Defining Inflation Targets, the Policy Horizon, the Output-Inflation Tradeoff, and more

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Introduction

Introduction

- The inflation objective can be described in terms of a desired distribution for inflation, with an average value and a variability (variance). But in practice the target is always defined by a mean value or a range.
- Setting the target in terms of a mean and a variance is equivalent to setting it in terms of a range and a percentage of time that inflation is expected it to lie within that range. This is comparable to setting the target around an inflation projection, where the future time frame is known as the "policy horizon" and depends on the variance of the inflation target. The greater the fraction of time that inflation is sought to lie within the range, the shorter the necessary policy horizon.
- A flexible inflation targeting scheme, where the target is defined with a time horizon, reflects the objective function of a central bank that values both price and output stability. In particular, a direct relationship also exists between the policy horizon and tolerance of inflation deviations from the target, on one hand, and the importance attributed by the authorities to deviations from full-employment output, on the other. The more inflation averse the policymaker, the shorter the policy horizon and the less volatility in inflation will be tolerated. In addition, the policy horizon increases with the degree to which price setting in the economy is backward looking, and decreases with the slope of the Phillips curve.

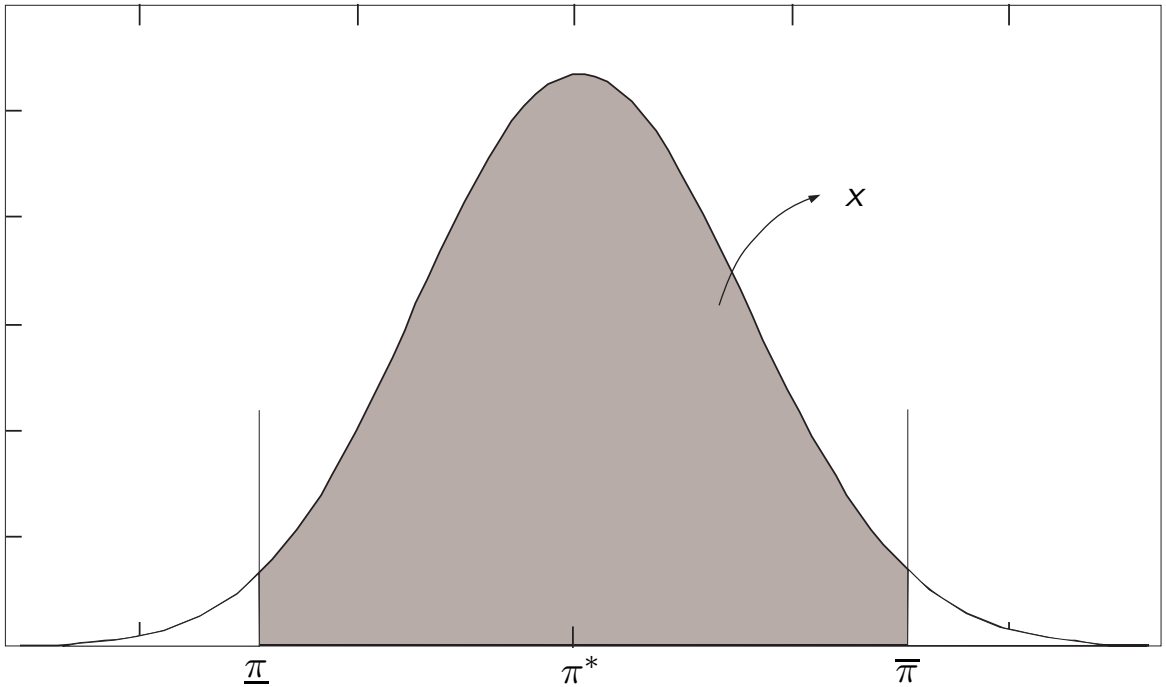
Introduction

- The great moderation in developing countries took place at least ten years after that of industrial countries, i.e. in the second half of the nineties. This casts doubts on global factors to explain these developments. In contrast, a salient feature in developing countries has been the simultaneous decline in inflation and improvement in public finances, which lends support to the view that to a large extent the great moderation is the result of better macroeconomic policies.
- Most inflation targets refer to headline inflation, in contrast to support from the literature on measures closer to core inflation, or "sticky-prices" inflation. Although core inflation may be a useful tool for forecasting inflation, credibility factors, as well as clear guidelines on which precise index central banks should target, support the current practice of most central banks.

Country	Beginning	Current Range (%)	Target	Current Horizon (quarters)	Selects Target
	(1)	(2)	(3)	(4)	(5)
Australia	1993Q1	2-3	CPI	open	CB–G
Brazil	1999Q2	2.5-6.5	CPI	4	CB–G
Canada	1991Q1	1-3	CPI	6-8	CB–G
Chile	1999Q3	2-4	CPI	8	CB
Colombia	1999Q3	4.5-5.5	CPI	4	CB–G
Czech Republic	1998Q1	2-4	CPI	6-8	CB
Hungary	2001Q3	2.5-4.5	CPI	4	CB
Iceland	2001Q1	1-4	CPI	all times	CB–G
Israel	1997Q2	1-3	CPI	year end	G
Korea	1998Q2	2.5-3.5	Core CPI	4	CB–G
Mexico	2002Q1	2-4	CPI	4	CB
New Zealand	1990Q1	1 - 3	CPI	6-8	CB–G
Norway	2001Q1	1.5-3.5	CPI	8	G
Peru	2002Q1	1.5-3.5	CPI	4	CB
Philippines	2002Q1	5-6	CPI	4	CB–G
Poland	1999Q1	1.5-3.5	CPI	5-7	CB
South Africa	2000Q1	3-6	CPIX	4	CB
Sweden	1993Q1	1-3	CPI	4-8	CB
Switzerland	2000Q1	0-2	CPI	open	CB
Thailand	2000Q2	0-3.5	Core CPI	4	CB
United Kingdom	1992Q4	1-3	CPI	all times	G

Source: Columns (1) and (2) from Batini and Laxton (2005), (3) and (5) from Tuladhar (2005), and column (4) and revisions of other columns from individual country sources. Notes: CB: central bank; G: government; CPI: consumer price index.

