard	Price level	U.K. price level	Excess money
1940-1983	Inflation rate	% $\Delta$ Excess money Global inflation	% $\Delta$ Commodity p.
1984-2019 Great moderation	Inflation rate	Global inflation output gap	% $\Delta$ Commodity p.
2020-2023 Pandemic arc	Inflation rate	Global inflation UnemployVacancies	Backlogs % $\Delta$ Real cars prices

# How were the monetary regimes dated?

- Automatic statistical procedures for regime change (Markov switching, TARs, etc.) are unfeasible.
- The main reason is that both the dependent variable and the drivers change by regime.
- The procedure indicates approximated dates with a mixture of narrative approach and statistical tests.

# U.S. Price Level Determination

Gold standard 1871-1939

- Until before WWII, the price levels of most developed countries had very similar trends.
- Until the mid 1920s, Britain was the leading economy and its price level was Granger-causing those of other economies, including the U.S.
- The main reason is that both the dependent variable and the drivers change by regime.

# U.S. Price Level Determination 1871-1939

Price Level Determination for the U.S. 1871-1939.

ARDL model with no trend and unconstrained constant.

Conditional error correction form.

	Model (i)												
$\Delta p_t^{us}$	=	-0.12	$p_{t-1}^{us}$	+ 0.12	$p_{t-1}^{uk}$	+ 0.22	$\Delta p_{t-1}^{us}$	+ 0.40	$\Delta p_t^{uk}$	+ 0.28	$\Delta bm_t^{us}$	- 0.10	$d_{1921}$
s.e.		(0.04)		(0.32)		(0.08)		(0.08)		(0.06)		(0.03)	
JarqueB	=	2.16		FB-Stat.	=	8.16**		tB-Stat.	=	-3.06*			
$\tilde{R}^2$	=	0.81		F-Autoc.	=	1.83		BPG-Het.	=	1.19			

Source: Own elaboration with data from Jordà et al. (2017).

Variables in logs. Superscript “us” means United States and “uk” United Kingdom.

s.e. = standard errors. F.B. = F Bounds Statistic. tB = t Bounds Statistic.

F-Autoc. = ARCH(2) L.M. test. BPG-Het. = Breusch et al. heteroskedasticity test.

\* and \*\* indicate significant at 10% and 5%, respectively, for I(1) variables.

# U.S. Inflation Rate Determination 1940-2019

- U.S. price level was no longer determined by the external price level.
- However, its inflation rate has been strongly correlated with global inflation.
- From 1940 to 1983, money growth was another determinant of U.S. inflation.
- As noticed by several authors (Bernake, 2006 and Lucas and Nicolini, 2015), since 1984 money lost its central role.
- Labor market conditions and the output gap have been weak drivers.

# U.S. Inflation Rate Determination Pandemic Arc

- After many years of failing to reach the 2% target, the Fed faced surging inflation.
- As in any regime of inflation rate determination, the influence of different causes is still debated.
- .
- As noticed by several authors (Bernake, 2006 and Lucas and Nicolini, 2015), since 1984 money lost its central role.
- Labor market conditions and the output gap have been weak drivers.



# U.S. Inflation Rate Determination Pandemic Arc

Core Inflation Rate Determination in the U.S. 2020-2023.

Two Stage Least Squares estimation with instruments:  $\Delta u2v_t$ ,  $ezpc_{t-1}$ ,  $\Delta ezpc_{t-2}$ ,  $bklg_t$ ,  $\Delta pcar_t$ ,  $vm2_{t-1}$ ,  $\Delta pcore_{t-1}^{us}$ ,  $\Delta pcore_{t-2}^{us}$ ,  $C$

						Model (iv)
$\Delta pcore_t^{us}$	=	-0.64	+ -0.09 $\Delta u2v_t$	+ 0.15 $ezpc_t$	+ 0.01 $bklg_t$	+ 0.10 $\Delta pcar_t \dots$
s.e.		(0.02)	(0.22)	(0.26)	(0.26)	(0.26)
		+ 0.27 $\Delta pcore_{t-1}^{us}$		- 0.30 $pcore_{t-2}^{us}$		
s.e.		(0.02)	(0.26)			
	JarqueB =	2.34	J-Stat =	0.69	P(J-Stat) =	0.70
	$\hat{R}^2$ =	0.86	F-Autoc. =	0.81	BPG-Het. =	0.30

Source: Own elaboration with data from BLS, Eurostat and Markit.

Variables in logs. Superscript "us" means United States.  $pcore$  = core cpi;  $u2v$  = unemployed to vacancies ratio;  $ezpc$  = first principal component of euro area CPIs;  $bklg$  = Markit backlogs index;  $pcar$  = cars CPI to total CPI component;  $vm2$  = velocity of circulation of M2;  $C$  = constant.

s.e. = standard errors. J-Stat = Hansen J Statistic. P(J-Stat) = p-value of J Statistic.

F-Autoc. = ARCH(2) LM test. BPG-Het. = Breusch et al. heteroskedasticity test.

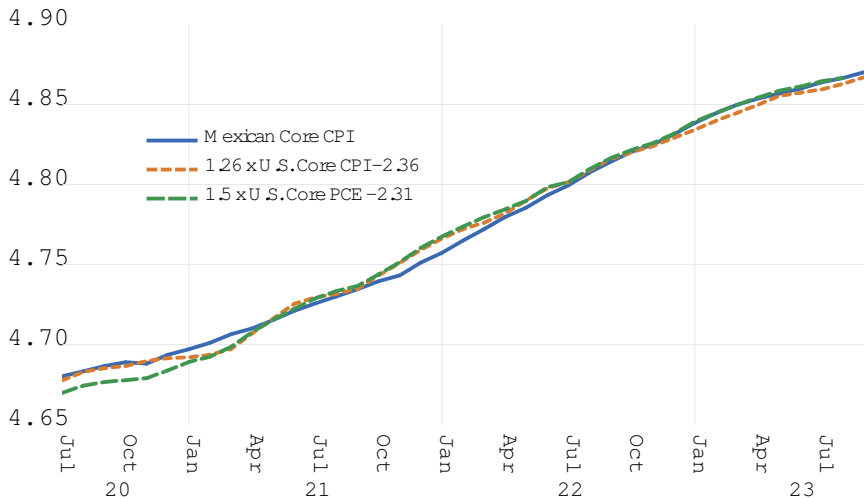
# Global Impact

## Advanced economies

- U.S. inflation historically highly correlated with that of Western advanced economies.
- Specially true for Canada, as the behavior of its price level over medium and long term is indistinguishable from that of U.S.
- During the pandemic, the relationship became even stronger to the point to cointegrate the levels.
- The causation went from U.S. inflation to euro zone and Canada inflation.

# Global Impact

## Mexico



# Conclusions

- The scarcity of inflation models over extended horizons might be due to the insistence of applying a particular theory.
- In some situations, inflation is driven by systematic causes that might not be active in others.
- A crucial distinction is if the monetary authority is trying to set a path for the price level versus the inflation rate.
- During the classical gold standard, the U.S. had price level determination but the driver was not domestic money but the U.K. price level.
- During the pandemic inflation arc, inflation started first in the U.S. and impacted other economies even some that had no domestic causes (example, Mexico).