Globalization and Disinflation: A Note

by

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Abstract

We analyze how globalization forces induce monetary authorities, guided in their policies by the welfare criterion of a representative household, to put greater emphasis on reducing the inflation rate than on narrowing the output gaps.

I. Introduction

Ken Rogoff (2003, 2004) elaborates on some favorable factors that have been helping to drive down global inflation in the 1990s. An hypothesis, which he put forth, is that the “globalization—interacting with deregulation and privatization—has played a strong supporting role in the past decade’s disinflation.”

It is interesting to explore what has guided monetary authorities in the pursuit of low inflation in the 1990s, in the presence of strong forces of globalization.

This note considers how the output-gap and inflation weights, in a utility-based loss function of the monetary authority, are affected by opening of the country to trade and by the liberalization of the international capital flows.

II. Utility Based Welfare Criterion

Michael Woodford (2003, Chapter 6) demonstrates how to derive a quadratic loss function from a standard welfare criterion of a representative household. The welfare criterion, from which he derives a quadratic loss function, is the expected utility of the representative household, given by

$$\boldsymbol{E}\left(\sum_{t=0}^{\infty}\beta^{t}U_{t}\right)$$

Where,

$$U_t = \left[u(C_t;\xi_t) - \int_0^1 w(h_t(j);\xi_t)dj\right] .$$

C_t is an index of differentiated products that constitutes aggregate consumption, $h_t(j)$ is the labor supply to, and $A_t f(h_t(j))$ is the production function of variety j, and (A_t , ξ_t) are productivity and preference shocks. The aggregate output is specified as $Y_t = \left[\int_0^1 y_t(j)^{\frac{\theta-1}{\theta}} dj\right]^{\frac{\theta}{\theta-1}}$, and P_t is the corresponding aggregate price level.

Let $v(y_t(j)) \equiv w(f^{-1}(y_t(j)\frac{1}{A_t})$. Then, using the closed economy condition C=Y, and the production function $y_t(j) = A_t f(h_t(j))$, we get:

$$U_t = \left[u(Y_t;\xi_t)) - \int_0^1 v(y_t(j);\xi_t, A_t)dj \right].$$

Real marginal costs are:

$$s(y(j), Y;\xi, A) = v_y(y(j);\xi, A) / u_c(Y;\xi).$$

It follows that the elasticity of $v_y(y(j);\xi, A)$ with respect to y is given by ω, and the elasticity of real marginal cost s with respect to Y is given by

$$\sigma^{-1} = -\frac{\bar{Y}u_{cc}}{u_c} > 0.$$

Efficient Level of the Output Gap

The steady state level of output is given by

$$s(\bar{Y}, \bar{Y}; 0,1) = v_y(\bar{Y}; 0,1) / u_c(\bar{Y}; 0) = \frac{(1-\tau)}{\mu} \equiv 1 - \Phi,$$

The symbol Φ Summarizes the overall distortion in the steady state output level as a result of both taxation and market power:

(1) τ is the Woodford-Rothemberg sales-subsidy (financed by lump sum taxes) that aims at neutralizing the monopolistic competition inefficiency in the steady state); and

(2) $\mu = \frac{\theta}{\theta - 1}$ is the mark up as a result of producers' market power.

Efficient (zero mark up) output is thus given by

$\boldsymbol{s}(\boldsymbol{Y}^*, \boldsymbol{Y}^*; 0,1) = 1$.

Note that $\bar{\boldsymbol{Y}} / \boldsymbol{Y}^*$ Is a decreasing function of Φ, equal to one when $\Phi = 0$.

This property enables us to get the approximation

$\log(\bar{\boldsymbol{Y}} / \boldsymbol{Y}^*) = -(\omega + \sigma^{-1})\Phi$.

We can naturally define $\boldsymbol{x}^* = \log(\bar{\boldsymbol{Y}} / \boldsymbol{Y}^*) = -(\omega + \sigma^{-1})\Phi$ as the efficient level of the output gap.