Distribution of Inflation



The policy horizon

As shown by Svensson (1997), the inflation target may be operationalized by setting the objective in terms of an inflation projection over a given horizon (policy lags and output-inflation tradeoff).
Inflation process:

$$\pi_t - \pi^* = \rho(\pi_{t-1} - \pi^*) + \epsilon_t, \tag{1}$$

and

$$\sigma_\pi^2 = \frac{\sigma_\varepsilon^2}{1-\rho^2}. \tag{2}$$

Inflation forecast: The projection T periods ahead is

$$\mathrm{E}_t \pi_{t+T} = \rho^T \pi_t + (1-\rho^T)\pi^*. \tag{3}$$

As the horizon lengthens (that is, as T rises), ρ^T approaches zero and the projection approaches π^*. The conditional forecast, $\rho^T \pi_t + (1-\rho^T)\pi^*$ is the variable in which the operational objective of the central bank is based.

The policy horizon

Given that only as T goes to infinity does the projection converge to π^*, it is assumed that a tolerance margin is allowed, expressed as the variance of the conditional forecast s. As a consequence, the variance of the projected inflation that is obtained from equation (3) is:

$$T = \frac{\log s - \log \sigma_\pi^2}{2 \log \rho} \tag{4}$$

$$= \frac{\log s - \log \sigma_\varepsilon^2 - \log(1-\rho^2)}{2 \log \rho}. \tag{5}$$

