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ABSTRACT

Globalization and Disinflation: The Efficiency Channel

The paper analyses 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 the marginal rate of substitution between the output gap and the inflation (at a constant value of the utility-based loss function) rises when the economy is opening up to international trade in goods, and is integrated to the world capital markets. We associate the marginal rate of substitution with the sacrifice ratio, and provide evidence on trade and capital openness effects on inflation, through the efficiency channel.

JEL Classification: E50 and F40
Keywords: capital-account openness, trade openness and utility-based loss function

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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." Previously, Romer (1993, 1998), and Lane (1997) show that inflation and trade liberalization are negatively, and significantly, correlated in large (flexible exchange rate) OECD economies. Gali and Monacelli, (2003) analyze the effect of exchange rate movements on inflation. More recently, Chen, Imbs and Scott (2004) investigate the competitive effects of increased international trade in goods and services on prices, productivity and markups. Using dis-aggregated 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* in the utility-based loss function, associated with the output gap and the inflation rate. [1] We thus bring forth an *efficiency* argument for putting heavier weight on the inflation, relative to the output gap, in

[1] . The relative weight of inflation, in terms of the output gap, is also proportional to the marginal rate of substitution between inflation and output gap, holding the value of in the utility-based loss function constant.

the utility-based loss function. when the economy opens up. This argument also means that the incentive of the central bank to deviate from its pre-announced monetary rule (as in the dynamic inconsistency literature, due to Kydland and Prescott (1977), Barro and Gordon (1983), and Rogoff (1985)) is lessened by the forces of globalization. In other words, globalization in effect makes central banks more conservative. Therefore, to the extent that monetary authorities are actually guided by the utility-based loss function, globalization provides a good reason for central banks to target low inflation, as was the case for the world economy in the 1990s.

The organization of the paper is as follows. Section 2 derives for a closed economy a quadratic approximation to the representative household welfare criterion. Section 3 provides an extension to the open economy. Section 4 compares the output-gap and the inflation weights in the utility-based loss function for a closed, trade open, and capital-open economies. Section 5 provides evidence on the effect of openness on the inflation-output gap policy trade off. Section 6 concludes.

II. THE WELFARE CRITERION

Michael Woodford (2003, Chapter 6) demonstrates, in an elegant way, how to derive a quadratic loss function from a standard welfare criterion of a representative household for closed economies. 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 , $\boldsymbol{x}_t$) is a vector of productivity and preference shocks. Then, the welfare criterion, from which one can derive the quadratic loss function, is the conventional expected utility of the representative household, given by

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

With,

$$U_t = \left[u(C_t;\boldsymbol{x}_t) - \int_0^1 w(h_t(j);\boldsymbol{x}_t)dj\right] .$$

Aggregate output is specified as $\boldsymbol{Y}_t = \left[\int_0^1 \boldsymbol{y}_t(\boldsymbol{j})^{\frac{\boldsymbol{q}-1}{\boldsymbol{q}}}\boldsymbol{dj}\right]^{\frac{\boldsymbol{q}}{\boldsymbol{q}-1}}$, and P_t is the corresponding aggregate price level. Transforming the labor disutility function into $\boldsymbol{n}(y_t(j)) \equiv w(f^{-1}(y_t(j)\frac{1}{A_t})$, and substituting 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:

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

A compact expression for the real marginal costs is given by:

$$\boldsymbol{s}(\boldsymbol{y}(\boldsymbol{j}),\boldsymbol{Y};\boldsymbol{x},\boldsymbol{A}) = \boldsymbol{v}_y(\boldsymbol{y}(\boldsymbol{j});\boldsymbol{x},\boldsymbol{A})/\boldsymbol{u}_c(\boldsymbol{Y};\boldsymbol{x}) .$$

It follows that the elasticity of $\boldsymbol{v}_y(\boldsymbol{y}(\boldsymbol{j});\boldsymbol{x},\boldsymbol{A})$ with respect to y is given by$\boldsymbol{w}$, and the elasticity of real marginal costs with respect to Y is given by $\boldsymbol{s}^{-1} = -\frac{\overline{\boldsymbol{Y}}\boldsymbol{u}_{cc}}{\boldsymbol{u}_c} > 0$.

