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GLOBALIZATION AND DISINFLATION: THE EFFICIENCY CHANNEL

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Globalization and Disinflation: The Efficiency Channel

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Abstract

The paper analyzes how globalization forces induce monetary authorities, guided in their policies by the welfare criterion of a representative household, to put a greater emphasis on reducing the inflation rate than on narrowing the output gaps. We demonstrate that with capital account liberalization the representative household is able to smooth fluctuations in consumption, and thus becomes relatively insensitive to fluctuations in the output gap. With trade liberalization the economy tends to specialize in the production of relatively few varieties of goods. The specialization in production as a result of trade openness increases the distortion originating from fluctuations in the inflation rate. Therefore, policymakers (guided by efficiency considerations) become more aggressive on inflation and less responsive to the output gap when trade and financial openness increases. We provide evidence on the effect on preferences towards fluctuations in the output gap and in inflation of trade and capital openness, which supports the theory predictions.

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1. Introduction

Ken Rogoff (2003, 2004) elaborates on some favorable factors that have been helping to drive down global inflation in the 1990s. A 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.”

Romer (1993, 1998), and Lane (1997) show that inflation and trade liberalization are negatively, and significantly, correlated in large (flexible exchange rate) OECD economies. Chen, Imbs and Scott (2004) investigate theoretically and empirically the competitive effects of increased international trade in goods and services on prices, productivity and markups. Using disaggregated data for EU manufacturing over the period 1988-2000 they find that increased openness exerts a negative and significant impact on sectors’ prices. Increased openness lowers prices by reducing markups and by raising productivity. Their results suggest that the increase in the trade volume could account for as much as a quarter of European disinflation over the sample period.

This paper explores the effect of globalization (the opening of the country to trade in goods, and the liberalization of international capital markets) on the *weights* applied to the output gap and the inflation surprise in the utility-based loss function. We bring forth an efficiency argument for putting heavier weight on inflation, relative to output gap in the utility-based loss function, as the economy opens up. An important implication is that the incentive of the central bank to deviate from its pre-announced monetary rule (as in the Kydland and Prescott, 1977; Barro and Gordon, 1983; and Rogoff, 1985) is lessened by the forces of globalization.

For the case in which monetary authorities are guided by utility-based loss function, we are able provide another explanation to the pursuit of low inflation in the 1990s by the central banks, in the presence of strong forces of globalization in this period.

2. Utility Based Welfare Criterion

The model main characteristics are:

(1) The representative household utility is defined over consumption and leisure.

(2) A small open economy; all varieties are tradable (that is, the purchasing power parity condition prevails); foreign firms’ prices are exogenous.

(3) Domestic economy produces a continuum of varieties; its representative household has Dixit-Stiglitz preferences over varieties (with fixed elasticities).

(4) A proportion of domestic prices is set one period in advance, whereas all others are flexible.

The model is an open-economy variant of Woodford (2003, Chapter 6), who demonstrates how to derive a quadratic loss function from a standard welfare criterion of a representative household. The welfare criterion, from which we will derive a quadratic loss function, is the conventional expected utility of the representative household, given by

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

where

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

We denote by C_t the index of differentiated products that constitutes aggregate consumption. Labor supply is denoted by $h_t(j)$, $A_t f(h_t(j))$ denotes the production function of product variety j, and $(A_t,\ \xi_t)$ is a vector of productivity and preference shocks. The closed economy aggregate output is specified as

$$\boldsymbol{Y}_t = \left[\int_0^1 \boldsymbol{y}_t(\boldsymbol{j})^{\frac{\theta-1}{\theta}} \boldsymbol{dj}\right]^{\frac{\theta}{\theta-1}},$$

The aggregate price level is:

$$P_t = \left\{\int_0^1 p_t(j)^{1-\theta} dj\right\}^{\frac{1}{1-\theta}}.$$

When the economy is closed, the number of domestically produced varieties is equal to 1, which is also equal to the number of the domestically consumed varieties. When the economy is open to trade in goods, the number of domestically produced varieties is equal to n, less than the number of domestically consumed varieties. When the economy is financially open output fluctuations are separated from consumption fluctuations.