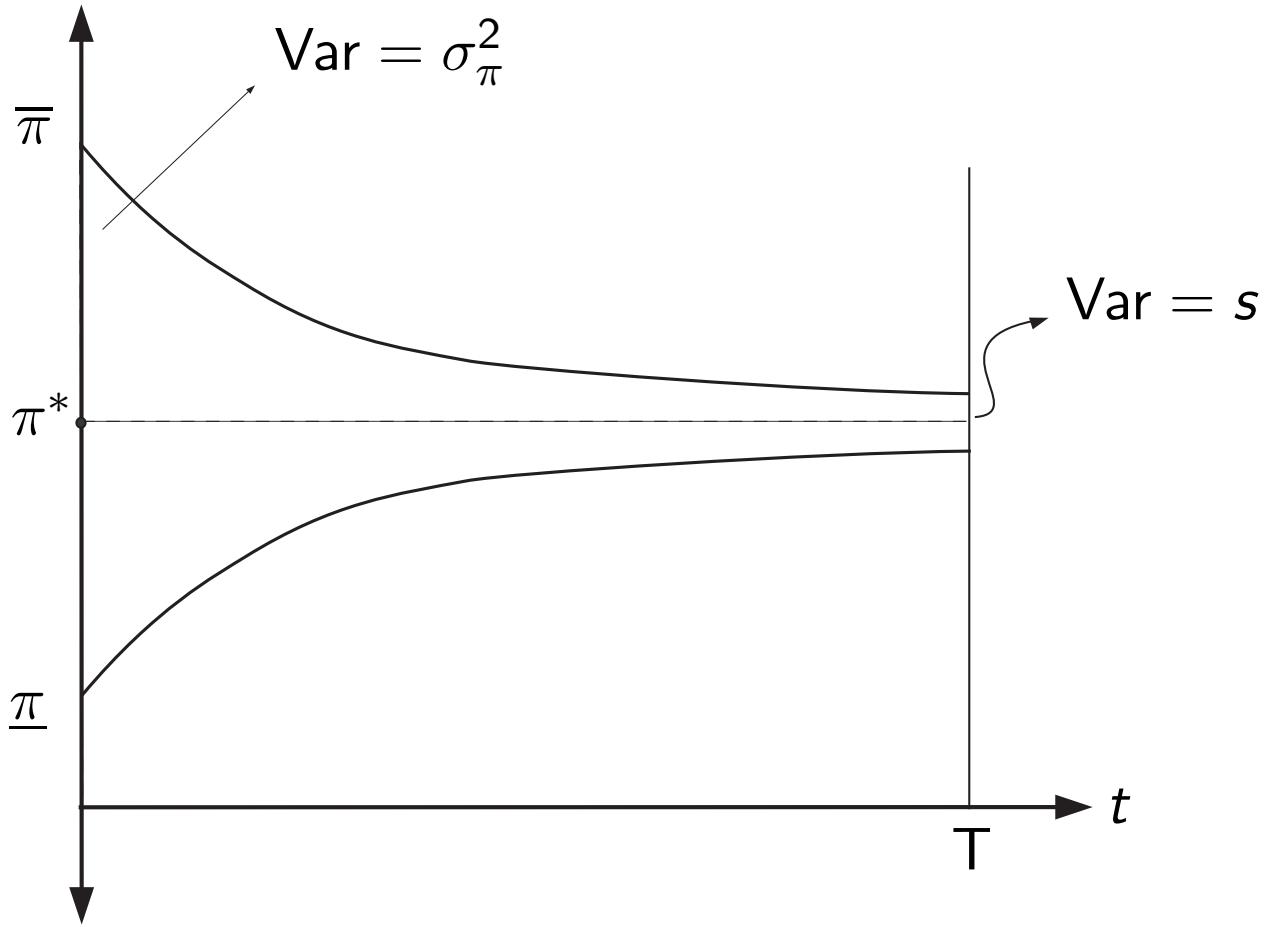


Figure: Inflation Target and Policy Horizon

Table: **Implicit Parameters of the Inflation Target**

	Beginning	Current Range (%)	ρ	$\sigma_\epsilon^2 \times 1000$	x (%)	Current Horizon	T $\pm.1$ (months)	T $\pm.2$	T $\pm.3$
Stable Inflation Targets									
Australia	1994Q3	2-3	0.84	0.09	22.4	-	60	48	41
Canada	1995Q1	1-3	0.66	0.04	77.7	24	20	15	12
Chile	2001Q1	2-4	0.82	0.05	59.4	24	47	37	31
Iceland	2002Q1	1-4	0.54	0.06	89.4	-	14	11	9
Korea	1999Q1	2.5-3.5	0.79	0.04	63.6	12	40	31	26
New Zealand	1993Q1	1-3	0.89	0.04	53.3	24	88	70	59
Norway	2001Q1	1.5-3.5	0.62	0.13	50.9	24	21	17	14
Peru	2002Q1	1.5-3.5	0.84	0.08	45.9	12	60	48	41
South Africa	2001Q1	3-6	0.85	0.31	34.8	12	78	65	57
Sweden	1995Q1	1-3	0.93	0.03	50.6	24	134	106	90
Switzerland	2000Q1	0-2	0.60	0.01	97.9	-	12	8	6
United Kingdom	1992Q4	1-3	0.81	0.02	79.2	-	40	30	24
Median			*0.82*	*0.05*	*59.4*	*24*	*40*	*31*	*26*
Unstable Inflation Targets									
Brazil	1999Q2	2.5-6.5	0.9	0.41	33.3	12	128	108	97
Colombia	1999Q3	4.5-5.5	0.73	0.19	19.5	12	36	29	25
Czech Republic	1998Q1	2-4	0.76	0.11	46.1	24	38	30	26
Hungary	2001Q3	2.5-4.5	0.79	0.06	56.3	12	41	32	27
Israel	1997Q2	1-3	0.73	0.37	27.7	6	39	32	28
Mexico	2002Q1	2-4	0.72	0.07	59.4	12	29	23	19
Philippines	2002Q1	5-6	0.89	0.29	10.5	12	113	95	84
Poland	1999Q1	1.5-3.5	0.85	0.15	33.3	21	71	58	51
Median			*0.78*	*0.17*	*33.3*	*12*	*40*	*32*	*27.5*
Median All			*0.82*	*0.07*	*52.1*	*12*	*40*	*31.5*	*26.5*

The output-inflation tradeoff

[Base Model]

$$\mathsf{L} = a(y - \bar{y})^2 + (\pi - \pi^*)^2. \tag{6}$$

Inflation is determined by the following Phillips curve:

$$\pi_t = \alpha\pi_{t-1} + (1-\alpha)\mathsf{E}_{t-1}\pi_t + \delta(y - \bar{y}) + \nu. \tag{7}$$

Solution:

$$\pi - \pi^* = \frac{1}{1+\phi}(\pi_{-1} - \pi^*) + \frac{\nu}{1+\phi\alpha}, \tag{8}$$

where

$$\phi \equiv \frac{1}{a\theta^2\alpha}. \tag{9}$$

Optimal inflation has the same form assumed in equation (1) where the autocorrelation coefficient and the error depend on the fundamental parameters of the model and on the inflationary shock. That is,

$$\rho = \frac{1}{1+\phi} = \frac{a\theta^2\alpha}{1+a\theta^2\alpha}, \quad \varepsilon = \frac{\nu}{1+\phi\alpha}, \text{ and } \sigma_\pi^2 = \left(\frac{a\theta^2}{1+a\theta^2}\right)\frac{\sigma_\nu^2}{1-\rho^2}. \tag{10}$$

Discussion:

- Expected inflation is equal to the central value of the target, π^*, and inflation follows an AR(1) process.
- When the central bank is not concerned about unemployment (that is, $a = 0$), the value of ρ would be zero and expected inflation would adjust to π^* in each period. Therefore the policy horizon collapses to zero.
- The greater the volatility of inflationary shocks (σ_ν^2), the greater the variance of target inflation, which, in turn, generates a longer policy horizon.
- When the degree of backward-lookingness, measured by α, increases, as this also produces a slower adjustment and greater variability of the inflation target: the target range increases
- When the slope of the Phillips curve decreases (δ falls and θ rises), the output gap has a smaller impact on inflation. Therefore the central bank will accept a greater inflation variance, or a longer policy horizon, because it does not want to vary the output gap too much to offset inflationary shocks

Extensions

Infinite Horizon - App. A

$$
\begin{aligned}
L_t &= E_t\left[\sum_{i=0}^{\infty}\beta^i\left\{a(y_{t+i}-\overline{y})^2+(\pi_{t+i}-\pi^*)^2\right\}\right] \\
y_t-\overline{y} &= \theta\left[\pi_t-(1-\alpha)E_{t-1}\pi_t-\alpha\pi_{t-1}-\nu_t\right]
\end{aligned}
$$

Hybrid NK Phillips curve - App. B

$$
\begin{aligned}
L_t &= a(y_t-\bar{y})^2+(\pi_t-\pi_t^*)^2 \\
\pi_t &= \alpha\pi_{t-1}+(1-\alpha)E_t\pi_{t+1}+\delta(y_t-\overline{y})+\nu_t
\end{aligned}
$$