A. Output Gap: The Two Versions

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

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

The symbol Φ summarizes the overall distortion in the steady state output level as a result of both taxation and market power. Key parameters affecting the distortion are:

(1) τ, sales' subsidy[2],

(2) $\mu=\frac{\theta}{\theta-1}$, the monopolistic- competition mark up.

The efficient (e.g., zero mark up) output is defined by[3]

$$\sigma(Y^*,Y^*;0,1)=1 .$$

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

This property of Φ enables us to get the approximation

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

We now define

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

An *efficient* level of the output gap. In contrast, we define the *ordinary* level of the output gap by

[2] In some contexts the subsidy (financed by lump sum taxes) is invoked to neutralize the monopolistic competition distortion in the steady state; thus making the steady state efficient.

[3] $\mu=1, \tau=0$.

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

A "hat" denotes proportional deviation from steady state, and superscript n denotes flexible prices.

B. Quadratic Approximation for the Utility function

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

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

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

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

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

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

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

(For details of this derivation see Appendix I).

C. Cross-Variety Dispersion Measure in the Utility Criterion

Equation (1) can be rewritten as

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

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

and the term $(\omega+\theta^{-1})\,\mathrm{var}_j\,\hat{y}_t(j)$ originates from the subutility $\int_0^1 \nu(y_t(j);x_t,A_t)dj$.

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

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

This yields:

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

Substituting in equation (2) yields:

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

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

D. Inflation and Relative Price Distortions

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

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 now exploit the rational-expectation property that

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

Thus,

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

In turn, this expression yields:

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

Finally, substituting this relationship into equation (2), yields

$Ut = -(constant)L_t$

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

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

This means that the output gap (or, more precisely, the difference between the output gap and the efficient output gap) and the unexpected inflation are genuine arguments in the utility-based loss function.

Noteworthy is that the *marginal rate of substitution* between inflation and output gap (the relative weight that is placed upon the two objects) is equal to the *sacrifice ratio* (the slope of the aggregate supply).

III. THE OPEN ECONOMY

In this section we compare the magnitudes of the marginal rate of substitution between inflation and output gap for three regimes: (1); (2) open trade account but closed capital account; and (3) closed economy.

A. open capital and trade accounts

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. That is,

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

The Aggregate-Supply curve is[4]:

[4] 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.

(continued)

$$p_t - E_{t-1}p_t = \frac{g}{1-g}\left[\frac{nw}{1+wq}(\hat{Y}_t^h - \hat{Y}_t^N) + \frac{(1-n)w}{1+wq}(\hat{Y}_t^f - \hat{Y}_t^N)\right] + \frac{1-n}{n}\left(\frac{1}{1-g}\hat{e}_t - E_{t-1}\hat{e}_t\right),$$

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 quadratic utility function is:

$$\boldsymbol{U}_t = -(\boldsymbol{cons}\tan\boldsymbol{t})\boldsymbol{L}_t$$

$$\boldsymbol{L}_t = (\boldsymbol{p}_t - \boldsymbol{E}_{t-1}\boldsymbol{p}_t)^2 + \frac{1}{\boldsymbol{q}}\frac{\boldsymbol{g}}{1-\boldsymbol{g}}\frac{\boldsymbol{n}\boldsymbol{v}}{1+\boldsymbol{v}\boldsymbol{q}}(\boldsymbol{x}_t - \boldsymbol{x}^*)^2$$

$$\boldsymbol{x}^* = (\boldsymbol{w} + \boldsymbol{s}^{-1})^{-1}\Phi$$

.

