Economic Research Paper: 2009-07

FINANCIAL INTEGRATION, NOMINAL RIGIDITY AND MONETARY POLICY

KE PANG*

APRIL 2009

* Department of Economics, School of Business and Economics, Wilfrid Laurier University. Contact: kpang@wlu.ca

Financial Integration, Nominal Rigidity and Monetary Policy*

Ke Pang†

March, 2009

Abstract

This paper analyzes the welfare impact of financial integration in a standard monetary open-economy model. Financial integration may reduce welfare in the presence of nominal price rigidity and constraints on the efficient use of monetary policy. The reason is that financial integration leads to an increase in the terms of trade volatility, which is already excessive from a welfare standpoint. From a policy perspective, the model implies that developing economies that are experiencing financial integration may attempt to alleviate the welfare cost of integration by stabilizing the exchange rate, which eliminates the excessive terms of trade adjustment. Hence, this paper provides a novel explanation of "fear of floating". On the other hand, for advanced economies that have the ability to operate efficient inflation targeting monetary policies, financial integration is always beneficial. Thus, the model accounts for the observed acceleration in cross-border asset trade among advanced economies in the early 1990s, as it was mainly the industrial countries that switched to an inflation targeting regime at the time.

JEL: E52, F36, F41

Keywords: Financial Integration, Nominal Rigidity, Monetary Policy

*I am grateful to Michael B. Devereux for advice, guidance and inspiration. I thank Paul Beaudry, Viktoria Hnatkovska, Amartya Lahiri, Henry Siu, and Todd Smith for insightful comments and suggestions. I have also benefited from conversations with seminar participants at the University of British Columbia, the 2007 and 2008 Annual Meeting of Canadian Economic Association, and the 2008 Annual Meeting of Asia-Pacific Economic Association. This research is partly supported by WLU Operating funds and partly by the SSHRC Institutional Grant awarded to WLU.

†Department of Economics, Wilfrid Laurier University, 75 University Avenue W., Waterloo, O.N., Canada N2L 3C5. Email: kpang@wlu.ca.

1 Introduction

Cross-country gross asset positions have increased dramatically in the past few decades. According to Lane and Milesi-Ferretti (2006), the sum of foreign assets and liabilities to GDP ratio (IFIGDP) has increased from 45 percent to over 300 percent in industrial countries and from 40 percent to 150 percent in developing countries between 1970 and 2004.[1] As shown in Figure 1, the increase in cross-border asset trade was fairly stable during the 1970s and the 1980s. The two country groups had very similar trends in international financial integration up to the early 1990s. Since then, an *acceleration* of cross-border asset trade has taken place in industrial countries, while developing countries have failed to pick up the pace. The main goal of this paper is to explain the observed evolution of financial integration. Obviously, the early 1990s is a decisive period to focus on.

New Zealand adopted the first inflation targeting regime in 1990, quickly followed by other developed countries. In line with Rose (2006), Goodfriend (2003), Ito and Mishkin (2004), and Wyplosz (2006), all the twenty three industrial countries classified by Lane and Milesi-Ferretti (2006) target inflation either explicitly or implicitly. In other words, the entire industrial country group has essentially adopted the same monetary strategy since the early 1990s, which is exactly the time when the acceleration in cross-border asset trade began. However, as stated by the *De Facto* Classification of Exchange Rate Regime and Monetary Policy Framework (IMF, 2006), only 17 out of 122 developing countries classified by Lane and Milesi-Ferretti (2006) have adopted an inflation targeting regime.[2] Most of these countries started to adopt such a regime after the 1997 Asian Financial Crisis. The majority of developing countries still use exchange rate as the nominal anchor when conducting monetary policies. This phenomenon is well-known as "fear of floating".[3]

[1] IFIGDP has been widely used as a measure of *de facto* financial integration. The industrial countries include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

[2] The developing countries that adopt an inflation targeting regime are Brazil, Chile, Colombia, Czech Republic, Hungary, Israel, Korea, Mexico, Peru, Philippines, Poland, South Africa, Thailand, Indonesia, Romania, Slovak Republic, and Turkey.

[3] See Calvo and Reinhart (2002), Reinhart and Rogoff (2002), and Levy-Yeyati and Sturzenegger (2003).

Overall the industrial country group and the developing country group participate at very different levels in the international financial markets. The two groups also adopt very different monetary strategies. Does the monetary policy regime have an impact on the desirability of financial integration? Furthermore, is there a welfare case for fixed exchange rate regimes as financial openness increases?

To answer these questions, I study a simple two-country general equilibrium model with nominal price rigidity. Agents choose optimal portfolio positions from familiar assets such as bonds and equities. Conditional on the range of assets and other aspects of the model, the financial market structure can be divided into three types: financial autarky, incomplete financial market and complete financial market. By contrasting the financial autarky with the complete and the incomplete financial market, this paper unifies the analysis of full and partial financial integration. Monetary authorities adopt one of the following four policy rules: a money targeting rule, a unilateral exchange rate peg, a bilateral exchange rate peg, and a producer price targeting rule. The money targeting rule simply involves a constant money supply, representing a passive floating exchange rate regime. The producer price targeting rule, representing an active floating exchange rate regime, corresponds to inflation targeting. By analyzing the choice of financial integration (given the rule of monetary policy) and the choice of monetary policy (given the structure of financial market), this paper reveals the interaction between financial integration and monetary policy.

The most striking result of this paper is that in a sticky price world with a money targeting rule, financial integration reduces welfare. The reason is that financial integration leads to an increase in the terms of trade volatility, which is already excessive from a welfare standpoint in financial autarky. Pegging exchange rates eliminates the excessive terms of trade adjustment. Hence, fixed exchange rate regimes become more appealing than a passive floating exchange rate regime to a country that has some access to the international asset market. Nonetheless, a producer price targeting rule removes the sticky price distortion and replicates the flexible price equilibrium. In this case, financial integration still results in a higher volatility in the

terms of trade, but the terms of trade volatility is below optimal in financial autarky. In fact, this active floating exchange rate policy, combined with perfect consumption risk sharing, brings the economy to the first-best. Thus, countries that can successfully target inflation will benefit the most from financial integration.

This paper accounts for the observed acceleration in cross-border asset trade among industrial countries, as it was mainly the industrial countries that have switched to an inflation targeting regime in the early 1990s. This paper also sheds light on the cause of "fear of floating". In order to implement efficient inflation targeting, countries need to meet certain initial conditions, such as having a central bank that has enough independence, accountability and transparency, having well developed domestic financial markets and sufficient financial stability, and having adequate research and statistic resources. While industrial countries seem to have no problem fitting into an inflation targeting regime, developing countries may find it significantly challenging. When financial liberalization is inevitable, it is rational for developing countries to adopt fixed exchange rate regimes first to alleviate the welfare cost of financial integration before they are ready to adopt inflation targeting.

It deserves to notice that most countries have relaxed their legal controls on the capital account over the past three decades. This process of *de jure* financial liberalization speeded up in the early 1990s and has slowed down since the mid-1990s, which raises an obvious question: is the observed pattern of cross-border asset trade a natural outcome of the *de jure* liberalization rather than the change in monetary policy? Accordingly, I test the hypothesis that inflation rate is negatively related to the *de facto* financial integration after controlling for the *de jure* financial liberalization. I also test the key mechanism of this paper that the terms of trade volatility is positively related to financial integration.