Table: **Summary of Results**

	ρ	σ_π^2	T
Base Model - Section 4			
a	+	+	+
α	+	+	+
θ	+	+	+
σ_ν^2	0	+	+
Infinite Horizon - App. A			
a	+	+	+
α	?	?	?
θ	+	+	+
σ_ν^2	0	+	+
Hybrid Phillips Curve - App. B			
a	+	+	+
α	+	+	+
θ	+	+	+
σ_ν^2	0	+	+

The great moderation

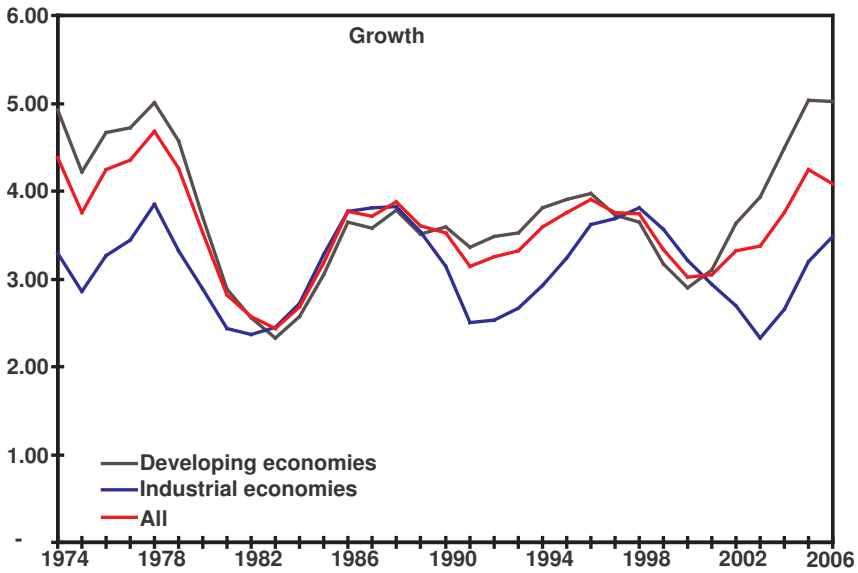
- There has been a significant decline in output as well as inflation volatility since the mid-1980s for industrial countries and more recently in emerging markets. Can this model help us to explain this evidence?

$$\partial\sigma_\pi^2/\partial a > 0, \quad \partial\sigma_\pi^2/\partial\alpha > 0, \quad \partial\sigma_\pi^2/\partial\theta > 0, \quad \text{and} \partial\sigma_\pi^2/\partial\sigma_\nu^2 > 0$$

$$\partial\sigma_y^2/\partial a < 0, \quad \partial\sigma_y^2/\partial\alpha > 0, \quad \partial\sigma_y^2/\partial\theta ? 0, \quad \text{and} \partial\sigma_y^2/\partial\sigma_\nu^2 > 0.$$

- A number of explanations have been offered for the increased stability of inflation and output in recent decades. Several of these lie outside the realm of monetary policy, such as the impact of better inventory management, sectoral shifts toward sectors less sensitive to the business cycle, or financial deepening.
- In this model a reduction in α, the degree of indexation or backward-looking price setting, reduces the variance of both inflation and output. We can also interpret this as an increase in credibility.
- A reduction in the variance of inflationary shocks, σ_ν^2, would increase the stability of output and inflation.
- In contrast, as expected, an increase in *a*, the degree of preference for output versus inflation stability, reduces the variance of output but increases the variance of inflation, and therefore changes in *a*, by itself, cannot account for the great moderation. Finally, with an increase in the slope of the Phillips curve (θ declines), the variance of inflation declines, and the effect on the variance of output is uncertain and will depend on the configuration of the parameter.

The Great Moderation: Is it policy? Is it inflation targeting?



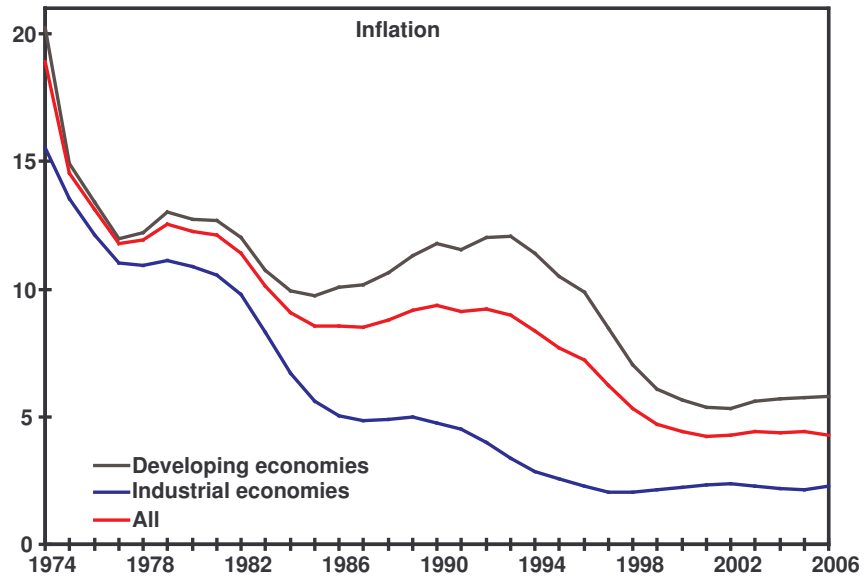
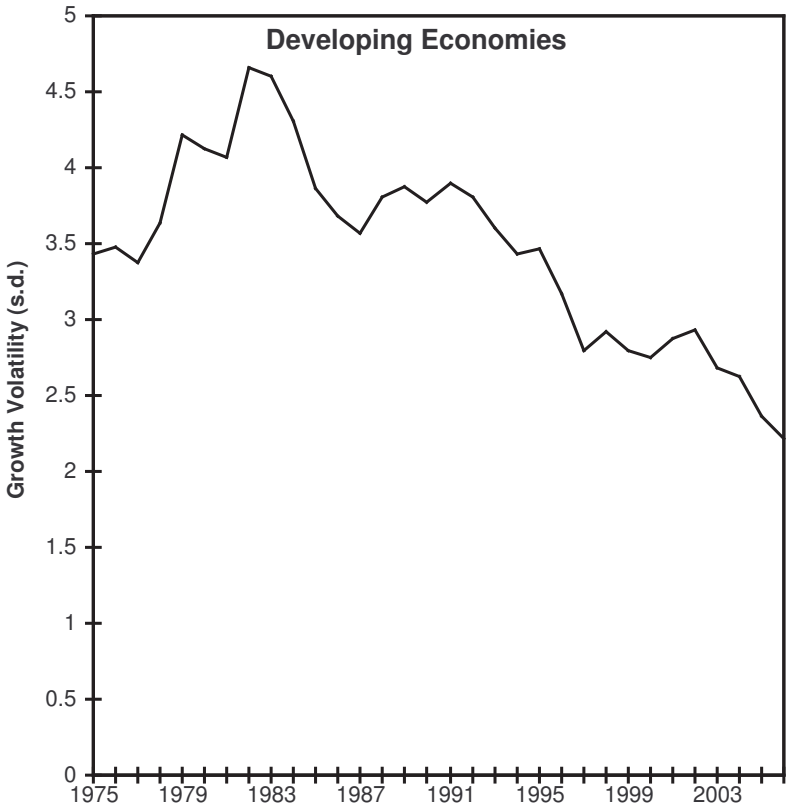