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

B. Open trade account and Closed Capital Account

If the domestic economy is not integrated to 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:

$$p_t - E_{t-1}p_t = \frac{g}{1-g}\left[\frac{nw + s^{-1}}{1+wq}(\hat{Y}_t^h - \hat{Y}_t^N) + \frac{(1-n)w}{1+wq}(\hat{Y}_t^f - \hat{Y}_t^N)\right] + \frac{1-n}{n}\left(\frac{1}{1-g}\hat{e}_t - E_{t-1}\hat{e}_t\right),$$

where, e denotes the real exchange rate.

The quadratic loss function is:

$$\boldsymbol{U}_t = -(\boldsymbol{cons}\tan\boldsymbol{t})\boldsymbol{L}_t$$

$$\boldsymbol{L}_t = (\boldsymbol{p}_t - \boldsymbol{E}_{t-1}\boldsymbol{p}_t)^2 + \frac{1}{\boldsymbol{q}}\frac{\boldsymbol{g}}{1-\boldsymbol{g}}\frac{1}{\boldsymbol{q}}\frac{\boldsymbol{g}}{1-\boldsymbol{g}}\frac{\boldsymbol{n}\boldsymbol{v}}{1+\boldsymbol{v}\boldsymbol{q}}(\boldsymbol{x}_t - \boldsymbol{x}^*)^2 \quad .$$

$$\boldsymbol{x}^* = (\boldsymbol{w} + \boldsymbol{s}^{-1})^{-1}\Phi$$

.

C. 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:

$$p_t - E_{t-1}p_t = \left(\frac{g}{1-g}\right)\left(\frac{w + s^{-1}}{1+wq}\right)(\hat{Y}_t^h - \hat{Y}_t^N) \cdot$$

The quadratic loss function is:

$$U_t = -(cons\tan t)L_t$$

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

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

.

IV. MARGINAL RATE OF SUBSTITUTION: OUTPUT GAP AND INFLATION

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

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

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

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

We can easily verify that,

$$\psi_1 < \psi_2 < \psi_3.^{5}$$

This means that in each one of the successive rounds of opening the economy globalization reduces the weight of the output gap relative weight of inflation, in the utility-based loss function.

[5] Note we implicitly assume that across the different openness scenarios the price-setting fractions $(\gamma, 1-\gamma)$ are the same. Also, the open economy steady state elasticities are assumed to be equal to the closed economy steady state elasticities.

V. Evidence on the Effect of Globalization on the Marginal Rate of Substitution

We associate the de-facto ratio between the change in output gap and the change in inflation (the sacrifice ratio) to the marginal rate of substitution between inflation and output gap in central bank loss function. Thus the sacrifice ratio is equal to the marginal rate of substitution between the inflation and the output gap; that is,

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

Thus, the de-facto output-inflation tradeoff (as in Lucas (1973)) could be used to back up the relative weight in the loss function, which the policy maker put on inflation. Our regressions focus on explaining the determinants of sacrifice ratios as measured by Ball ((1993).

A. Data

Sources of data are Ball (1993, 1994) and Quinn (1997). We also take from Ball the data on the determinants of the sacrifice ratios, such as the initial level of inflation, the change in inflation over the course of the episode and the length of the disinflation episode.

B. Sacrifice ratios and their determinants

Ball (1993) 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.

C. 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 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."

On the other hand, in the absence of good instruments, the endogeneity issue is severe when the trade and capital flows are being used as measures of openness.

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 openness (a rise in the index indicates lessened restrictions). We also use the sum of the two measures, as an overall measure of the degree of 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 fully exogenous.

D. 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.

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

Independent Variables	(1)	(2)	(3)	(4)
Constant	-0.001 (0.012)	-0.059 (0.025)	-0.033 (0.022)	-0.058 (0.026)
Initial Inflation	0.002 (0.002)	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)
Length of Disinflation Episode	0.004 (0.001)	0.004 (0.001)	0.004 (0.001)	0.004 (0.001)
Change in Inflation during Episode	-0.006 (0.003)	-0.007 (0.003)	-0.006 (0.003)	-0.007 (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.				