Quadratic Approximation for U

A quadratic approximation of the utility function is given by

$$U_t = -\frac{\bar{Y}u_c}{2}\left\{(\omega+\sigma^{-1})(x_t - x^*)^2 + (\omega+\theta^{-1})\operatorname{var}_j \hat{y}_t(j)\right\}$$

$$\hat{y}_t(j) \equiv \log(\frac{y_t(j)}{\bar{Y}});\ x_t \equiv \hat{Y}_t - \hat{Y}_t^n;\ \hat{Y}_t = \log(Y_t/\bar{Y})$$

$$x^* = \log(\frac{Y^*}{\bar{Y}}) \qquad . \qquad (3)$$

$$\operatorname{var}_j \hat{y}_t(j) = \gamma[\hat{y}_t(1) - E_j\,\hat{y}_t(j)]^2 + (1-\gamma)[\hat{y}_t(2) - E_j\,\hat{y}_t(j)]^2$$

$$E_j\,\hat{y}_t(j) = \gamma\,\hat{y}_t(1) + (1-\gamma)\,\hat{y}_t(2)$$

(See derivation in the Appendix).

Cross-Variety Dispersion Measure in the Utility Criterion

Equation (3) can be rewritten

$$U_t = -\frac{\bar{Y}u_c}{2}\left\{(\omega+\sigma^{-1})(x_t - x^*)^2 + (\omega+\theta^{-1})\operatorname{var}_j \hat{y}_t(j)\right\}.$$

Where, the term $(\omega+\sigma^{-1})(x_t - x^*)^2$ originates from

$$\left[u(Y_t;\xi_t))\right],$$

And the term $(\omega+\theta^{-1})\operatorname{var}_j \hat{y}_t(j)$ originates from

$$\int_0^1 v(y_t(j);\xi_t, A_t)dj\,.$$

The familiar Dixit-Stigliz preferences over differentiated goods imply

$$y_t(j) = Y_t\left(\frac{p_t j)}{P_t}\right)^{-\theta}$$

$$\log y_t(j) = \log Y_t - \theta(\log p_t(j) - \log P_t)$$

$$\Rightarrow$$

$$\mathrm{var}_j \log y_t(j) = \theta^2 \,\mathrm{var}_j \log p_t(j)$$

$$U_t = -\frac{\bar{Y}u_c}{2}\left\{(\omega + \sigma^{-1})(x_t - x^*)^2 + \theta(1+\omega\theta)\,\mathrm{var}_j \log p_t(j)\right\}.$$

Inflation and Relative Price Distortions

We postulate a $(\gamma, 1-\gamma)$ split between the goods prices that are fully flexible (group 1) and the good prices that are set one period in advance (group 2).

The aggregate supply relationship is:

$$\pi_t = E_{t-1}\pi_t + \kappa x_t$$

$$\kappa \equiv \frac{\gamma}{1-\gamma}\frac{\sigma^{-1}+\omega}{1+\theta\omega}$$

.

Now we exploit the property that

$$\log p_t^{(2)} = E_{t-1} \log p_t^{(1)}$$
$$\log P_t = \gamma \log p_t^{(1)} + (1-\gamma) \log p_t^{(2)}$$

$$\Rightarrow$$
$$\pi_t - E_{t-1}\pi_t = \gamma[\log p_t^{(1)} - E_{t-1} \log p_t^{(1)}]$$
$$= \gamma[\log p_t^{(1)} - \log p_t^{(2)}]$$
$$\Rightarrow$$
$$\text{var}_j \log p_t(j) = \gamma(1-\gamma)[\log p_t^{(1)} - \log p_t^{(2)}]^2$$

$$= \frac{1-\gamma}{\gamma}[\pi_t - E_{t-1}\pi_t]^2$$

And substituting this relationship into U, yields

$$\boldsymbol{U_t} = -(\boldsymbol{cons}\text{tan}\boldsymbol{t})\boldsymbol{L_t}$$

$$\boldsymbol{L_t} = (\pi_{\boldsymbol{t}} - \boldsymbol{E_{t-1}}\pi_{\boldsymbol{t}})^2 + \frac{1}{\theta}\frac{\gamma}{1-\gamma}\frac{\sigma^{-1}+\omega}{1+\theta\omega}(\boldsymbol{x_t} - \boldsymbol{x}^*)^2$$

$$\boldsymbol{x}^* = (\omega + \sigma^{-1})^{-1}\Phi$$

.