Price Setting

Firms behave *monopolistically* in the goods markets, and *monopsonistically* in the labor market (with producer j as the sole demander for labor of type-j and the household supply of labor is perfectively competitive). A fraction γ of the monopolistically competitive firms sets their prices flexibly at p_{1t}, supplying y_{1t}; whereas the remaining fraction $1 - \gamma$ sets their prices one period in advance (in period $t - 1$) at p_{2t}, supplying y_{2t}. In the former case, the price is marked up above the marginal cost, s, by the factor

$$\mu = \left(\frac{\theta}{\theta - 1} > 1\right),$$

so that

$$\frac{p_{1t}}{P_t} - \mu s(k_t, y_{1t}, Y_t; \xi_t, A_t) = 0.$$

In the latter case, p_{2t} will be chosen to maximize expected discounted profit

$$E_t\left[\left(\frac{1}{1+i_{t-1}}\right)(p_{2t}y_{2t} - w_t h_t)\right] = \quad E_{t-1}\left\{\left(\frac{1}{1+i_{t-1}}\right)\left[Y_t P_t^{\theta} p_{2t}^{1-\theta} - w_t f^{-1}\left(Y_t P_t^{\theta} p_{2t}^{\theta}\right)\right]\right\},$$

One can show that p_{2t} satisfies

$$E_{t-1}\left\{\left(\frac{1}{1+i_{t-1}}\right)Y_t P_t^{\theta-1}\left[\frac{p_{2t}}{P_t} - \mu s(y_{2t}, Y_t, \xi_t, A_t)\right]\right\} = 0,$$

where i_{t-1} denotes the nominal rate of interest.

In the special case of perfect certainty, this is nothing but the standard equation describing price as a mark-up over marginal cost. With uncertainty, it can be interpreted as a weighted average of price mark-ups over marginal cost. This expected value is equal to zero. With price-pre-setting, the firm is committed to supply according to the realized demand. Hence, the realization of shocks will affect actual output, with negative shocks leading to excess capacity and positive shocks to over-capacity.

The model predicts that the mark-ups of the producers who pre-set their prices will be counter-cyclical. Negative demand shocks will induce the flex-price firms to adjust their prices downward, attracting demand away from, and thus lowering the marginal costs and jacking up the price mark-ups, of fix-price firms.

Given p_{1t} and p_{2t}, the aggregate price index in equation (1) can be rewritten as:

$$P_t = \left[\gamma p_{1t}^{1-\theta} + (1-\gamma) p_{2t}^{1-\theta}\right]^{\frac{1}{1-\theta}}. \tag{1'}$$

Figure 1 describes equilibrium in one such market. The downward-sloping, marginal-productivity curve is the demand for labor. Supply of labor, S_h, is implicitly determined by the utility-maximizing condition for h. The upward-sloping marginal factor cost curve is the marginal cost change from the producer point of view. It lies above the supply curve because, in order to elicit more hours of work, the producer has to offer a higher wage not only to that (marginal) hour but also to all the (infra-marginal) existing hours. Equilibrium employment occurs at a point where the marginal factor costs is equal to the marginal productivity. Equilibrium wage is given by B, with the worker's real wage marked down below her marginal product by a distance AB.[1]

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 conventional expected utility of the representative household, given by

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

where

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

We denote by C_t the index of differentiated products that constitutes aggregate consumption. Closed economy aggregate output is specified as

$$Y_t = \left[\int_0^1 y_t(j)^{\frac{\theta-1}{\theta}} dj\right]^{\frac{\theta}{\theta-1}}.$$

Transform the labor disutility function to $\nu(y_t(j)) \equiv w(f^{-1}(y_t(j)\frac{1}{A_t})$. Then, using the closed economy condition, C=Y, and the production function, $\boldsymbol{y}_t(\boldsymbol{j}) = \boldsymbol{A}_t \boldsymbol{f}(\boldsymbol{h}_t(\boldsymbol{j}))$,
we get:

$$\boldsymbol{U}_t = \left[\boldsymbol{u}(\boldsymbol{Y}_t;\boldsymbol{\xi}_t)) - \int_0^1 \boldsymbol{\nu}(\boldsymbol{y}_t(\boldsymbol{j});\boldsymbol{\xi}_t,\boldsymbol{A}_t)\boldsymbol{dj}\right].$$

[1] Full employment obtains because workers are offered a wage according to their supply schedule. This is why the aggregate supply curve will be stated in terms of excess capacity (product market version) rather than unemployment (labor market version). In fact, the model can also accommodate unemployment by introducing a labor union, which has monopoly power to bargain on behalf of the workers with the monopsonistic firms over the equilibrium wage. In such case, the equilibrium wage will lie somewhere between *Sh* and *M Ph*, and unemployment can arise – so that the labor market version of the Phillips curve can be derived as well. To simplify the analysis, we assume in this paper that the workers are wage-takers. In the limiting case where the producers behave perfectly competitive in the labor market, the real wage becomes equal to the marginal productivity of labor and the marginal cost of labor curve is not sensitive to output changes. Thus, with a constant markup $\frac{\theta}{\theta-1}$, the aggregate supply curve becomes flat, i.e., no relation exists between inflation and excess capacity.