This paper compliments the literature that examines the impact of financial integration by paying particular attention to the interaction between financial globalization and monetary policies (that are popular in practice). A large literature in international finance analyzes the size of gains from financial integration.[4] As models in this literature are frictionless other

[4]See for example Backus et al. (1993), Cole and Obstfeld (1991), Lewis (1996), Tesar (1995), and van

than imperfect risk sharing, they all imply positive gains from financial integration. Some find huge gains, while some find rather small benefits. However, in an environment with more than one distortion, financial integration may not always be beneficial. In a multi-country model with endogenous growth, Devereux and Smith (1994) shows that increased international risk sharing discourages precautionary saving, which reduces the growth rate. Hence, welfare in complete financial markets is actually lower than that in financial autarky. Using a similar open-economy framework, Tille (2005) also finds that integration is not universally beneficial. However, he assumes a unity elasticity of substitution between home and foreign goods and focuses on the effect of exchange rate pass-through. Instead, this paper solves for a general elasticity of substitution between home and foreign goods, which is a critical parameter that determines the welfare impact of integration. I find loss from integration when this elasticity is greater than unity, a case that is more empirically relevant and indicates that terms of trade play a key role in welfare evaluations.

This paper is also related to the literature regarding the analysis of endogenous portfolio choices in dynamic general equilibrium models with complex asset markets.[5] Devereux and Sutherland (2007) are the first to analyze monetary policy when international portfolio decisions are endogenous. While they explore the impact of monetary policy on country asset positions in both complete and incomplete financial market environments, they limit their examination to a producer price targeting rule and to the impact of the stance of monetary policy on equilibrium asset holdings.

The paper proceeds as follows. Section 2 describes the structure of the model. Section 3 presents the method used to solve optimal portfolios and welfare. Section 4 discusses the impact of financial integration under the money targeting rule. Section 5 analyzes alternative monetary policies. Section 6 tests the empirical hypothesis derived from the model. Some conclusions then follow.

Wincoop (1999).

[5]A list of related papers are authored by Devereux and Sutherland (2006a,b), Engel and Matsumoto (2005), Evans and Hnatkovska (2005), and Kollmann (2005).

2 The Model

The world consists of two countries of the same size, denoted as the home country and the foreign country. The world population is normalized to have a measure of one. Home agents are indexed by $h \in [0, \frac{1}{2}]$ and foreign agents are indexed by $f \in [\frac{1}{2}, 1]$. Agents derive utility from aggregate consumption (composed of home and foreign produced goods), real balance and leisure. Each agent, using a linear technology in labor, is a monopoly producer of a particular differentiated product. In each country, there are two types of shocks: productivity and money demand shocks. All prices are set before the realization of shocks, and the prices are in the currency of the producer. Each country starts with zero net foreign asset.

For simplicity, I abstract from any dynamics by considering a single-period model with uncertainty.[6] The sequence of events within the period is as follows. First, prior to the realization of shocks, agents can trade in a range of financial assets. Then agents set prices, given the expected discount factor, the expected demand, and the expected marginal cost. After the realization of shocks, production and consumption take place, and monetary authorities adjust money supplies in accordance with the underlying policy rules.

The detailed structure of the home country is described below. The foreign country has an identical structure. Where appropriate, foreign variables are denoted with an asterisk.

2.1 Household

The representative household in the home country maximizes the following expected utility:

$$E\left[U\left(C, \frac{M}{P}, L\right)\right] = E\left(\frac{C^{1-\rho}}{1-\rho} + \chi log\frac{M}{P} - \eta\frac{L^{1+\psi}}{1+\psi}\right) \quad (1)$$

[6]The results for complete financial integration will carry over to an infinite horizon setting without change because (1) complete integration yields perfect risk sharing, and (2) price setting is ex-ante. For incomplete financial integration, the results will generally be different in a dynamic environment because portfolio decisions change over time. Solving such problems requires using complicated numerical methods or taking approximations to a minimum of third-order.

where C is the consumption index, defined as

$$C = \left(\frac{1}{2}\right)^{\frac{1}{\theta-1}} \left(C_H^{\frac{\theta-1}{\theta}} + C_F^{\frac{\theta-1}{\theta}}\right)^{\frac{\theta}{\theta-1}} \tag{2}$$

θ is the elasticity of substitution between home and foreign goods. C_H (C_F) is the index of home (foreign) produced goods with an elasticity of substitution between individual goods denoted by ϕ ($\phi > 1$). $\frac{M}{P}$ is the real money balances, and L is the labor supply. All real variables in this paper are defined in terms of home aggregate consumption. ρ ($\rho > 0$) is the coefficient of relative risk aversion, η is the coefficient of labor supply, ψ ($\psi \geq 0$) is the elasticity of labor supply, and χ is an i.i.d. stochastic money demand shock, with $E(log\chi) = 0$, $Var(log\chi) = \sigma_\chi^2$, and $log\chi \in [-\epsilon, \epsilon]$.

From equation (2), I can derive the consumer price index (CPI) and the optimal demand for home and foreign goods, respectively

$$P = \left(\frac{1}{2}\right)^{\frac{1}{1-\theta}} \left(P_H^{1-\theta} + P_F^{1-\theta}\right)^{\frac{1}{1-\theta}} \tag{3}$$

$$C_H = \frac{1}{2}\left(\frac{P_H}{P}\right)^{-\theta} C, \quad C_F = \frac{1}{2}\left(\frac{P_F}{P}\right)^{-\theta} C \tag{4}$$

where P_H (P_F) is the price index of home (foreign) produced goods.

The budget constraint of the home households is

$$M + PC = M_0 + wL + \Pi + P\sum_{k=1}^{n} \alpha_k r_k + T \tag{5}$$

where α_k represents the real holding of asset k, and n is the total number of assets. r_k is the real aggregate rate of return on asset k. M_0 is the initial nominal money holding, and T is a lump-sum government transfer. w is the wage, and Π is the profit (dividend). Here, home agents are assumed to first receive all profits from domestic firms. Then, if an international equity market exists, claims to home profits may be transferred to foreign consumers via trade

in equity shares.[7]

The optimal portfolio choice is characterized by a set of arbitrage conditions,

$$E\left(r_k C^{-\rho}\right) = E\left(r_n C^{-\rho}\right), \quad k = 1, \ldots, n-1 \tag{6}$$

In addition, the labor-leisure choice and the money demand conditions are given by

$$\eta L^{\psi} = \frac{wC^{-\rho}}{P} \tag{7}$$

$$\frac{\chi}{M} = \frac{C^{-\rho}}{P} \tag{8}$$

2.2 Firms

Firms engage in monopolistic competition. Each produces specific goods indexed by h with a linear technology in labor $Y_H(h) = AL(h)$. A is an i.i.d. stochastic technology shock with $E(logA) = 0$, $Var(logA) = \sigma_A^2$, and $logA \in [-\epsilon, \epsilon]$.

The profit maximization problem of a firm h is

$$Max \;\; E\left\{D(h)\left[(1+\gamma)P_H(h) - \frac{w}{A}\right]\left[Y_H(h) + Y_H^*(h)\right]\right\}$$

where $D(h)$ is the stochastic discount factor used by firm h. $Y_H(h)$ and $Y_H^*(h)$ are the demand for goods h from the home and foreign markets

$$Y_H(h) = \left[\frac{P_H(h)}{P_H}\right]^{-\phi}\left(\frac{P_H}{P}\right)^{-\theta} C, \quad Y_H^*(h) = \left[\frac{P_H^*(h)}{P_H^*}\right]^{-\phi}\left(\frac{P_H^*}{P^*}\right)^{-\theta} C^* \tag{9}$$

γ is the rate of production subsidy. This production subsidy is introduced to offset the friction of imperfect competition. Therefore, only two types of distortions remain in the model, namely nominal price rigidity and incomplete consumption risk sharing.

