

Optimal Taxation of Inflation

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Monetary policy faces challenges to stabilize inflation

- ▶ Monetary Policy (MP) adequate for demand shocks
- ▶ But MP faces trade-offs when...
 - ▶ Supply shock (energy price, supply-chain)
 - ▶ Inflation expectation shock (“de-anchoring”)
 - ▶ Distributional conflicts (Werning and Lorenzoni 2023a,2023b)
- ▶ Recent challenges: financial stability

A (new) instrument: a tax on inflation policy (TIP)

- ▶ A tax paid by firms, proportional to the increase in their price (or wages)
- ▶ **Hypothesis:** an effective instrument to control inflation
 - ▶ Especially for cost-push shocks and inflation expectation shocks
 - ▶ Mechanism: incentives to moderate price increases
- ▶ Widely discussed in 1970s, proposed by U.S. government in 1979 [More](#)

Contributions to literature

- ▶ Early literature on TIP (=Tax-based Income Policies) in 1970s and 1980s.
Wallich and Weintraub (1971), Kotowitz and Portes (1974), Latham and Peel (1977), Seidman (1978,1979), Okun and Perry (1978), Jackman and Layard (1982,1989), Koford and Miller (1992)
 1. Assess effectiveness of TIP in microfounded model
 2. Finding: TIP and MP are complement (\neq substitute)
- ▶ Optimal tax policies in New Keynesian models
Eggertsson and Woodford (2006), Correia et al. (2013), Farhi et al. (2014), Bilbie et al. (2023)
Generalize instruments.
- ▶ A few case studies of TIPS: Hungary in 1960s, Bulgaria, Poland in early 1990s
Portes (1970), Koford et al. (1993), Bogetic and Fox (1993), Enev and Koford (2000)

TIP in a conventional new keynesian model

- ▶ Households choose
 - ▶ Consumption and savings
 - ▶ Varieties of final goods (CES preferences)
 - ▶ Labor and wage (imperfectly substitutable)
- ▶ Firms in monopolistic competition choose prices and hire labor subject to
 - ▶ Convex adjustment cost $C(P_{t-1i}, P_{ti}) = \frac{\theta}{2} \left(\frac{P_{ti}}{P_{t-1i}} - 1 \right)^2 P_t Y_t$ (Rotemberg, 1982)
 - ▶ Tax on inflation

$$\Pi = P_{ti} Y_{ti} - W_t N_{ti} - C(P_{t-1i}, P_{ti}) - \tau_t (P_{ti} - P_{t-1i}) Y_{ti}$$

First-best with TIP: stabilization and specialization

- ▶ MP alone can address demand (discount factor, tax cut) and tfp
- ▶ MP cannot address cost-push and π -expectation shocks
 - ▶ Externality in the pricing decision of firms
 - ▶ TIP re-aligns private and social valuations and corrects excessive inflation

Proposition

- ▶ **Specialization**
 - ▶ *MP (demand/TFP) and TIP (markup/ π -expectation)*
- ▶ **Stabilization:** *TIP with MP perfectly stabilize the economy*
 - ▶ *No output gap and no inflation*

Equivalence with feebate on inflation and market for inflation permits

Feebate on Inflation Policy (FIP) FIP

- ▶ A feebate combines tax on inflation with a rebate
- ▶ Advantage: decrease tax burden

Market for Inflation Permits (MIP) MIP

- ▶ Trade rights to increase prices (Lerner, 1978)
- ▶ Advantage: MIP minimizes administrative costs, simple rule

Proposition

TIP, FIP and MIP can implement the same allocations.