Figure: Growth and Inflation

The Great Moderation: Growth volatility has declined



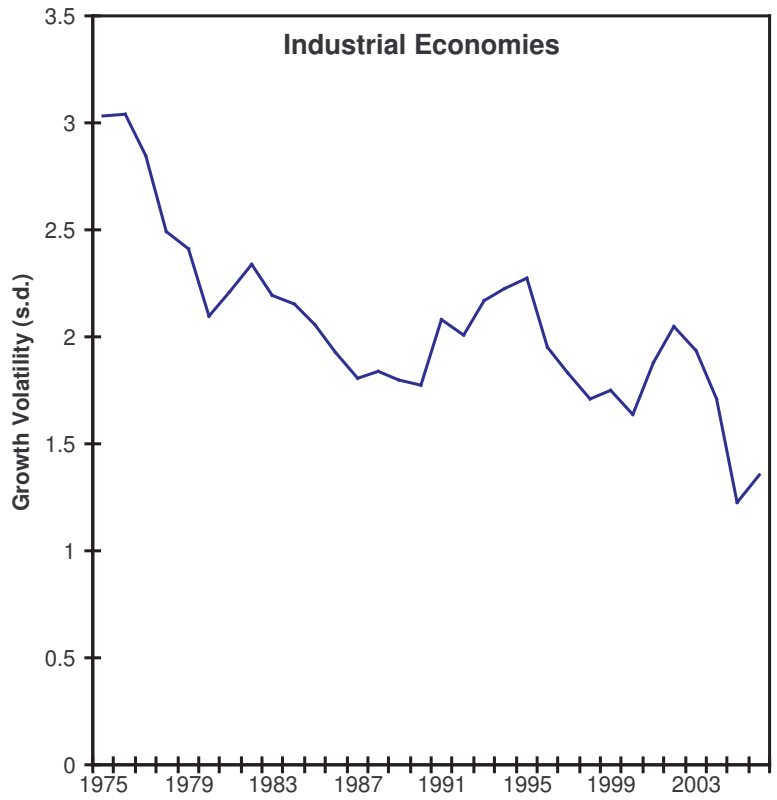
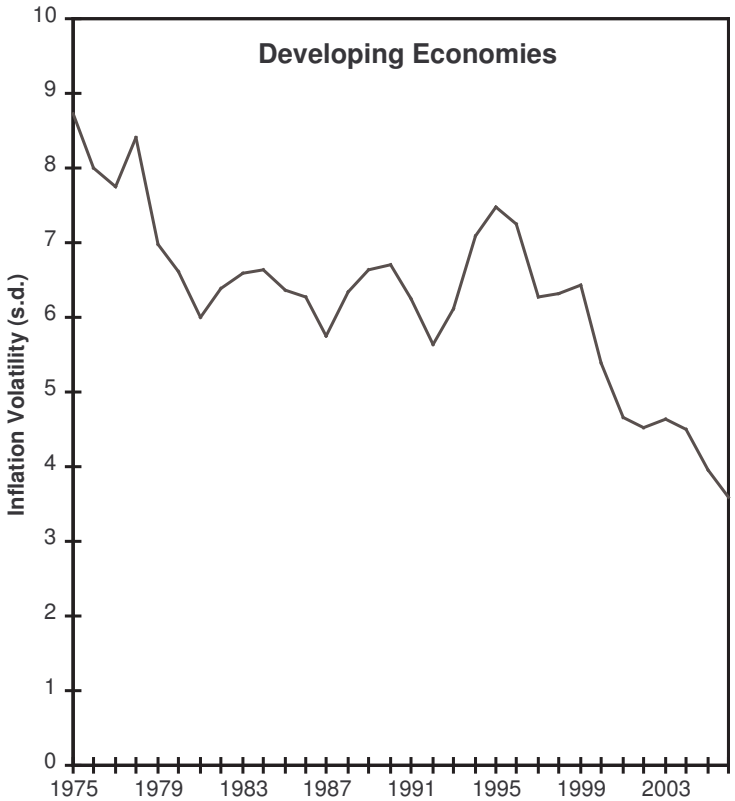
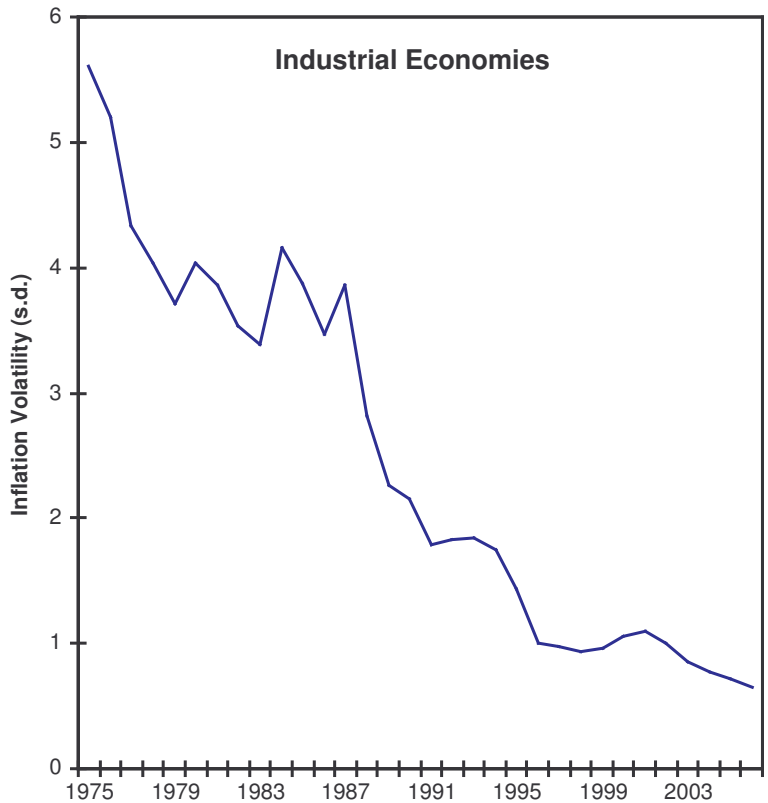