The expression for the real marginal costs is given by:

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

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

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

A. Output Gap: Two Versions

The ordinary output gap is defined by $x_t = \hat{Y}_t - \hat{Y}_t^n$, where a "hat" denotes proportional deviation from steady state, and superscript n denotes flexible prices.

The shock free steady state level of output is given by:

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

The symbol Φ summarizes the overall distortion in the steady state output level as a result of the firm's market power. Efficient (zero mark up) output is thus defined by $s(Y^*, Y^*; 0,1) = 1.$

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

This property enables us to get the approximation

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

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

B. Quadratic Approximation for the Flow Utility Function

A quadratic approximation of the utility function, around the steady state, is given by:

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

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

$$x^* = \log(\frac{Y^*}{\overline{Y}}) \qquad . \qquad (1)$$

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

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

The terms $\operatorname{var}_j \hat{y}_t(j), E_j\, \hat{y}_t(j)$ denote cross-variety output variance and average output, respectively.

(See more details of this derivation in the Appendix I).

C. Cross-Variety Price Dispersion Measure

Equation (1) can be rewritten as

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

Where, the term $(\boldsymbol{\omega}+\boldsymbol{\sigma}^{-1})(\boldsymbol{x_t}-\boldsymbol{x}^*)^2$ originates from the sub-utility $\left[\boldsymbol{u}(\boldsymbol{Y_t};\boldsymbol{\xi_t}))\right]$,

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

$$\int_0^1 \boldsymbol{\nu}(\boldsymbol{y_t}(\boldsymbol{j});\boldsymbol{\xi_t},\boldsymbol{A_t})\boldsymbol{dj}.$$

The familiar Dixit-Stigliz preferences over the differentiated goods (varieties) imply

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

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

These equations yield:
$\operatorname{var}_j \log y_t(j) = \theta^2 \operatorname{var}_j \log p_t(j)$. Finally, substituting in equation (2) yields:

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

This means that the approximate utility is a function of the output gap and price dispersion across varieties.

D. The Closed Economy Utility-Based Loss Function

The derived equilibrium aggregate supply relationship is:

$$\pi_t = E_{t-1}\pi_t + \kappa x_t$$
$$\kappa \equiv \frac{\gamma}{1-\gamma}\frac{\sigma^{-1}+\omega}{1+\theta\omega}.$$

We exploit the rational-expectation property that

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

The equations imply that:

$$\pi_t - E_{t-1}\pi_t = \gamma[\log p_t^{(1)} - E_{t-1}\log p_t^{(1)}]$$
$$= \gamma[\log p_t^{(1)} - \log p_t^{(2)}]$$

This, in turn, yields:

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

Now substituting this relationship into equation (2) yields the closed economy loss function:

$$L_t = (\pi_t - E_{t-1}\pi_t)^2 + \frac{1}{\theta}\frac{\gamma}{1-\gamma}\frac{\sigma^{-1}+\omega}{1+\theta\omega}(x_t - x^*)^2 \qquad (3)$$

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

This means that the output gaps (more precisely, the difference between the output gap and the efficient output gap) and an unexpected inflation is shown to be proper arguments in the (utility-based) loss function. Importantly, the relative weight that is placed upon the two objects is related to the slope of the aggregate supply. This property arises from the optimizing equilibrium condition where the monetary authority marginal rate of substitution between the inflation and the output gap is equal to the marginal rate of transformation between inflation and output gap along the aggregate supply schedule.

3. The Open Economy

In this section we draw on Razin and Yuen (2002) who explored the aggregate supply relationship for various openness regimes.

A. Perfect Capital Mobility

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

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

Thus when the capital market is open perfect consumption smoothing is achieved.

Trade openness implies that the number of domestically produced varieties is: $n < 1$. This means that the economy becomes more specialized in production.