Because firms are all alike, they will set identical prices in equilibrium. The optimal price

[7] Alternatively, it can be assumed that profits proceed directly to shareholders. There is no fundamental difference between the two assumptions.

of home goods is

$$P_H = \frac{\phi}{(\phi-1)(1+\gamma)} \frac{E\left[D\frac{w}{A}X_H\right]}{E\left[DX_H\right]} \tag{10}$$

where X_H represents the demand for home produced goods $X_H = P_H^{\phi}\left(\frac{P_H}{P}\right)^{-\theta}(C+C^*)$. When $\gamma = \frac{1}{\phi-1}$, the distortion created by monopoly is completely offset and the average output is at its first-best level.

Aggregate profit in the home country can be expressed as

$$\Pi = (1+\gamma)P_H Y_H - wL \tag{11}$$

where Y_H is the world demand for aggregate home produced goods $Y_H = \frac{1}{2}\left(\frac{P_H}{P}\right)^{-\theta}(C+C^*)$. It is useful to define home real disposable income as

$$Y = \frac{P_H Y_H}{P} = \frac{1}{2}\left(\frac{P_H}{P}\right)^{1-\theta}(C+C^*) \tag{12}$$

Combined with the government budget constraint $M - M_0 = \gamma P_H Y_H + T$, the home budget constraint (5) can be rewritten in real terms

$$C = Y + \sum_{k=1}^{n} \alpha_k r_k \tag{13}$$

2.3 Financial Sector

There are four different configurations of the asset market: (1) Financial Autarky (FA), in which no assets can be traded across countries; (2) Bond Economy (FB), in which home and foreign nominal bonds are allowed for trade; (3) Equity Economy (FE), in which home and foreign equities can be traded; (4) Bond and Equity Economy (FBE), in which both nominal bonds and equities are allowed for trade.

Nominal bonds represent a claim on a unit of currency. Equities represent a claim on

aggregate profits. The real aggregate rate of return on the home nominal bond and the home equity are defined as

$$r_B = \frac{1}{q_B P} \tag{14}$$

$$r_E = \frac{\Pi}{q_E P} \tag{15}$$

where q_k is the real price of asset k.

2.4 Monetary Rules

Monetary policy is represented as a money supply rule. There are four different regimes: a money targeting rule (MT), a unilateral (one-sided) exchange rate targeting rule (UERT), a bilateral (cooperative) exchange rate targeting rule (BERT), and a producer price targeting rule (PPT). In each regime, the money supply is targeted on some easily observable variables, such as exchange rate and price index.

With a constant money supply, the exchange rate responds endogenously to domestic and foreign disturbances. Hence, the money targeting rule corresponds to a passive floating exchange rate regime. The unilateral peg involves one country (w.o.l.g., the home country) adjusting its money supply to achieve a fixed exchange rate target. Under the bilateral peg, both countries target the same level of exchange rate. When the home currency depreciates, the home money supply contracts and the foreign money supply expands at the same time. The producer price targeting rule stabilizes the domestic producer price level, which eliminates the relative price distortion when some prices cannot be adjusted in the short-run. Such a policy represents a type of active floating exchange rate regime. Because all prices are pre-fixed, the producer price targeting rule is defined in terms of stabilizing the price that producers would choose if prices were fully flexible.

The home monetary rule can be written as

$$M = \bar{M}\left(\frac{S}{\bar{S}}\right)^{-\delta_s}\left(\frac{P_H^X}{\bar{P}_H}\right)^{-\delta_p} \tag{16}$$

where $\bar{S}$ is the target level of exchange rate, and $\bar{P}_H$ is the target level of home producer price. P_H^X is the "flexible"price given by

$$P_H^X = \frac{\phi}{(\phi-1)(1+\gamma)}\frac{w}{A} \tag{17}$$

δ_s and δ_p indicate the degree to which the home monetary authority attempts to control variations in the exchange rate and in the producer price index (PPI). δ_s^* and δ_p^* are the corresponding parameter in the foreign monetary rule. Table 1 summarizes all the regimes.

Table 1: Monetary Regimes

Regime	Policy Parameters
Money Targeting	$\delta_s = \delta_s^* = \delta_p = \delta_p^* = 0$
Unilateral Exchange Rate Peg	$\delta_s \to \infty,\ \delta_s^* = \delta_p = \delta_p^* = 0$
Bilateral Exchange Rate Peg	$\delta_s = \delta_s^* \to \infty,\ \delta_p = \delta_p^* = 0$
Producer Price Targeting	$\delta_s = \delta_s^* = 0,\ \delta_p = \delta_p^* \to \infty$

2.5 Market Clearing

The goods market clearing condition is

$$AL = \frac{1}{2}\left(\frac{P_H}{P}\right)^{-\theta}(C + C^*) \tag{18}$$

The asset market clearing condition is

$$\alpha_k = -\alpha_k^*, \quad k = 1, 2, \cdots, n \tag{19}$$

2.6 Equilibrium

The *equilibrium* comprises a set of prices, P, P^*, P_H, P_F^*, w, w^*, r_k, S, and a set of quantities C, C^*, L, L^*, Π, Π^*, Y, Y^*, α_k, α_k^*, M, M^*, which solves a system of equations (3), (6)-(8), (10)-(12), (14)-(16), (18), and their foreign counterparts, as well as (13) and (19), given productivity and money demand shocks, A, A^*, χ, and χ^*.[8]

3 Solving the Model

3.1 Optimal Portfolios

Following Devereux and Sutherland (2006a,b), the equilibrium portfolio choices are solved to a second-order accuracy. The set of equations to solve for the equilibrium portfolios are given by

$$E[\rho(\hat{C} - \hat{C}^*)\hat{r}_x] \;=\; 0 + O(\epsilon^3) \tag{20}$$

where $\hat{r}_x$ is the vector of relative returns between each asset and the reference asset n, $\hat{r}_x' = [\hat{r}_1 - \hat{r}_n,\ \hat{r}_2 - \hat{r}_n,\ \cdots,\ \hat{r}_{n-1} - \hat{r}_n]$. Detailed derivation of equation (20) is presented in Appendix A.1.[9]

Condition (20) contains only the second moments of endogenous variables, indicating that solving the portfolio choice to a second-order accuracy only requires the first-order solution of the non-portfolio part of the model. This is because second-order accurate second moments can be computed from first-order solutions for realized variables. Moreover, firms' discount factors do not appear in equation (20) or any other equilibrium condition up to the first-order. Hence, they do not affect the solution of optimal portfolio choices. The log-linearized model is presented in Appendix A.2.

[8] By Walras' Law, there is one equation redundant in the system. The foreign agent's budget constraint is dropped.

[9] Hereafter, $\hat{x} = log(x) - log(\bar{x})$, where $\bar{x}$ is the non-stochastic steady state value of variable x.

3.2 Welfare

It is not possible to derive an exact analytical expression for welfare in this model. A second-order accurate solution for welfare is necessary.[10] It requires solving the model as a second-order approximation around the non-stochastic steady state.