Equivalence with payroll or production subsidies

- ▶ Advantage of payroll subsidies: conventional
- ▶ Weaknesses:
 - ▶ much larger fiscal cost: 3.5% of output to cut π by .5pp

Proposition

TIP and payroll subsidies can implement the same allocations.

subsidies

Targeting rules: TIP provides substantial stabilization gains

► $\tau_t = \varphi_\pi \pi_t$

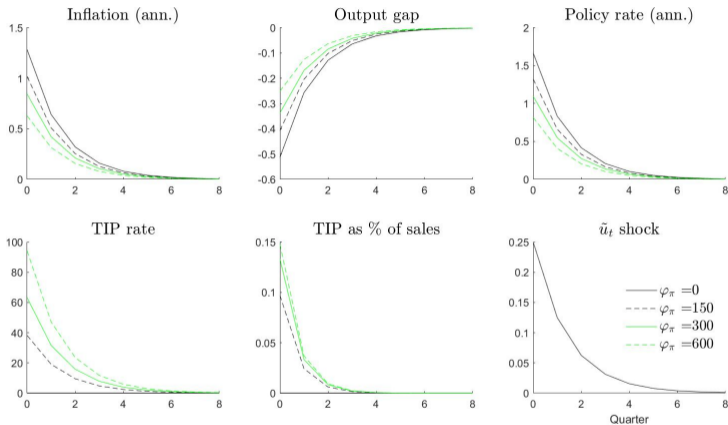


Figure: Effects of TIP following a cost-push or π -expectation shock

Targeting rules: TIP provides substantial stabilization gains

► $\tau_t = \varphi_\pi \pi_t$

► Stochastic environment

More

► Specialization

More

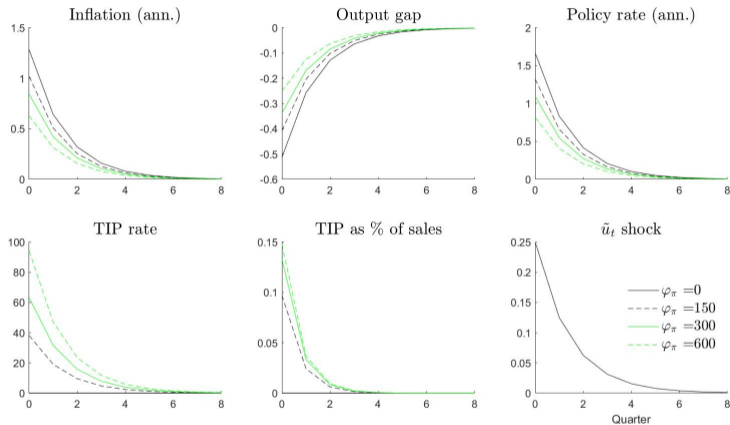


Figure: Effects of TIP following a cost-push or π -expectation shock

Calibration

TIP doesn't exacerbate relative price distortion

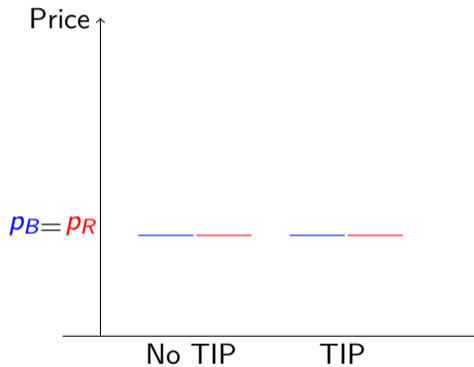
- ▶ Extension: many sectors with specific TFP shocks
- ▶ Are distortions due to sticky prices exacerbated by TIP? **No**

Proposition

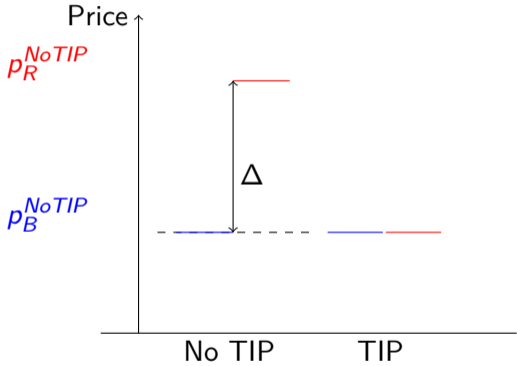
At 1st order, if price stickiness is homogeneous across sectors, the distribution of relative prices across sectors is independent of TIP.