This means that Aggregate output and inflation variations are proper arguments in the welfare function. It is the output gap and the unexpected inflation); and the relative weight that is placed upon the two objects is related to slope of the aggregate supply.

III. The Open Economy

Razin and Yuen (2002) extended this closed-economy framework to an open economy. Specifically, they derive the slope of the aggregate supply relationship for various openness regimes.

Perfect Capital Mobility

If capital is perfectly mobile, then the domestic agent has a costless access to the international financial market. As a consequence, household can smooth consumption similarly in the rigid price and flexible price cases.

=> $\hat{C}_t = \hat{C}_t^N$

The Aggregate-Supply curve is:

$$\pi_t - E_{t-1}\pi_t = \frac{\gamma}{1-\gamma}\left[\frac{n\varpi}{1+\varpi\theta}(\hat{Y}_t^h - \hat{Y}_t^N) + \frac{(1-n)\varpi}{1+\varpi\theta}(\hat{Y}_t^f - \hat{Y}_t^N)\right] + \frac{1-n}{n}\left(\frac{1}{1-\gamma}\hat{e}_t - E_{t-1}\hat{e}_t\right),$$

where, $\hat{e}$ is a proportional deviation of the real exchange rate from its corresponding steady state level, and $\hat{Y}_t^f$ is a proportional deviation of the rest-of-the-world output from its corresponding steady state level.

The approximate utility function is:

$$U_t = -(\text{constant})L_t$$

$$L_t = (\pi_t - E_{t-1}\pi_t)^2 + \frac{1}{\theta}\frac{\gamma}{1-\gamma}\frac{n\varpi}{1+\varpi\theta}(x_t - x^*)^2$$

$$x^* = (\omega + \sigma^{-1})^{-1}\Phi$$

Where, n denotes the number of domestically produced goods, and 1-n denotes the number of imported goods. .

Closing the Capital Account

If the domestic economy does not participate in the international financial market, then there is no possibility of consumption smoothing, and we have that:

$$\hat{C}_t = \hat{Y}_t; \hat{C}_t^N = \hat{Y}_t^N$$

In this case, the Aggregate-Supply Curve is:

$$\pi_t - E_{t-1}\pi_t = \frac{\gamma}{1-\gamma}\left[\frac{n\varpi+\sigma^{-1}}{1+\varpi\theta}(\hat{Y}_t^h - \hat{Y}_t^N) + \frac{(1-n)\varpi}{1+\varpi\theta}(\hat{Y}_t^f - \hat{Y}_t^N)\right] + \frac{1-n}{n}\left(\frac{1}{1-\gamma}\hat{e}_t - E_{t-1}\hat{e}_t\right)$$

, where, e denotes the real exchange rate.

The Loss function is:

$$\boldsymbol{U_t = -(constant)L_t}$$

$$\boldsymbol{L_t} = (\boldsymbol{\pi_t} - \boldsymbol{E_{t-1}\pi_t})^2 + \frac{1}{\theta}\frac{\gamma}{1-\gamma}\frac{1}{\theta}\frac{\gamma}{1-\gamma}\frac{\boldsymbol{n\varpi}}{1+\varpi\theta}(\boldsymbol{x_t} - \boldsymbol{x}^*)^2$$

$$\boldsymbol{x}^* = (\omega + \boldsymbol{\sigma}^{-1})^{-1}\Phi$$

Closing the Trade Account (Back to the Closed Economy)

If both the capital and trade accounts are closed, then the economy is an autarky, completely isolated of the rest of the world. In this case, all the goods in the domestic consumption index are produced domestically, which means that n = 1.