Figure: Average Growth Volatility

The Great Moderation: Inflation volatility has declined

The moderation took place in the mid 80s in industrial countries and in the second half of the 90s in developing economies, for growth as well as inflation. If there were global factors the reduction of volatility should occur at the same time in most countries. In contrast, the great moderation coincides with the decline in inflation, which suggests a key role for monetary policy.





The Great Moderation: Greater stability in IT developing economies

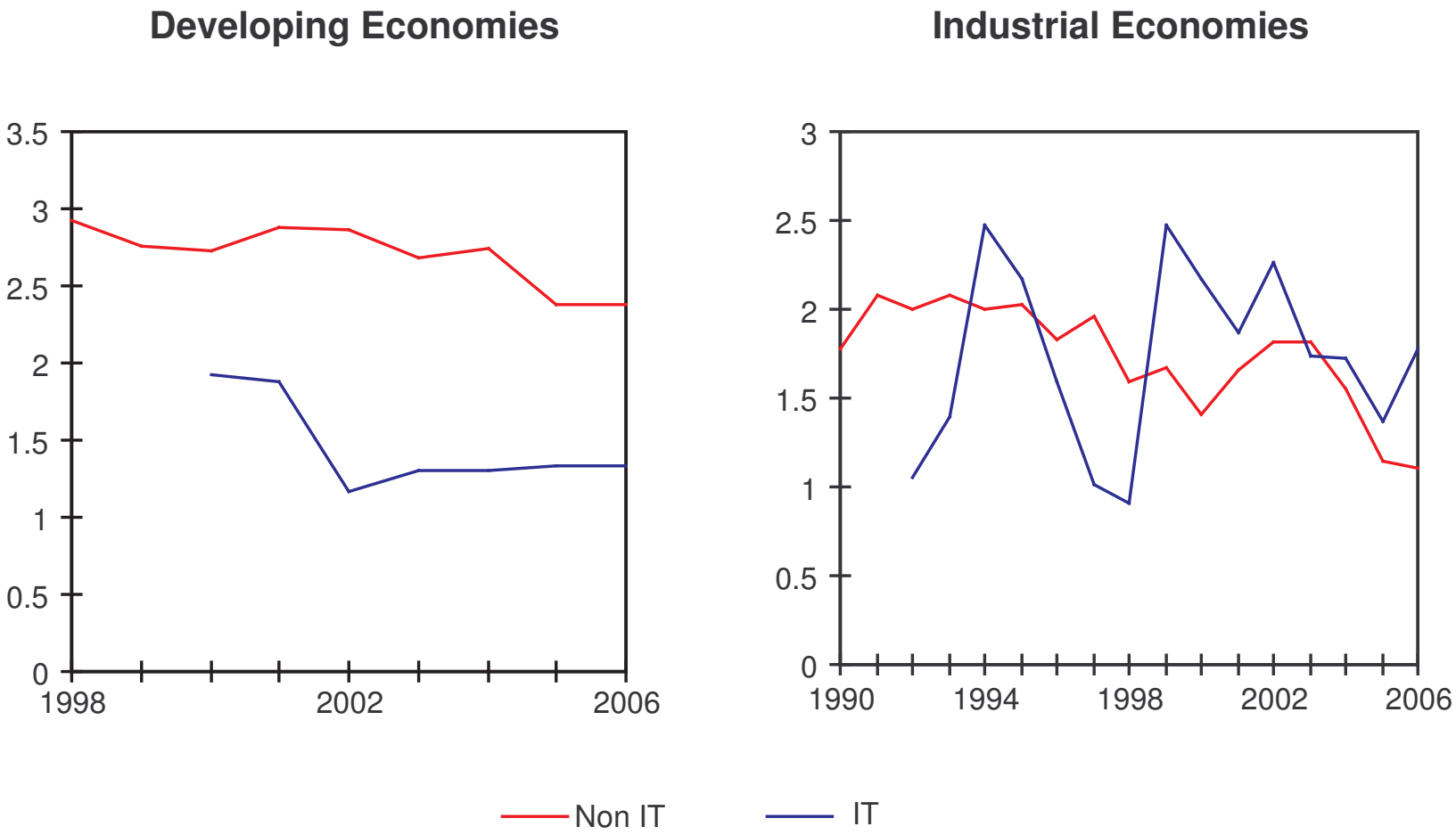


Figure: Growth Volatility IT vs. Non-IT Economies

IT regimes are more stable than non-IT in developing countries, although there could be selectivity bias. The evidence is not clear in industrial countries.

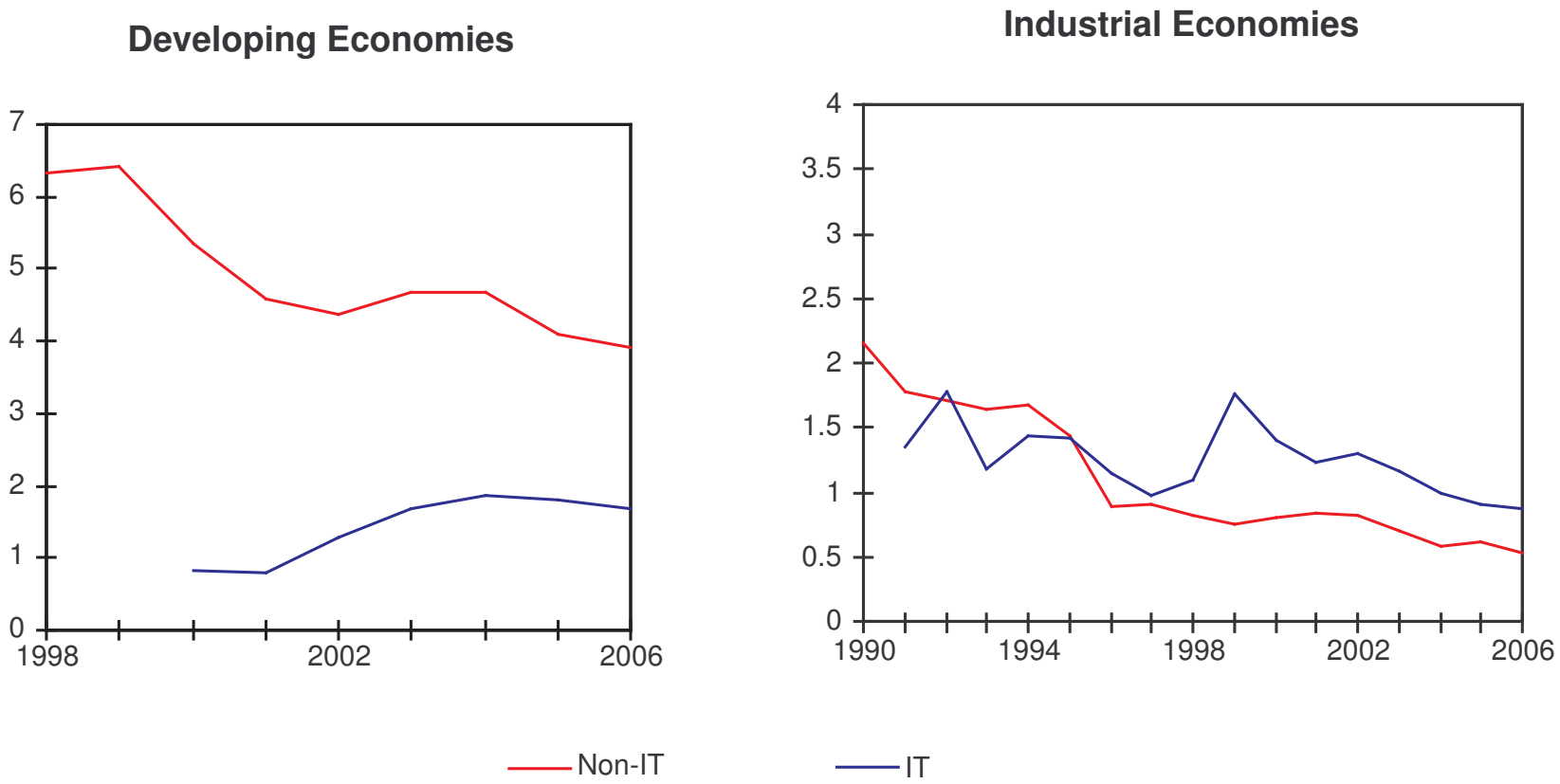
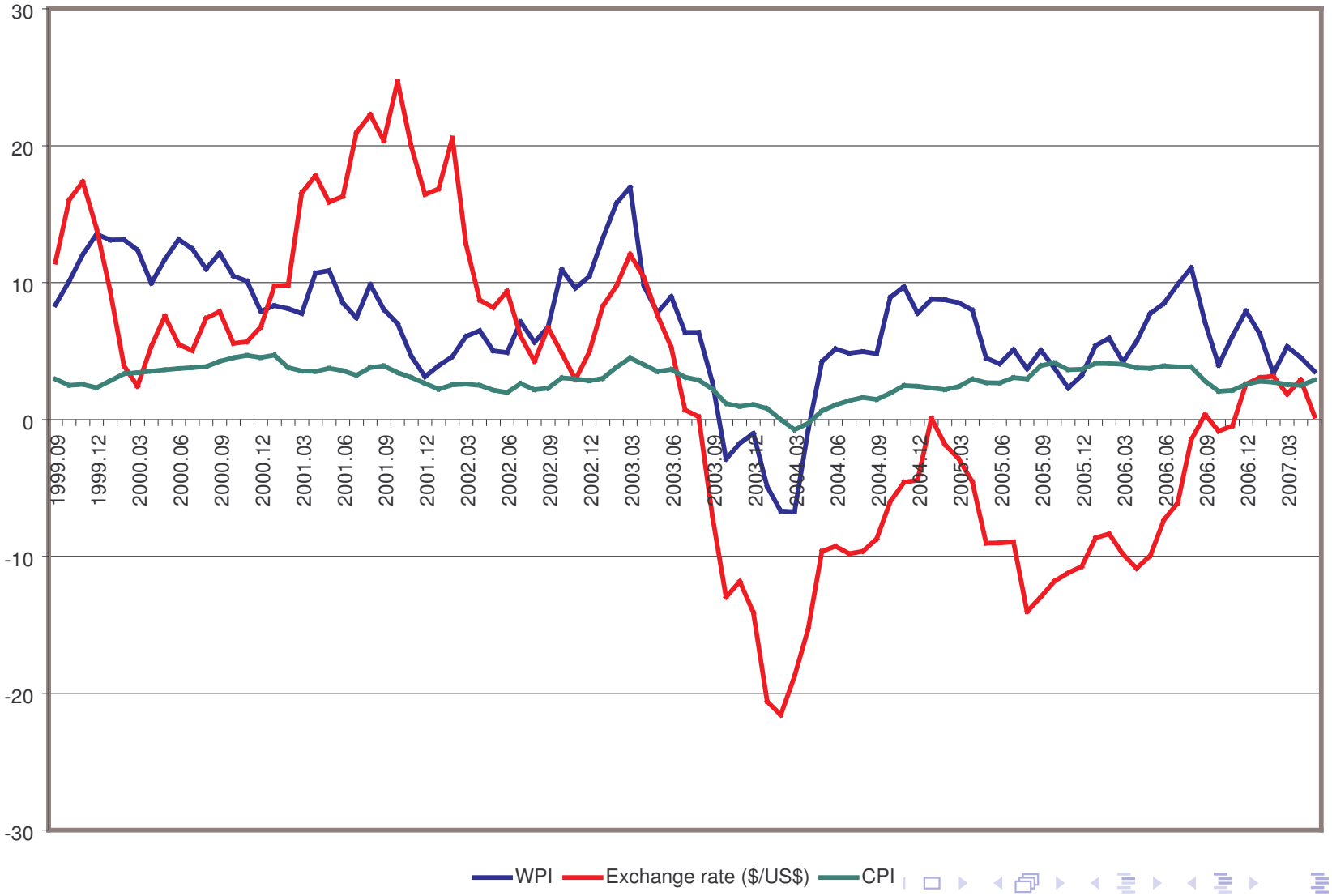