A second-order approximation of the welfare measure is given by

$$\tilde{U} = E\left[\bar{C}^{1-\rho}\left(\hat{C}+\frac{1-\rho}{2}\hat{C}^2\right)-\eta\bar{L}^{1+}\left(\hat{L}+\frac{1+\psi}{2}\hat{L}^2\right)\right]+O(\epsilon^3) \tag{21}$$

where $\tilde{U}$ is the deviation of welfare from the non-stochastic equilibrium. $\bar{C}$ and $\bar{L}$ are the steady state values of consumption and labor supply. Welfare is increasing in the expected level of consumption but is decreasing in the variance of consumption, in the expected level of labor and in the variance of labor.

In the second-order approximation of the model, the discount factors reappear through the pricing equations. In order to compute welfare appropriately, it is important to specify the discount factors clearly. In financial autarky, the discount factor is automatically equal to the marginal utility of consumption of the domestic agents because all firms are domestically owned. If the financial market is complete, the marginal utility of consumption of one dollar is equalized across countries. Thus, it makes no difference whether the discount factor is equal to the marginal utility of consumption of the domestic agents or of the foreign agents or of the shareholders (a combination of home and foreign agents). The only case that needs to be approached with caution is when the financial market is incomplete. In this case, the marginal utility of consumption of one dollar differs across countries. For simplicity, I assume $D = \frac{C^{-\rho}}{P}$. In this single-period model, the results will not change qualitatively if firms evaluate profits at their shareholders' discount rate.

[10] This point has been well addressed in the literature. For example, see Collard and Juillard (2001), Kim and Kim (2003), and Schmitt-Grohe and Uribe (2004).

The second-order approximation of the home optimal pricing equation is given by

$$\hat{P}_H = E(\psi\hat{L} + \hat{P} + \rho\hat{C} - \hat{A}) + \lambda_{P_H} + O(\epsilon^3) \tag{22}$$

where λ_{P_H} summarizes the second-order terms and represents the risk premium that home firms build into their pricing decisions

$$\lambda_{P_H} = \frac{1}{2}E\left[(\psi\hat{L} + \hat{P} + \hat{Y} - \hat{A})^2 - (\hat{Y} - \rho\hat{C})^2\right] \tag{23}$$

Similarly, the second-order approximation of the home CPI is

$$\hat{P} = \frac{1}{2}(\hat{P}_H + \hat{P}_F^* + \hat{S}) + \lambda_P + O(\epsilon^3) \tag{24}$$

where λ_P sums up the second-order terms

$$\lambda_P = \frac{1-\theta}{8}(\hat{P}_H - \hat{P}_F^* - \hat{S})^2 \tag{25}$$

Define terms of trade as the price of exports in terms of imports, $\tau = \frac{P_H}{SP_F^*}$. $E(\lambda_P)$ represents the variance of home terms of trade.

The complete second-order approximation of the model is presented in Appendix A.3. Eventually, the approximated welfare function (1) can be expressed in terms of the second moments of variables in the model, and the second-order accurate second moments can be computed from the first-order solutions for the realized values of endogenous variables.[11] In addition, home and foreign countries have symmetric structures and are subject to i.i.d. shocks with zero means. Thus, the two countries are ex-ante identical and have same expected utilities.

[11]This solution technique has been employed in a series of papers. For instance, see Sutherland (2004) and Senay and Sutherland (2005).

4 Solution under a Money Targeting Rule

This section abstracts from policy issues and only looks at the solution under a money targeting rule. First, I discuss the relationship between the exchange rate, the terms of trade, and the risk sharing condition. Then I show that there are two key aspects of the terms of trade in determining the welfare. One is the volatility of the terms of trade and the other is the efficiency of the terms of trade adjustment (whether the terms of trade move in the right direction to achieve efficient relative price adjustments with respect to country-specific shocks). Interestingly, both the volatility and the efficiency of the terms of trade depend on the financial market structure.

4.1 Exchange Rate, Terms of Trade and Risk Sharing

Purchasing power parity (PPP) holds in this model due to full exchange rate pass-through to consumer prices and an absence of home bias in consumption. From the PPP and the money demand equations, I can write the exchange rate as

$$\hat{S} \;=\; (\hat{M} - \hat{M}^*) - (\hat{\chi} - \hat{\chi}^*) - \rho(\hat{C} - \hat{C}^*) \tag{26}$$

Basically, the exchange rate is the relative price of two countries' currencies. It is factored according to the relative money supply and demand in each country. Money supply is given by the policy rule adopted by each country. With money targeting rules, $\hat{M} = \hat{M}^* = 0$. Money demand shocks are indeed preference shocks, which are meant to capture the technology innovations that alter the usefulness of money balances (for example, benefits of saving time during transactions). Other things being equal, the more that agents consume, the more demand for real balances. It is easy to see that higher money supply makes a currency depreciate, while higher money demand makes a currency appreciate.

Home terms of trade in log-linear form are given by

$$\hat{\tau} = \hat{P}_H - \hat{P}_F^* - \hat{S} \tag{27}$$

Combined with the log-linearized home CPI and the log-linearized aggregate demand for home produced goods, home real GDP can be written as

$$\hat{Y} = \frac{1-\theta}{2}\hat{\tau} + \frac{1}{2}(\hat{C} + \hat{C}^*) + O(\epsilon^2) \tag{28}$$

Together with the log-linearized home budget constraint,

$$\hat{C} = \hat{Y} + \tilde{\alpha}'\hat{r}_x + O(\epsilon^2) \tag{29}$$

the consumption difference between home and foreign can be expressed as

$$\frac{1}{2}(\hat{C} - \hat{C}^*) = \frac{1-\theta}{2}\hat{\tau} + \tilde{\alpha}'\hat{r}_x + O(\epsilon^2) \tag{30}$$

Clearly, households' consumption risks originate from real income risks, which all come from the terms of trade fluctuations given there is no aggregate uncertainty at the world level. Agents can diversify away at least part of the consumption risks by trading assets across borders — as long as the returns on these assets are correlated with the terms of trade.

4.2 Volatility of the Terms of Trade

The exchange rate equation (26), the terms of trade equation (27), and the consumption difference equation (30) are crucial for us to understand how the terms of trade would adjust in the process of financial integration. Suppose that home terms of trade deteriorate owing to certain fundamental shocks, $\hat{\tau} < 0$. Home goods become cheaper relative to foreign goods. Given that home and foreign goods are substitutes, the world demand shifts towards home goods. Home output increases, which is called the expenditure switching effect. However,

home goods are sold at a relatively lower price and foreign goods cost relatively more. Whether home GDP rises or falls in real terms depends on the strength of this substitution across countries. If the expenditure switching effect is strong enough (when $\theta > 1$), home real GDP increases. Without international consumption risk sharing, home agents consume more relative to foreign agents. As shown in equation (26), home currency appreciates in this case, flattening the initial deterioration in home terms of trade. The income effect of the initial terms of trade movement triggers an additional exchange rate adjustment that stabilizes the terms of trade. Once international asset markets open, the cross-country consumption difference diminishes, and even disappears if the market is complete. Hence, the higher the degree of consumption risk sharing, the smaller the damping effect from the exchange rate. As a result, financial integration increases the terms of trade volatility when $\theta > 1$.[12] Additionally, this result does not hinge on the degree of nominal price rigidity in the economy.

Proposition 1 *When $\theta > 1$, terms of trade become more volatile as financial markets liberalize.*

Proof: See Appendix A.4 and the above discussion.