The Aggregate Supply Curve becomes:

$$\pi_t - E_{t-1}\pi_t = \left(\frac{\gamma}{1-\gamma}\right)\left(\frac{\varpi + \sigma^{-1}}{1+\varpi\theta}\right)(\hat{Y}_t^h - \hat{Y}_t^N)$$

The loss function is:

$$\boldsymbol{U_t} = -(\boldsymbol{cons}\tan \boldsymbol{t})\boldsymbol{L_t}$$

$$\boldsymbol{L_t} = (\boldsymbol{\pi_t} - \boldsymbol{E_{t-1}\pi_t})^2 + \frac{1}{\theta}\frac{\gamma}{1-\gamma}\frac{1}{\theta}\frac{\gamma}{1-\gamma}\frac{\boldsymbol{\sigma}^{-1} + \boldsymbol{\omega}}{1+\boldsymbol{\theta\omega}}(\boldsymbol{x_t} - \boldsymbol{x}^*)^2$$

$$\boldsymbol{x}^* = (\boldsymbol{\omega} + \boldsymbol{\sigma}^{-1})^{-1}\Phi$$

IV. Comparing the Output Gap and Inflation Weights in the Loss Function

The weight of the output gap in each one of the openness scenarios is given by:

(i) $\psi_1 = \frac{1}{\theta}\frac{\boldsymbol{\gamma n \varpi}}{(1-\gamma)(1+\boldsymbol{\theta\varpi})}$ (Perfect International Capital and Goods Mobility)

(ii) $\psi_2 = \frac{1}{\theta}\frac{\gamma(\boldsymbol{n\varpi} + \sigma^{-1})}{(1-\gamma)(1+\theta\varpi)}$ (Closed Capital Account and Open Trade)

(iii) $\psi_3 = \frac{1}{\theta}\frac{\gamma(\varpi + \sigma^{-1})}{(1-\gamma)(1+\theta\varpi)}$ (Fully Closed economy)

We can see that,

$\psi_1 < \psi_2 < \psi_3$.

(Note we implicitly assume that the price-setting fractions $(\gamma, 1-\gamma)$ across the different openness scenarios are the same; empirically this assumption can be relaxed).

This means that successive rounds of opening reduce the output gap weight in the utility-based loss function.

V. Conclusion

Global inflation has dropped from 30 percent a year to about 4 percent a year. At this period a massive globalization process also swept emerging markets in Latin America and East Asia. This note put forth the hypothesis that globalization induces the monetary authority, guided in its policy by the welfare criterion of a representative household, to put more emphasis on reducing inflation, at the expense of larger output gaps. In such an endogenous policy set up, globalization motivates central banks to engage in pro-active disinflation policies.

References

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Appendix:

Derivation of Equations (2) and (3)

Approximate $\frac{Y_t}{\overline{Y}} = 1 + \hat{Y}_t + (\hat{Y}_t)^2$. Then,

$$\hat{u}(Y_t;\xi_t,A_t) = \bar{u} + u_c \overline{Y} + u_\xi \hat{\xi}_t + \frac{1}{2} u_{cc} (\tilde{Y}_t)^2 + u_{c\xi} \overline{Y} \xi_t + \frac{1}{2} (\hat{\xi}_t, A_t)' u_{\xi\xi} (\hat{\xi}_t, A_t)$$

$$= \bar{u} + u_c \overline{Y} + (\hat{Y}_t + \frac{1}{2} (\hat{Y}_t)^2) + u_\xi \hat{\xi}_t + \frac{1}{2} (\overline{Y})^2 u_{cc} (\hat{Y}_t)^2 + u_{c\xi} \overline{Y} \hat{\xi}_t \hat{Y}_t + \frac{1}{2} (\hat{\xi}_t, A_t)' u_{\xi\xi} (\hat{\xi}_t, A_t)$$