The Aggregate-Supply curve is:

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

The term $\hat{e}$ 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:

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

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

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

B. 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:

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

The Loss function is:

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

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

C. 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:

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

The loss function is:

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

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

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

The relative output-gap weight, in terms of the unexpected-inflation weight, in each one of the openness scenarios is given by:

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

(ii) $\psi_2 = \frac{1}{\theta}\frac{\gamma(n\varpi + \sigma^{-1})}{(1-\gamma)(1+\theta\varpi)}$ (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 verify that,

$$\psi_1 < \psi_2 < \psi_3.$$ [2]

2 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. Also, the open economy steady state elasticities are assumed to be equal to the closed economy steady state elasticities.

This means that successive rounds of opening of the current and capital accounts reduce the output gap relative weight in the utility-based loss function. The intuition is given by the following considerations.

(1) With capital account liberalization the representative consumer is able to smooth fluctuations in consumption. As a result, the representative individual becomes less sensitive to fluctuations in the output gap.

(2) The expected disutility of labor supply diminishes when the dispersion in the supply of different varieties increases, as a result of fluctuations in inflation. Thus the representative household expected disutility of labor supply becomes more pronounced when fluctuations in surprise inflation increase the price-quantity dispersion, and the negative effect on utility is magnified by the specialization in production of relatively few goods that is driven by trade openness. Thus, trade openness increases the distortion associated from fluctuations in the inflation rate.

The upshot of the analysis is that the representative individual becomes more sensitive to the inefficiencies associated with fluctuations in the rate of inflation and less sensitive to fluctuations in the output gap.

5. Some Evidence[3]

We equate the de-facto ratio between the output gap and inflation (the sacrifice ratio) with the marginal rate of substitution between inflation and output gap derived from the central bank loss function:

$$\frac{\Delta \inf}{\Delta gap} = -\frac{L_{\inf}}{L_{gap}}$$

Thus, the de-facto output-inflation tradeoff characterizes the relative weight in the loss function which the policy maker put on inflation.

Data

The source of the data is Ball (1993, 1994) and Quinn (1997).

Sacrifice ratios and their determinants

Our regressions focus on explaining the determinants of sacrifice ratios as measured by Ball. He starts out by identifying disinflations, episodes in which the trend inflation rate fell substantially. Ball identifies 65 disinflation episodes in 19 OECD countries, over the period 1960 to 1987. For each of these episodes he calculates the associated sacrifice ratio. The denominator of the sacrifice ratio is the change in trend inflation over an episode. The numerator is the sum of output losses, the deviations between output and its trend ("full employment") level.

We also take from Ball the data on the determinants of the sacrifice ratios such as the initial level of

3 This section is based on Assaf Razin and Prakash Loungani (2002). See also Loungani, Razin and Yuen (2001).

inflation, the change in inflation over the course of the episode and the length of the disinflation episode.

Restrictions on trade and capital Accounts

Measuring the degree of openness of trade and capital accounts is always a heroic task. Since 1950, the IMF has issued an annual publication, which tries to describe the controls that its member countries have in place on various current account capital account transactions. However, as Cooper (1999, p. 111) notes, these descriptions are very imperfect measures of the extent of restrictions, particularly in the case of the capital account:

> "... restrictions on international capital transactions ... come in infinite variety. Therefore an accurate portrayal requires knowledge not only of the laws and regulations in place, but also of how they are implemented – which often requires much official discretion – and of how easily they are circumvented, either legally or illegally. The IMF reports the presence of restrictions, but not their intensity or their impact."

Quinn (1997) takes the basic IMF qualitative descriptions on the presence of restrictions and translates them into a quantitative measure of restrictions using certain coding rules. This translation provides a measure of the intensity of restrictions on current account transactions on a (0, 8) scale and restrictions on capital account transactions on a (0, 4) scale; in both cases, a higher number indicates fewer restrictions. We use the Quinn measures, labeled CURRENT and CAPITAL, respectively, as our measures of restrictions. We also use the sum of the two measures, as an overall measure of the degree of restrictions on the openness of the economy; this measure is labeled OPEN.

For each disinflation episode identified by Ball, we use as an independent variable the current account and capital account restrictions that were in place the year before the start of the episode. This at least makes the restrictions pre-determined with respect to the sacrifice ratios, though of course not necessarily exogenous.

Regressions

The first column of Table 1 reports a regression of the sacrifice ratio on initial inflation, the length of the episode (measured in quarters) and the change in inflation over the course of the episode. Not surprisingly, as all the data were taken from Ball's study, the results are qualitatively similar and quantitatively virtually identical to regressions reported in his paper. The key finding is that sacrifice ratios are smaller the quicker is the speed with which the disinflation is undertaken. The change in inflation also enters with the predicted sign and is significant (t=1.8, p-value=.076). Initial inflation is insignificant (and has the wrong sign from the perspective of the theory).