4.3 Efficiency of the Terms of Trade

Efficient terms of trade adjustment should respond only to productivity shocks. In particular, a country's terms of trade should deteriorate if the country experiences a positive productivity shock relative to another country. The reason is straightforward: shocks to productivity are real shocks; they affect the comparative advantage of each country in producing substitutable goods. It is efficient to allow the country that has a better technology to produce more. This country's terms of trade have to worsen in order to increase the demand for its goods. In contrast, shocks to money demand are nominal shocks. Any response of the terms of trade with respect to money demand shocks represents a cost to efficiency. The

[12]The result will be reversed if $\theta < 1$.

real allocation of consumption and labor must be suboptimal if two countries, with the same technology and preference, produce at different levels.

In an environment with only pre-fixed prices, terms of trade adjust through exchange rates. If a country's currency depreciates regarding a positive productivity shock, the efficiency of world production will increase. Nonetheless, if a country's currency appreciates regarding a positive productivity shock or if the value of a currency changes in any way regarding a money demand shock, the efficiency of world production will decrease.

4.4 Welfare Impact of Financial Integration

The general solution is very complicated and can only be addressed numerically. Here, I focus on a simplified version of the model, in which utility is logarithmic in consumption and linear in labor, $\rho = 1$ and $\psi = 0$. This special case has interpretable analytical expressions. Results are robust to the value of ρ and ψ.

When $\rho = 1$ and $\psi = 0$, it can be shown that $E(\hat{L}) + \frac{1}{2}E(\hat{L}^2) = 0 + O(\epsilon^3)$.[13] In this case, welfare only depends on the expected level of consumption. Home country's welfare is given by

$$\tilde{U} \;=\; E(\hat{C}) \;=\; -E(\lambda_P) - \frac{1}{2}(\lambda_{P_H} + \lambda_{P_F^*}) + O(\epsilon^3) \tag{31}$$

where λ_P stems from the non-log-linearity of CPI and $E(\lambda_P) = \frac{1-\theta}{8}Var(\hat{\tau})$. When $\theta > 1$, CPI is concave in the price of home and foreign goods. Any volatility in the relative price of home and foreign goods reduces the expected cost of the consumption basket. Intuitively, when home and foreign goods are substitutes, agents can spend less by switching expenditure towards a set of goods that is cheaper ex-post. Hence, the volatility of the terms of trade affects welfare positively.

The volatility of the terms of trade also affects the risk of setting prices in advance, namely λ_{P_H} and $\lambda_{P_F^*}$. Such risks are caused by the fact that firms cannot adjust their prices

[13] Proof see Appendix A.5.

after knowing the state of the economy. Given the structure of the economy, firms know in advance how the exchange rate would respond to different shocks, ex-post. If the exchange rate facilitates efficient adjustment in production, the risk of the inability to change prices after shocks are realized is smaller. Firms will charge a lower price, ex-ante, leading to an increase in the expected consumption. On the other hand, if the exchange rate causes inefficient adjustment in production, the pricing risk is higher. Firms will charge a higher price, ex-ante, leading to a reduction in the expected consumption. As asset markets liberalize, the volatility of the exchange rate goes up. Welfare will fall if financial integration causes excessive adjustments in the terms of trade.

Financial Autarky vs. Complete Markets

When prices are sticky, output is demand-determined. Productivity shocks have no effect on firm revenue. The only changes are associated with the allocation between labor income and profit. If home agents hold one hundred percent of their own firms, their income as well as consumption are independent of productivity shocks. In other words, the default equity position, or a complete home bias in equities, provides a perfect hedge against productivity shocks. Money demand shocks are the only source of income risk. As Home and foreign nominal bonds provide a perfect hedge against money demand shocks, the financial market is complete in the bond and in the bond equity economies. Table 2 summarizes the key second moments and welfare results in the financial autarky and in the complete market.

Table 2: Second Moments and Welfare with Money Targeting Rules

	Financial Autarky	Bond and Bond Equity Economy
$Var(\hat{S})$	$\frac{2}{\theta^2}\sigma_\chi^2$	$2\sigma_\chi^2$
$\lambda_{P_H} = \lambda_{P_F^*}$	$\frac{1}{2}\sigma_\chi^2 + \frac{1}{2}\sigma_A^2$	$\frac{\theta}{2}\sigma_\chi^2 + \frac{1}{2}\sigma_A^2$
$E(\lambda_P)$	$\frac{1-\theta}{4\theta^2}\sigma_\chi^2$	$\frac{1-\theta}{4}\sigma_\chi^2$
$\tilde{U} = E(\hat{C})$	$-\frac{2\theta^2-\theta+1}{4\theta^2}\sigma_\chi^2 - \frac{1}{2}\sigma_A^2$	$-\frac{1+\theta}{4}\sigma_\chi^2 - \frac{1}{2}\sigma_A^2$

Because productivity shocks receive perfect hedging in both the financial autarky and

the complete market, exchange rates react solely to money demand shocks. Any induced adjustment on real allocations is inefficient. Increased exchange rate volatility simply means bigger distortion and higher pricing risk. Let $\sigma_A^2 = \sigma_\chi^2 = 0.0001$. Figure 2 shows that the pricing risk is clearly higher under the complete market when $\theta > 1$. Although the variance of consumption is reduced due to enhanced consumption risk sharing, financial integration is still costly because it leads to a lower level of consumption. As long as the first-moment effect dominates the second-moment effect, welfare is lower under the complete market.

Proposition 2 *With complete nominal price rigidity and money targeting rules, perfect international consumption risk sharing reduces welfare when* $\theta > 1$.

Proof: From Table 2, $\tilde{U}_{FB/FBE} - \tilde{U}_{FA} = \frac{(\theta^2+1)(1-\theta)}{4\theta^2}\sigma_\chi^2 < 0$ if $\theta > 1$.

Incomplete Market

When prices are sticky, international consumption risk sharing is generally incomplete in the equity economy. The exchange rate responds to both productivity and money demand shocks. Portfolio diversification may raise or reduce welfare depending on the parameters in the model, especially the steady state labor income share ζ. In particular, I find a hump-shape relationship between the value of ζ and welfare in the equity economy.

When $\zeta = 0$, each equity has a payoff equal to the GDP of the corresponding country. Agents are indeed trading two state-contingent assets. Agents can perfectly insure themselves by holding half of each country's equities. In this case, markets are complete, and the exchange rate responds to money demand shocks only. Thus, the equity economy yields the same welfare as the complete market. This result holds for any θ.

When $\zeta > 0$, money demand shocks affect both the firm revenue and the labor cost. In response to a positive home demand shock, home currency appreciate and both the firm revenue and the wage rate decrease in the home country. If ζ is small, the dividend on equity moves in the same direction as the firm revenue. Hence, it is optimal for home households

to hold some foreign equities, $\tilde{\alpha}_{FE,E^*} > 0$. On the other hand, if ζ is big, the reduction in wages is so significant that the dividend on equity moves in the opposite direction to the firm revenue. Hence, it is optimal for home households to take a short position in foreign equities, $\tilde{\alpha}_{FE,E^*} < 0$. Once households start trading equities, exchange rates (or terms of trade) are influenced by productivity shocks as well. That is, productivity shocks will have real income effects on the economy.