- ▶ Numerically robust to non-linear model with heterogeneous price stickiness
- ▶ TIP is linear in price changes (subsidy for price decreases)

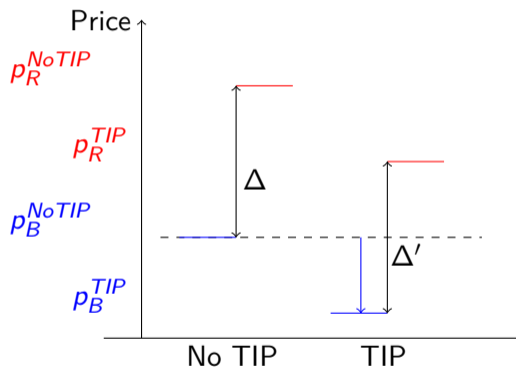
TIP doesn't exacerbate relative price distortion



TIP doesn't exacerbate relative price distortion



TIP doesn't exacerbate relative price distortion



Robustness checks and implementation issues

1. Tax on large firms (top 1%)
 - ▶ TIP is almost as effective as in the baseline case
 - ▶ They account for 75% of sales
2. Tax on wages
 - ▶ Effectiveness of TIP on wages at controlling price inflation depends on the shock
 - ▶ For shocks in the price Phillips curve, TIP on wages is much less effective
3. Time-dependent Calvo-type frictions

Conclusion

- ▶ A tax on inflation policy (TIP) is a powerful instrument to control inflation in the face of persistent wage-price spirals and shifts to inflation expectations
- ▶ Relevant today for addressing "stubborn" inflation
- ▶ Future research
 - ▶ Tax avoidance by firms and workers [More](#)
 - ▶ Political economy [More](#)

Future research on implementation

- ▶ Tax avoidance by firms and workers
 - ▶ Firms relabel old products as seemingly new ones, or shrink quality.
 - ▶ Risks are small given low tax burden of TIP
 - ▶ Taxing wages or a price index at the firm-level could mitigate
 - ▶ Quantification with endogenous product creation, information asymmetries about quality and costly monitoring is important next step
- ▶ Firms postpone quality innovation if authorities fail to distinguish price from quality changes
 - ▶ Issue is confined to periods of elevated TIP (i.e. of high inflation)
 - ▶ May not significantly impede long-run growth
- ▶ TIP in corporate, income, payroll tax or standalone tax?

Future research on political economy

- ▶ Risks that TIP be used for objectives other than macroeconomic stabilization
- ▶ Risks that it leads to less independent monetary policy
- ▶ Its conduct should be given to an **independent committee**
 - ▶ like central banks or energy and telecommunication commissions
 - ▶ justification: revenues generated by TIP are very small + clear and narrow mandate

TIP in practice

- ▶ In the 1970s, versions of TIP were implemented.
 - ▶ France: 1974-1977, "prélèvement conjoncturel"
 - ▶ Mexico, Belgium, Italy, the Netherlands: more research is needed
- ▶ Close to be implemented in the U.S. in 1978
 - ▶ "Real wage insurance"
 - ▶ Supplement the wage-price guidelines (voluntary limits on wage and price increases)
- ▶ Transition of formerly Soviet countries to market economies
 - ▶ Early 1990s in Bulgaria, Poland and Romania
 - ▶ World Bank put forward an anti-inflation plan to stabilize prices and output

Why have discussions around TIP stopped?

- ▶ In the U.S. case, Congress was afraid of its uncertain costs for the Federal budget
- ▶ Combined TIP with price controls which were unpopular
- ▶ Successful Volcker's disinflation policy in the 1980s
- ▶ Change in policy views: supremacy of MP

What we don't do

- ▶ Truthful reporting and tax avoidance by firms and workers
 - ▶ firms can replace their old product with seemingly "new" product
 - ▶ and/or shrink quality ("shrinkflation")
 - ▶ and or sell on underground markets
- ▶ Should TIP be included into the corporate, income, payroll tax or standalone tax?