$$= \hat{Y}_t u_c \overline{Y} + \frac{1}{2} (\overline{Y} u_c + \overline{Y}^2 u_{cc}) (\hat{Y}_t)^2 - \overline{Y}^2 u_{cc} g_t (\hat{Y}_t)^2$$

$$= \overline{Y} u_c [\hat{Y}_t + \frac{1}{2} (1 - \sigma^{-1}) (\hat{Y}_t)^2] + \sigma^{-1} g_t (\hat{Y}_t)$$

$$\bar{u} = u(\overline{Y};0,1); \hat{Y}_t = Y_t - \overline{Y}$$

$$g_t \equiv - \frac{u_{c\xi} \hat{\xi}_t}{\overline{Y} u_{cc}}$$

Using $v_y(\overline{Y};0,1) / u_c(\overline{Y};0) = \frac{(1-\tau)}{\mu}$ we get an approximation for the term: $\hat{v}(y_t(j);\xi_t)$:

$$\hat{v}(y_t(j);\xi_t) = \bar{v} + \bar{u}_c \bar{Y}[\hat{y}_t(j) + \frac{1}{2}(1+\omega)(\hat{y}_t(j))^2 - \omega q_t \hat{y}_t(j)]$$

$$= u_c \bar{Y}[(1-\Phi)\hat{y}_t(j) + \frac{1}{2}(1+\omega)(\hat{y}_t(j))^2 - \omega q_t \hat{y}_t(j)]$$

$$\hat{y}_t(j) = \log(\frac{y_t(j)}{\bar{Y}}); q_t \equiv -\frac{v_{y\xi}\hat{\xi}_t}{\bar{Y}v_{yy}}$$

.

$$\int_0^1 \hat{v}(y_t(j);\xi_t) = u_c \bar{Y}[(1-\Phi_y)E_j \hat{y}_t(j) + \frac{1}{2}(1+\omega)[E_j(\hat{y}_t(j))^2 + \operatorname{var} \hat{y}_t(j)] - \omega q_t E_j \hat{y}_t(j)]$$

$$=$$

$$\bar{Y}u_c[(1-\Phi_y)\hat{Y}_t + \frac{1}{2}(1+\omega)[(\hat{Y}_t)^2 - \omega q_t \hat{Y}_t] + \frac{1}{2}[(\theta^{-1}+\omega)\operatorname{var}_j \hat{y}_t(j)]$$

$$\operatorname{var}_j \hat{y}_t(j) = \gamma[\hat{y}_t(1) - E_j \hat{y}_t(j)]^2 + (1-\gamma)[\hat{y}_t(2) - E_j \hat{y}_t(j)]^2$$

$$E_j \hat{y}_t(j) = \gamma \hat{y}_t(1) + (1-\gamma)\hat{y}_t(2)$$

, where, $E_j(\hat{y}_t(j))$ is the mean value of $\hat{y}_t(j)$ across all differentiated goods, and $\operatorname{var} \hat{y}_t(j)$ is the corresponding variance.

Finally, going back to U, we get:

$$U_t = \bar{Y}u_c[(\Phi_y)\hat{Y}_t - \frac{1}{2}(\sigma^{-1}+\omega)[(\hat{Y}_t)^2 + (\sigma^{-1}g_t + \omega q_t)(\hat{Y}_t) - \frac{1}{2}[(\theta^{-1}+\omega)\operatorname{var}_j \hat{y}_t(j)] =$$

$$-\frac{\bar{Y}u_c}{2}\left\{(\sigma^{-1}+\omega)(x_t - x^*)^2 + (\theta^{-1}+\omega)\operatorname{var}_j \hat{y}_t(j)\right\}$$

$$x_t = \hat{Y}_t - \hat{Y}_t^n$$

$$\hat{Y}_t^n = \frac{\sigma^{-1}g_t + \omega q_t}{\sigma^{-1}+\omega}$$

$$\Rightarrow \log(\frac{\bar{Y}}{Y^*}) = -(\sigma^{-1}+\omega)^{-1}\Phi$$