As ζ increases, the welfare first rises and then falls. The intuition to this hump-shape relationship lies in how the terms of trade respond to different shocks. Up to the first-order, the exchange rate in the equity economy is given by

$$\hat{S}_{FE} = s_1(\hat{A} - \hat{A}^*) + s_2(\hat{\chi} - \hat{\chi}^*) \tag{32}$$

$$s_1 = \frac{2\zeta\tilde{\alpha}_{FE,E^*}}{(1-\zeta)[\theta + 2\tilde{\alpha}_{FE,E^*}(1-\theta)]} \tag{33}$$

$$s_2 = \frac{2\zeta\tilde{\alpha}_{FE,E^*} - 1 + \zeta}{(1-\zeta)[\theta + 2\tilde{\alpha}_{FE,E^*}(1-\theta)]} \tag{34}$$

where $\tilde{\alpha}_{FE,E^*} = \frac{(1-\theta)(1-\zeta)[(1-\theta)(1-\zeta)+\theta\zeta]\sigma_\chi^2}{2\{\theta\zeta^2\sigma_A^2+(1-\theta+\theta\zeta)[(1-\theta)(1-\zeta)+\theta\zeta]\sigma_\chi^2\}}$. Figure 3 plots the response coefficient of the exchange rate to each type of shock against the value of labor income share. Suppose productivity and money demand shocks are equally volatile and that the elasticity of substitution between home and foreign goods is equal to 1.5, Backus et al. (1993). Similar results hold for any $\theta > 1$.

With respect to a positive home demand shock, home currency always appreciates. It is already known that any terms of trade adjustment due to monetary shocks cause inefficient movement in production. Therefore, the smaller the absolute value of s_2, the less there is of real distortion. With respect to a positive home productivity shock, home households experience a loss from their portfolio holdings, if $\tilde{\alpha}_{FE,E^*} > 0$. In this case, home currency depreciates, which helps lower the relative price of home goods and shift world demand towards home produced goods. World production thus becomes more efficient. On the contrary, home currency appreciates if $\tilde{\alpha}_{FE,E^*} < 0$. World production is definitely more distorted. This is the

case when ζ is greater than a certain level.

International consumption risk sharing is usually imperfect in an equity economy, but it still trims down some of the income effect on exchange rate. Terms of trade are more volatile in the equity economy than that in the financial autarky. Whether portfolio diversification is welfare improving depends on the parameterization of the model, particularly on the value of ζ. If ζ is big enough, the exchange rate reacts inefficiently to both productivity and money demand shocks. Hence, increased international risk sharing makes people worse off. Instead, the exchange rate reacts efficiently to productivity shocks if ζ is small. There exists potential gain from diversification.

Proposition 3 *With complete nominal price rigidity and money targeting rules, imperfect international risk sharing may either raise or reduce welfare, as a condition of the value of structural parameters in the model.*

Proof: See the above discussion.

This paper illustrates the welfare effect by computing the consumption equivalent measure, which shows how much consumption would have to be given up under segmented markets to lead to the welfare level observed under complete markets. Appendix A.6 gives the details of the derivations. Figure 4 plots the consumption equivalent measure (under each market configuration) against the value of the labor income share. As discussed, welfare is lower in the complete market than that in the financial autarky. The rank of incomplete market relies on the value of ζ. The labor income share is normally set equal to two thirds, which implies that the equity economy generates a welfare lower than both the financial autarky and the complete market.

5 Policy Analysis

Financial integration may reduce welfare in the presence of nominal price rigidity and a passive floating exchange rate regime. This quite surprising result suggests that active monetary policy might improve welfare as asset markets liberalize.

5.1 Exchange Rate Targeting Rules

If the nominal exchange rate is fixed, there will be no idiosyncratic income risk. Hence, welfare with each type of exchange rate targeting rule is independent of the financial market structure. In addition, a cooperative peg welfare dominates a one-sided peg due to the difference in the induced aggregate money supply.

When all prices are sticky, output is demand-determined. The output volatility depends on the volatility of the relative price and the volatility of the aggregate demand. The bigger the output volatility, the higher the pricing risk faced by producers. Although the terms of trade are fully stabilized with a one-sided peg, the aggregate money supply varies so much that the pricing risk is indeed the same as that under a money targeting rule in financial autarky. For a cooperative peg, not only there is no terms of trade adjustment, but there is no aggregate money supply change. The pricing risk is smaller under a bilateral peg, $\lambda_{P_H}^{UERT} > \lambda_{P_H}^{BERT}$. As shown in Table 3, the cooperative peg always dominates the unilateral peg, $\tilde{U}^{BERT} > \tilde{U}^{UERT}$.

Table 3: Second Moments and Welfare with Exchange Rate Targeting Rules

	One-sided Peg	Cooperative Peg
$Var(\hat{S})$	0	0
$\lambda_{P_H} = \lambda_{P_F^*}$	$\frac{1}{2}\sigma_\chi^2 + \frac{1}{2}\sigma_A^2$	$\frac{1}{4}\sigma_\chi^2 + \frac{1}{2}\sigma_A^2$
$E(\lambda_P)$	0	0
$\tilde{U} = E(\hat{C})$	$-\frac{1}{2}\sigma_\chi^2 - \frac{1}{2}\sigma_A^2$	$-\frac{1}{4}\sigma_\chi^2 - \frac{1}{2}\sigma_A^2$

For any positive θ, the cooperative peg also dominates the money targeting rule in both the financial autarky and the complete markets, $\tilde{U}^{BERT} > \tilde{U}^{MT}$. The ranking between the

money targeting rule and the unilateral peg depends on the structure of the financial markets and the value of θ. Consider the case $\theta > 1$. In the financial autarky, the money targeting rule dominates the unilateral peg, $\tilde{U}^{MT}_{FA} > \tilde{U}^{UERT}$. Although the two policies have the same level of pricing risks, the money targeting rule allows some terms of trade volatility, which helps to lower the average cost of a consumption basket consisting of all home and foreign produced goods. When the financial market is complete, the terms of trade become too volatile under a money targeting rule, and the pricing risk is much higher. In this case, the money targeting rule is dominated by the unilateral peg, $\tilde{U}^{UERT} > \tilde{U}^{MT}_{FB/FBE}$. Similar results hold for the incomplete market with standard calibration.

5.2 Producer Price Targeting Rule

With a producer price targeting rule, prices are still one hundred percent pre-fixed, but they are set at a level that is optimal, even after shocks are realized. That is to say, firms will stick to the prices they have chosen even when they are allowed to readjust the prices after the state of the economy is revealed. As shown in Table 4, there is no pricing risk at all, $\lambda^{PPT}_{P_H} = \lambda^{PPT}_{P^*_F} = 0$. Thus, a price targeting rule actually replicates the flexible price equilibrium. The only difference compared to a flexible price environment is that the relative price modification is made through nominal exchange rates rather than by prices themselves. There is no fundamental difference on real allocations or on any other aspect.

Table 4: Second Moments and Welfare with Price Targeting Rules

	Financial Autarky	Bond, Equity, and Bond Equity Economy
$Var(\hat{S})$	$\frac{2}{\theta^2}\sigma^2_A$	$2\sigma^2_A$
$\lambda_{P_H} = \lambda_{P^*_F}$	0	0
$E(\lambda_P)$	$\frac{1-\theta}{4\theta^2}\sigma^2_A$	$\frac{1-\theta}{4}\sigma^2_A$
$\tilde{U} = E(\hat{C})$	$\frac{\theta-1}{4\theta^2}\sigma^2_A$	$\frac{\theta-1}{4}\sigma^2_A$

If monetary authorities target producer prices directly, international consumption risk

sharing is perfect with either bonds or equities available for trade. The welfare of a producer price targeting rule only depends on whether asset markets exist or not. In brief, producer price targeting and financial integration bring the economy to the first-best. As a result, financial integration is always welfare improving once the sticky price distortion is removed, $\tilde{U}^{PPT}_{FB/FE/FBE} > \tilde{U}^{PPT}_{FA}$.