Figure: Inflation Volatility IT vs. Non-IT Economies

Core versus headline inflation

- The literature suggests to target "sticky prices." For example non-tradables inflation, or some component close to wages. But, tradables good inflation is also sticky since passthrough from exchange rates to inflation is high for import prices but low at the consumer price level (Allsopp, et al 2006).
- Globalization has been used to explain the decline of inflation, the flip side is that strong growth of China and the world in general also explains part of the increase in oil prices, and therefore there are no reasons to exclude part of the effects of globalization (Bean, 2004). In addition if high oil and food prices squeezes spending, this will result in downward pressures on other prices (King, 2007).
- Credibility and second-round effects. Wages and prices setters base their decisions mostly on aggregate price level. Eliminating the anchor for some set of prices may result in higher volatility of inflation, and loss of anchor for inflationary expectations.
- Although the target is done for CPI inflation, different measures of core inflation are helpful in evaluating and forecasting inflationary pressures. Therefore, they provide useful indicators for monetary policy decisions, but there is no strong case for defining the target in terms of core inflation.

CPI and WPI Inflation vs. Exchange Rate Depreciation in Chile (12-month %)



Concluding remarks

- Targeting inflation on the basis of a range within which one expects inflation to lie most of the time is similar to fixing an objective for projected inflation in a given policy horizon, or indicating an expected value and a variance for target inflation.
- Defining the monetary authorities' objective in terms of an inflation target does not mean that the business cycle, particularly unemployment, becomes irrelevant in monetary policy decisions.
- Since inflation targeting is a way of organizing monetary policy that takes into account the trade-offs between inflation and unemployment, one might think that the target of monetary policy could instead be defined in terms of output (or unemployment). Inconvenience of defining two objectives that might be mutually inconsistent, and, above all, loosing the anchor for inflation.
- An increase in the aversion to output fluctuations (a), an increase in the extent of backward-lookingness in the Phillips curve (α), or a decline in the slope of the Phillips curve (δ or $1/\theta$) increases inflation volatility and lengthens the policy horizon.

Concluding remarks

- Credibility and open economy considerations.
- In developing countries the "great moderation" has taken place since the second half of the nineties, more than a decade after it happened in industrial countries, which is an indication that policy, rather than good luck, has been the main cause.
- Although measures of core inflation may give important indications on inflationary pressures, it still appears better to target and focus the inflationary objective on headline inflation.