Now consider the impacts of adding the measures of openness, which are shown in the next three regressions. Ball's findings continue to hold. The length of the episode and the decline in inflation become more significant, while initial inflation remain insignificant. The measures of openness enter with the positive sign predicted by the theory. The effect of openness on the sacrifice ratio is statistically significant, as reflected also in the perking up of the adjusted R-square of the three regressions when compared to the first. The restrictions on the current account appear statistically more significant than the restrictions on the capital account. When we enter both CURRENT and CAPITAL in the regression, CURRENT remained significant but CAPITAL was not. The correlation between the two variables is almost 0.5; hence, our inability to tease out separate effects is not entirely surprising.

Thus, the regressions in Table 1 provide some support to the notion that that relative weight of the inflation in the loss function increases with trade, capital, and overall openness.[4]

6. Conclusion

Global inflation dropped from 30 percent a year to about 4 percent a year in the 1990s. At the same time, massive globalization process also swept emerging markets in Latin America, the European transition economies, and East Asian economies. Furthermore, the 1992 single market reform in Europe and the formation of the Euro zone are important episodes of globalization which took place in this period, as well. Thus, globalization and disinflation seem to go hand in hand.

The paper analyzes 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. We demonstrate that with capital account liberalization the representative household is able to smooth fluctuations in consumption, and thus becomes relatively insensitive to fluctuations in the output gap. With trade liberalization the economy tends to specialize in the production of relatively few varieties of goods. The expected disutility of labor supply diminishes arising from fluctuations in surprise inflation as a result of the increase in the dispersion of the supply of the various varieties. Trade openness, characterized by the specialization in production of relatively few goods magnifies the negative effect of the price-quantity dispersion. Thus specialization in production as a result of trade openness increases the distortion associated with fluctuations in the inflation rate.

We provide evidence on the central bank preferences and trade and capital openness, which supports the theory prediction that goods and capital markets' openness increases the distortion associated with fluctuations in inflation and decreases the distortions associated with fluctuations in the output gap.

Summing up, when trade and financial openness increase, policymakers that are guided by efficiency considerations become more aggressive on inflation and less responsive to the output gap.

[4] See Appendix 2 for more indirect evidence.

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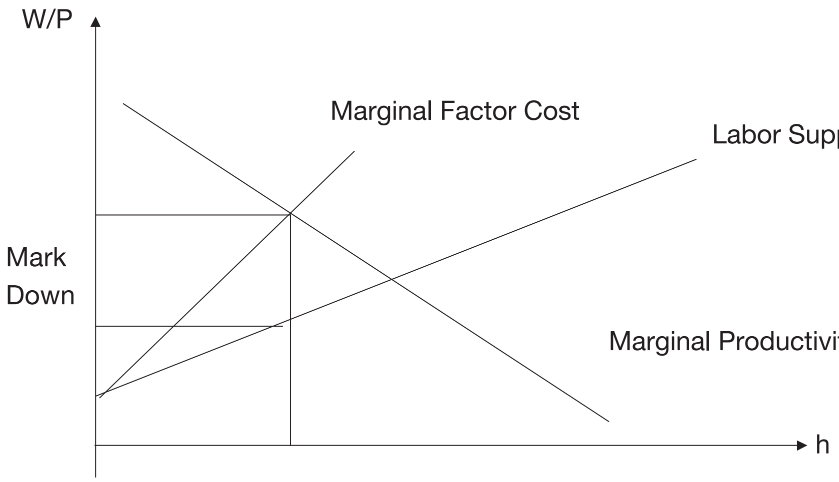
Table 1. Sacrifice Ratios and Restrictions on Current Account and Capital Account

Independent Variables	(1)	(2)	(3)	(4)
Constant	-0.001	-0.059	-0.033	-0.058
	(0.012)	(0.025)	(0.022)	(0.026)
Initial Inflation	0.002	0.003	0.003	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Length of Disinflation Episode	0.004	0.004	0.004	0.004
	(0.001)	(0.001)	(0.001)	(0.001)
Change in Inflation during Episode	-0.006	-0.007	-0.006	-0.007
	(0.003)	(0.003)	(0.003)	(0.003)
CURRENT				
Index of current account restrictions	—	0.008	—	—
		(0.003)		
CAPITAL				
Index of capital account restrictions	—	—	0.010	—
			(0.006)	
OPEN				
Sum of CURRENT and CAPITAL	—	—	—	0.006
				(0.002)
Adjusted R-square	0.16	0.23	0.19	0.23
Number of observations	65	65	65	65

Note: Numbers in parentheses are standard errors.