5.3 Financial Integration and Monetary Policy

Given the nature of monetary policy, the preferred depth of financial integration varies across countries. Countries with a money targeting rule are better off in financial autarky. Countries with exchange rate targeting rules are indifferent to the asset market structures. Only countries with an inflation targeting rule gain from financial integration, which implies that the most financially open economies should be those who can successfully target inflation. As a result, this paper provides an explanation for the acceleration of cross-border asset trade observed in industrial countries during the early 1990s because most industrial countries switched to an inflation targeting regime around that time. This model also rationalizes the developing countries' slow progress in the process of financial globalization because most developing countries still implement a de facto fixed exchange rate regime.

Given the process of financial integration, the producer price targeting rule should be the choice of monetary policy for all countries. However, inflation targeting is quite a sophisticated policy to conduct in practice. It requires a mandate to pursue an inflation objective, the accountability of the central bank, macroeconomic and financial stability, and well-functioning domestic asset markets (especially the bond market). The central bank should also be able to give credible inflation forecasting in order to carry out such a policy. Industrial countries seem to have no problem in qualifying for all these conditions. It might be hard for developing countries to meet even some of these conditions. Therefore, it is rational for developing countries (that have some access to international asset markets) to target the exchange rate first. Such a policy is easy to formulate, and it eliminates the excessive terms of trade adjustment.

Once the above prerequisites are met, developing countries can proceed by pursuing the optimal inflation targeting rule. As a result, financial integration and the lack of readiness for complex policy actions could be the reasons why most developing countries do not float the way they announce.

6 Empirical Result

This section tests two empirical implications suggested by the model. First, financial integration and the terms of trade volatility are positively correlated. Second, inflation targeting countries are more financially integrated.

I start by examining a simple regression of the terms of trade volatility on IFIGDP for 22 industrial countries.[14]

$$VOL_{it}^{TOT} = \alpha_0 + \alpha_1 IFIGDP_{it} + \alpha_2 X_{it} + \epsilon_{it} \tag{35}$$

where VOL_{it}^{TOT} is the terms of trade volatility of country i at time t, measured as the standard deviation of the log-difference of the terms of trade. X_{it} represents a set of control variables, including the trade openness (OPEN), the volatility of oil price (VOL^{OIL}), and the volatility of non-fuel commodity price (VOL^{NFUEL}). These control variables are chosen following the trade literature. Trade openness is measured as the ratio of exports and imports to GDP, while the volatility of the commodity price is measured as the standard deviation of the log-difference of the corresponding price index. The pooled dataset consists quarterly data over 1970q1 to 2004q4, drawn from the IMF *International Financial Statistics* CD-ROM.

Table 5 presents the regression coefficients and associated t-statistics for equation (35). In column (1), 3-year standard deviations are used to measure the volatilities; in column (2), 5-year standard deviations; in column (3), 10-year standard deviations. The pooled OLS regression indicates a positive and statistically significant (except column (1)) association

[14]The sample includes all the industrial countries classified by Lane and Milesi-Ferretti (2006) except Luxembourg due to a lack of data on terms of trade.

Table 5: Effect of Financial Integration on Terms of Trade Volatility

	(1)	(2)	(3)
$IFIGDP$	.000763	.0017249	.0014083
	(1.05)	$(2.53)^{**}$	$(2.72)^{***}$
$OPEN$	$-.0146744$	$-.0088779$	$-.0221711$
	(-1.46)	(-0.92)	$(-2.81)^{***}$
VOL^{OIL}	.1064797	.1000913	.1682145
	$(5.59)^{***}$	$(4.19)^{***}$	$(3.55)^{***}$
VOL^{NFUEL}	$-.1345124$	$-.0638862$	.014577
	$(-1.74)^{*}$	(-0.67)	(0.05)
R^2	0.1962	0.1218	0.1166
N	1496	1352	977

Pooled OLS estimation with fixed effect and time dummies.
Intercept is included in all estimations but not reported.
t-statistics in parentheses.
$***$, $**$ and $*$ denote 1%, 5% and 10% levels of significance.

between the *de facto* measure of financial integration and the terms of trade volatility. This result provides empirical evidence for the main driving force in the model.

Then, I study a simple regression of IFIGDP on inflation for the same sample.

$$IFIGDP_{it} = \beta_0 + \beta_1 \pi_{it} + \beta_2 Z_{it} + \mu_{it} \tag{36}$$

where π_{it} is the inflation rate of country i at time t. Z_{it} represents a set of control variables, including the trade openness, the growth rate of real GDP (G_{RGDP}), and a *de jure* measure of financial liberalization ($KAOPEN$). The growth rate of real GDP is used as a proxy for overall economic development. The *de jure* measure of financial liberalization is taken from the work of Chinn and Ito (2006).

Table 6 presents the regression coefficients and associated t-statistics for equation (36). In columns (1) and (3), inflation is measured as the annual percentage change in CPI; in column (2) and (4), inflation is measured as the annual percentage change in PPI. The pooled OLS regression indicates a negative (except column (3)) and statistically significant association between the inflation rate and the *de facto* measure of financial integration. The message

Table 6: Correlation between Financial Integration and Inflation

	(1)	(2)	(3)	(4)
π	-5.141061	-4.056977	.8409109	-1.311057
	$(-9.37)^{***}$	$(-9.27)^{***}$	(1.54)	$(-2.57)^{***}$
$OPEN$	5.178276	5.839718	1.469328	1.797947
	$(23.62)^{***}$	$(24.21)^{***}$	$(6.95)^{***}$	$(6.91)^{***}$
G_{RGDP}	-3.902612	-2.652572	$-.2064904$	$-.6142463$
	$(-5.12)^{***}$	$(-3.25)^{***}$	(-0.32)	(-0.82)
$KAOPEN$	.3626319	.3718733	.1706501	.1744272
	$(15.15)^{***}$	$(14.89)^{***}$	$(8.43)^{***}$	$(7.54)^{***}$
R^2	0.4978	0.5034	0.5486	0.5759
N	2163	1891	2163	1891

Pooled OLS estimation with fixed effect.
Time dummies are included in columns (3) and (4).
Intercept is included in all estimations but not reported.
t-statistics in parentheses.
$***$, $**$ and $*$ denote 1%, 5% and 10% levels of significance.

from this result is that the adoption of inflation targeting rules in the developed countries and the sharp increase in cross-border asset trade among these economies are not a coincidence. There is still a strong relationship between low inflation and high degree of financial integration after controlling for the process of capital account liberalization (less restrictions on capital account transactions).

7 Conclusion

This paper analyzes the welfare impact of financial integration in a standard monetary open economy model with nominal price rigidity. Financial integration may reduce welfare if integration leads to excessive terms of trade adjustment. This can happen when financial market segmentation is not the only distortion in the economy. Fixed exchange rate eliminates the excessive terms of trade volatility. Hence, this model implies that developing economies that are experiencing financial integration may attempt to alleviate the welfare cost of integration by stabilizing the exchange rate. This prediction is consistent with the widespread reluctance

to following freely floating exchange rates among these economies, a phenomenon that has been well documented in the "fear of floating"literature. On the other hand, for advanced economies that have the ability to operate efficient inflation targeting monetary policies, financial globalization is always beneficial. The model thus predicts that advanced economies that have introduced inflation targeting as a monetary policy rule should experience a deeper level of financial globalization. Most industrial countries started an inflation targeting regime in the early 1990s, which explains the acceleration of cross-border asset trade in industrial countries since then. Given that most developing countries still conduct a de facto fixed exchange rate regime, the slow progress of developing countries in the process of financial globalization is not surprising.