Thus, the regressions in Table 1 provide some support to the notion that that relative weight of the inflation in the loss function, in terms of the output gap, increases with trade, capital, and overall openness.[6]

IV. CONCLUSION

A massive globalization process also swept emerging markets in Latin America, European transition economies, and East Asia. The 1992 single market reform in Europe and the formation of the Euro zone are important episodes of globalization in this period, as well. The average annual inflation rate among developing countries was 41 percent in the early 1980s and came down to 13 percent towards the end of the 1990s. Global inflation in the 1990s has dropped from 30 percent a year to about 4 percent a year. Thus, disinflation and globalization go hand in hand.

This paper 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 the reduction of inflation, at the expense of an increase in the output gap. We demonstrate that in such endogenous-policy set up, when trade and financial openness increased,

[6] Loungani, Razin and Yuen (2001) use a different data set, and a different methodology, to link openness to the sacrifice ratio. They get similar results. In Appendix 2 we also discuss some evidence on the recent change in the anti inflation attitude of central banks; at the same time that market globalization significantly expand across countries and regions.

policymakers become more aggressive on inflation, less responsive to the output gap, and more gradualist in adjusting their policy instruments.

The paper provides evidence that lends support to the theory that the marginal rate of substitution between the inflation and the output gap is significantly affected by trade and capital account openness. Thus globalization lowers inflation through the efficiency channel.

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A quadratic approximation of the utility function: Derivation of Equation (1)

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

$$\hat{u}(Y_t; x_t, A_t) = \bar{u} + u_c \bar{Y} + u_x \hat{x}_t + \frac{1}{2} u_{cc} (\tilde{Y}_t)^2 + u_{cx} \bar{Y} x_t + \frac{1}{2} (\hat{x}_t, A_t)' u_{xx} (\hat{x}_t, A_t)$$

$$= \bar{u} + u_c \bar{Y} + (\hat{Y}_t + \frac{1}{2} (\hat{Y}_t)^2) + u_x \hat{x}_t + \frac{1}{2} (\bar{Y})^2 u_{cc} (\hat{Y}_t)^2 + u_{cx} \bar{Y} \hat{x}_t \hat{Y}_t + \frac{1}{2} (\hat{x}_t, A_t)' u_{xx} (\hat{x}_t, A_t)$$

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

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

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

$$g_t \equiv -\frac{u_{cx} \hat{x}_t}{\bar{Y} u_{cc}}$$

Using $v_y(\bar{Y}; 0, 1) / u_c(\bar{Y}; 0) = \frac{(1-t)}{m}$ we get an approximation for the term: $\hat{v}(y_t(j); x_t)$:

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

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

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

.

$$\int_0^1 \hat{v}(y_t(j);x_t) = u_c \bar{Y}[(1-\Phi_y)E_j\,\hat{y}_t(j) + \frac{1}{2}(1+w)[E_j(\hat{y}_t(j))^2 + \text{var}\,\hat{y}_t(j)] - wq_t E_j\,\hat{y}_t(j)]$$

$$=$$

$$\bar{Y}u_c[(1-\Phi_y)\hat{Y}_t + \frac{1}{2}(1+w)[(\hat{Y}_t)^2 - wq_t\,\hat{Y}_t] + \frac{1}{2}[(q^{-1}+w)\,\text{var}_j\,\hat{y}_t(j)]$$

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

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

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

Finally, going back to U, we get:

$$U_t = \bar{Y}u_c[(\Phi_y)\hat{Y}_t - \frac{1}{2}(s^{-1}+w)[(\hat{Y}_t)^2 + (s^{-1}g_t + wq_t)(\hat{Y}_t) - \frac{1}{2}[(q^{-1}+w)\,\text{var}_j\,\hat{y}_t(j)] =$$

$$-\frac{\bar{Y}u_c}{2}\left\{(s^{-1}+w)(x_t - x^*)^2 + (q^{-1}+w)\,\text{var}_j\,\hat{y}_t(j)\right\}$$

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

$$\hat{Y}_t^n = \frac{s^{-1}g_t + wq_t}{s^{-1}+w}$$

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

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 taketwo broad forms: (1) “adminstrative”, 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 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.