Figure 1. Labor Market Equilibrium



Appendix I. Derivation of Equation (1)

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: $\hat{v}(y_t(j);\xi_t)$

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

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

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

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

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

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

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

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

Finally, going back to U, we get:

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

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

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

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

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

Appendix II. Monetary Policy and Openness: Recent Trends

Sgherri (2002) reports the parameter estimates for a monetary model for the U.S. economy, both for the high inflation period (1970Q1-1982Q1, hereafter the 1970s) and the subsequent move to the low inflation (1982Q2 onward) period. Similar results are obtained for other industrial countries with independent monetary policies included in the sample (Canada, Germany, and the United Kingdom). The parameter estimates indicate that – since 1982 – policymakers have become significantly more aggressive on inflation, less responsive to the output gap, and more gradualist in adjusting their policy instruments.

Trade openness, as measured by a reduction in levels of assistance afforded to domestic industries through protectionist trade policies have risen: the protectionist policies have gradually fallen over the past 40 years. The average level of tariffs and the incidence of use of NTBs in most OECD countries for which data is available reached relatively low levels by the mid-1990s. Trends in the use of NTBs, as measured by incidence and frequency of use of NTBs, are shown in Table 1.

Table 1. Pervasiveness of non-tariff barriers
Per cent

	Frequency ratio (a)			**Import coverage ratio (b)**		
	1988	**1993**	**1996**	**1988**	**1993**	**1996**
United States	25.5	22.9	16.8	16.7	17.0	7.7
European Union	26.6	23.7	19.1	13.2	11.1	6.7
Japan	13.1	12.2	10.7	8.6	8.1	7.4
Canada	11.1	11.0	10.4	5.7	4.5	4.0
Norway	26.6	23.7	4.3	13.8	11.1	3.0
Switzerland	12.9	13.5	7.6	13.2	13.2	9.8
Australia	3.4	0.7	0.7	8.9	0.4	0.6
New Zealand	14.1	0.4	0.8	11.5	0.2	0.2
Mexico	2.0	2.0	14.6	18.6	17.4	6.9

Source: OECD (1998), Trends in market openness OECD Economic Outlook, June, 1998.

Anti-dumping cases filed by OECD countries are concentrated among a small number of products including base metals (primarily steel), chemicals, machinery and electrical equipment and plastics. See Table 2.

Table 2. Use of anti-dumping actions

Actions reported for the year ending 30 June

	1993	1996	1997	1998
European Union(a)	81	70	67	117
United States	178	46	57	60
Canada	83	24	19	25
Australia	106	11	30	65
Other OECD(b)	88	48	73	47
OECD Total(b)	536	199	246	314
Of which: Against Asia-5(c)	71	38	34	46
Total Non-OECD(b)	21	145	196	212
Of which: Against Asia-5(c)	2	13	24	31

a) Before 1995, Austria, Sweden and Finland were not members of the European Union, but are included in the EU calculations for 1993 to maintain consistency over time.

b) Of those countries reporting.

c) Asia-5 comprises Korea, Indonesia, Thailand, Malaysia and the Philippines.

Sources: WTO, Report of the Committee on Anti-dumping Practices, Various years. OECD (1998) Trends in market openness OECD Economic Outlook, June, 1998.

Controls on cross-border capital flows encompass a diversified set of measures. Typically, capital controls take two broad forms: (1) “administrative”, involving outright prohibitions; and (2) “market based that attempt to discourage particular capital movements by making them more expensive, through taxation. Kaminsky and Schmukler (2001) study the progress of financial liberalization (reducing policy barriers to the purchase and sale of assets across national borders) over the 1972-99 period in both the G-7 industrial economies and various regional sub-groups in the developing world. They prepared a composite index of liberalization of various segments of financial markets, including the capital accounts, domestic financial systems, and stock markets. They found that during the period under review removal of financially repressive measures was slow but continuous globally. They also concluded that the G-7 industrial economies were the first and the rapidest to liberalize their financial sectors. The rise in financial flows among industrial countries has enabled the United States to become both the world’s largest creditor and its largest debtor, while financial flows to developing countries have remained steady at about 4 percent of developing country GDP.