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Taylor Principle remains crucial to ensure determinacy

Proposition (Determinacy)

The equilibrium path is unique if one of the following holds

▶ $\phi_\pi > 1$ and $\varphi_y < \min \left(\frac{\theta\kappa}{1-\beta}, \frac{\theta\phi_\pi\kappa + \theta(1-\beta)(\sigma + \phi_y)\left(1 + \frac{\varphi_\pi}{\theta}\right)}{\phi_\pi - \beta} \right)$ (Taylor principle)

▶ $\beta < \phi_\pi < 1$ and $\frac{\theta\kappa}{1-\beta} < \varphi_y < \frac{\theta\phi_\pi\kappa + \theta(1-\beta)(\sigma + \phi_y)\left(1 + \frac{\varphi_\pi}{\theta}\right)}{\phi_\pi - \beta}$

▶ $\phi_\pi < \beta$ and $\frac{\theta\kappa}{1-\beta} < \varphi_y$

Calibration

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Parameters	Description	Value
α	One minus the elasticity of output to labor	0.25
β	Time discount factor	0.99
σ	Elasticity of intertemporal substitution	1
ψ	Inverse Frish elasticity of labor	5
ϵ	Elasticity of substitution across varieties	9
ϵ_N	Elasticity of substitution across labor types	∞
θ	Adjustment cost	372.8
ρ_u	Autocorrelation of markup shock	0.5
ρ_a	Autocorrelation of productivity shock	0.5
ρ_{mp}	Autocorrelation of monetary shock	0.5
η_y	Preference for output stability	0.113
η_i	Preference for interest rate stability	0.687

Table: Model parameters [Back](#)

Optimal MP

Setting:

- ▶ Find the loss function such that the optimal MP without TIP is the standard Taylor rule

$$\mathcal{L}^* = \min_{i_t, \tau_t} \sum_{t=0}^{\infty} E_0 \beta^t \left[\pi_t^2 + \alpha_y (\hat{y}_t^e)^2 + \alpha_i (i_t)^2 \right]$$

- ▶ To ensure an interior solution, the economy faces both supply and demand shocks

Given TIP (φ_π, φ_y) , solve the optimal MP (ϕ_π^*, ϕ_y^*)

- ▶ For TIP, we will focus on φ_π because the optimal φ_y is almost always 0 unless we allow for negative φ_y

A Two-Equation Summary of the Log-Linearized Model

Denote $\hat{x}^e = \log(X/X^e)$ where X^e is the efficient flex-price equilibrium.

Lemma

The equilibrium is described by a Euler equation and a Phillips curve augmented with the *current TIP* and *future TIP*

$$\hat{y}_t^e = E_t \hat{y}_{t+1}^e - \frac{1}{\sigma} (i_t - E_t \pi_{t+1} - r_t^e)$$
$$\pi_t = \beta E_t \pi_{t+1} + \kappa \hat{y}_t^e + \frac{1}{\theta} [u_t - \tau_t + \beta E_t \tau_{t+1}]$$

where u_t is a cost-push shock and $\kappa = \frac{\epsilon-1}{\theta} \left(\sigma + \frac{\psi+\alpha}{1-\alpha} \right)$

Feebate on Inflation Policy (FIP)

- ▶ Argument: TIP increases the tax burden on firms at a time where they are already facing shocks
- ▶ Solution: a feebate would combine tax on inflation with a well-designed rebate
- ▶ Under a feebate:

$$\Pi = P_{ti}Y_{ti} - W_tN_{ti} - \tau_t(P_{ti} - P_{t-1i})Y_{ti} - \mathcal{C}((P_{t-1i}, P_{ti}) + F_t$$

with $F_t = \tau_t(P_t - P_{t-1})Y_t$.

- ▶ Result: FIP can achieve exactly the same macroeconomic outcomes as TIP while preserving firms' profitability.

Market for Inflation Permits (MIP)

- ▶ Argument: TIP involves administrative costs
- ▶ Solution: Lerner originally proposed a market-based design, MIP, where firms trade rights to increase prices.
- ▶ Quantity of permits H_t is controlled by the government and price q_t endogenous

$$\begin{aligned}\Pi &= P_{ti}Y_{ti} - W_tN_{ti} - q_t(P_{ti} - P_{t-1i})Y_{ti} - C((P_{t-1i}, P_{ti})) \\ H_t &= \int_0^1 (P_{ti} - P_{t-1i})Y_{ti}di \quad (\text{Clearing of MIP})\end{aligned}$$

- ▶ Result: a MIP achieves exactly the same macroeconomic outcomes as the TIP if and only if $H_t = \frac{\pi_t^{TIP}}{1+\pi_t^{TIP}} P_t^{TIP} Y_t^{TIP}$.

Payroll or Production Subsidies

► $\Pi(P_{t-1i}, P_{ti}, Y_{ti}) = P_{ti}Y_{ti} - (1 - a_t^w)W_tN_{ti} - \mathcal{C}(P_{t-1i}, P_{ti})$ [Back](#)

Proposition

Payroll subsidies generate the same macro outcome as TIP if

$$a_t^w = \frac{\tau_t - E_t Q_t^e \left(\frac{A_{t+1}}{A_t} \right)^{\frac{(1+\psi)}{(1-\alpha)\sigma+\psi+\alpha}} \tau_{t+1}}{(\epsilon_t - 1)\mathcal{M}_t\mathcal{M}_t^w}$$

► Weaknesses:

1. large fiscal cost for the government's budget
2. regressive, politically less acceptable
3. distortive: energy consumption, emission

Targeting rules and determinacy

- ▶ Targeting rules:

$$i_t = \rho + \phi_\pi \pi + \phi_y \hat{y}_t^e$$

$$\tau_t = \bar{\tau} + \varphi_\pi \pi + \varphi_y \hat{y}_t^e$$

Targeting rules and determinacy

- ▶ Targeting rules:

$$i_t = \rho + \phi_\pi \pi + \phi_y \hat{y}_t^e \qquad \tau_t = \bar{\tau} + \varphi_\pi \pi + \varphi_y \hat{y}_t^e$$

- ▶ The equilibrium path is unique if and only if one of the following holds
 1. $\phi_\pi > \underline{\phi}_\pi$ and $\varphi_y < \bar{\varphi}_y$
 2. $\phi_\pi < \underline{\phi}_\pi$ and $\varphi_y > \bar{\varphi}_y$

Proposition

Targeting rules and determinacy

- ▶ Targeting rules:

$$i_t = \rho + \phi_\pi \pi + \phi_y \hat{y}_t^e \qquad \tau_t = \bar{\tau} + \varphi_\pi \pi + \varphi_y \hat{y}_t^e$$

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 2. $\phi_\pi < \underline{\phi}_\pi$ and $\varphi_y > \bar{\varphi}_y$

Proposition

- ▶ In practice, $\bar{\varphi}_y$ is too large – > focus on inflation-targeting TIP: $\tau_t = \bar{\tau} + \varphi_\pi \pi_t$

Cost-push and π -expectation shocks: TIP reduces impact on inflation and output

- ▶ Lower inflation and less need for aggressive MP
- ▶ Smaller impact on output
- ▶ Low effective tax burden

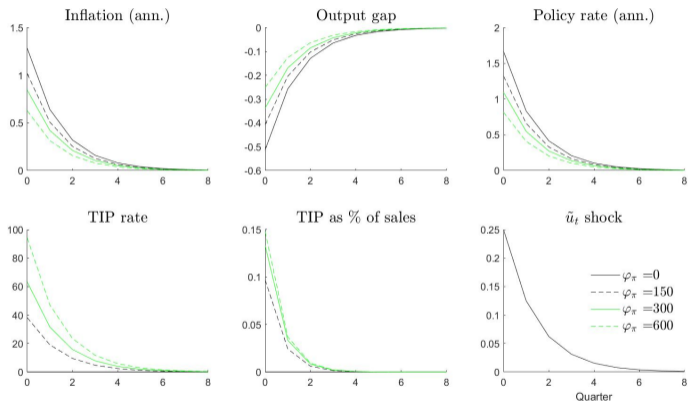


Figure: Effects of TIP following a cost-push or π -expectation shock

Demand shocks: TIP moderates inflation but implies a trade-off

- ▶ Similarly, lower inflation and less aggressive MP
- ▶ But inflation/output gap trade-off

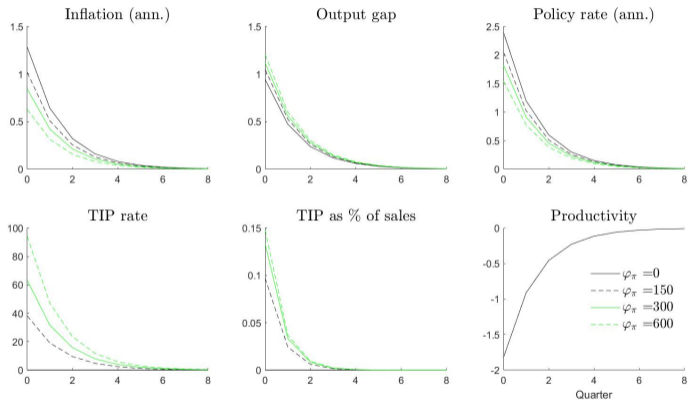


Figure: Effects of TIP following a demand shock

Special case: TIP reduces the cost of deviating from MP rule

In reality, MP may need to deviate from the policy rule in response to other factors.

- ▶ E.g., financial stability concerns may justify a looser MP stance
- ▶ Lower inflation cost
- ▶ Increase room for monetary loosening

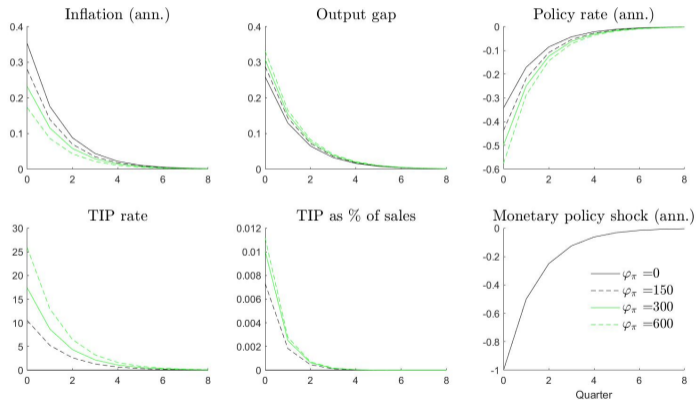


Figure: Effects of TIP following a MP shock

Substantial stabilization gains from TIP

- ▶ Larger for cost-push and π -expectation shocks

	No TIP	Strong TIP
φ_π	0	300
$\sigma(\pi_t^{ann})$	0.74	0.49
$\sigma(\hat{y}_t^e)$	0.59	0.39
$\sigma(i_t^{ann})$	0.96	0.63
$\sigma(\tau_t)$	0	73.0
$E(\pi_t \tau_t)$	0	0.18

Table: Cost-push and π -expectation shocks

- ▶ Smaller for demand shocks

	No TIP	Strong TIP
φ_π	0	300
$\sigma(\pi_t^{ann})$	0.74	0.49
$\sigma(\hat{y}_t^e)$	1.09	1.29
$\sigma(i_t^{ann})$	1.38	1.05
$\sigma(\tau_t)$	0	73.0
$E(\pi_t \tau_t)$	0	0.18

Table: Demand shocks

Specialization: TIP tilts the optimal MP towards output stabilization

- ▶ Given φ_π , solve the optimal MP and φ_y^*

	No TIP	Moderate TIP	Strong TIP
φ_π	0	150	300
φ_y^*	0	0	0
ϕ_π^*	1.5	0.99	0.98
ϕ_y^*	0.125	0.126	0.162

Table: TIP and Optimal MP

- ▶ Intuition: Each policy specializes in its comparative advantage