References

Backus, D., P. Kehoe, and F. Kydland (1993) 'International business cycles: Theory and evidence.' NBER Working Paper, No. 4493

Calvo, G.A., and C.M. Reinhart (2002) 'Fear of floating.' *Quarterly Journal of Economics* 117, 379–408

Chinn, M., and H. Ito (2006) 'What matters for financial development? capital controls, institutions, and interactions.' *Journal of Development Economics* 61(1), 163–192

Cole, H.L., and M. Obstfeld (1991) 'Commodity trade and international risk sharing.' *Journal of Monetary Economics* 28, 3–24

Collard, F., and M. Juillard (2001) 'Accuracy of stochastic perturbation methods: The case of asset pricing models.' *Journal of Economic Dynamics And Control* 25, 979–999

Devereux, M., and A. Sutherland (2006a) 'Country portfolio dynamics.' Manuscript, University of British Columbia and University of St. Andrews

_ (2006b) 'Solving for country portfolios in open economy macro models.' Manuscript, University of British Columbia and University of St. Andrews

_ (2007) 'Monetary policy and portfolio choice in an open economy macro model.' *Journal of the European Economic Association* 5, 491–499

Devereux, M., and G.W. Smith (1994) 'International risk sharing and economic growth.' *International Economic Review* 35(3), 535–550

Engel, C., and A. Matsumoto (2005) 'Portfolio choice in a monetary open-economy dsge model.' Manuscript, University of Wisconsin and IMF

Evans, M.D., and V. Hnatkovska (2005) 'Solving general equilibrium models with incomplete markets and many assets.' NBER Technical Working Paper No. 318

Goodfriend, M. (2003). Inflation Targeting in the United States. NBER Working Paper, No. 9981

Ito, T., and F.S. Mishkin (2004) 'Monetary policy in japan: Problems and solutions.' Conference paper

Kim, J., and H. Kim (2003) 'Spurious welfare reversals in international business cycle models.' *Journal of International Economics* 60, 471–500

Kollmann, R. (2005) 'International portfolio equilibrium and the current account: A dynamic general equilibrium perspective.' Manuscript, University of Paris XII

Lane, P.R., and G.M. Milesi-Ferretti (2006) 'The external wealth of nations mark ii: Revised and extended estimates of foreign assets and liabilities, 1970-2004.' IMF Working Paper, No. 06-69

Levy-Yeyati, E., and F. Sturzenegger (2003) 'Classifying exchange rate regimes: Deeds vs. words.' Manuscript, Universidad Torcuato Di Tella

Lewis, K.K. (1996) 'Consumption, stock returns, and the gains from international risk-sharing.' NBER Working Paper, No. 5410

Reinhart, C.M., and K.S. Rogoff (2002) 'The modern history of exchange rate arrangements: A reinterpretation.' NBER Working Paper, No. 8963

Rose, A. (2006) 'A stable international monetary system emerges: Inflation targeting is bretton woods, reversed.' NBER Working Paper, No. 12711

Schmitt-Grohe, S., and M. Uribe (2004) 'Solving dynamic general equilibrium models using a second-order approximation to the policy function.' *Journal of Economic Dynamics and Control* 28, 755–775

Senay, O., and A. Sutherland (2005) 'Foreign money shocks and the welfare performance of alternative monetary policy regimes.' Manuscript, Middle East Technical University and University of St. Andrews

Sutherland, A. (2004) 'International monetary policy coordination and financial market integration.' CEPR Discussion Paper, No. 4251

Tesar, L.L. (1995) 'Evaluating the gains from international risk sharing.' *Carnegie-Rochester Conference Series on Public Policy* 42, 95–143

Tille, C. (2005) 'The welfare effect of international asset market integration under nominal rigidities.' *Journal of International Economics* 65, 221–247

van Wincoop, E. (1999) 'How big are potential welfare gains from international risk sharing?' *Journal of International Economics* 47(1), 109–135

Wyplosz, C. (2006) 'European monetary union: the dark sides of a major success.' *Economic Policy* April, 207–261

Figure 1: Sum of Foreign Assets and Liabilities to GDP Ratio: Industrial Group and Developing Countries Group, 1970-2004

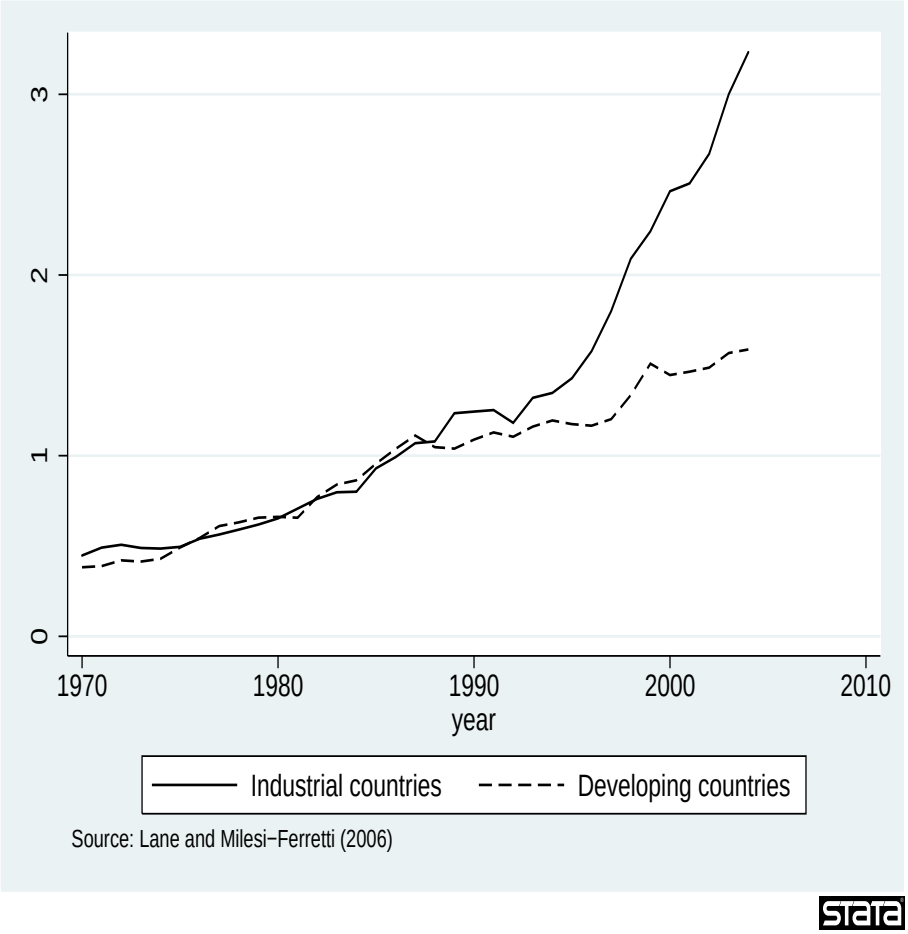

Figure 2: Second Moments and Welfare with Money Targeting Rules

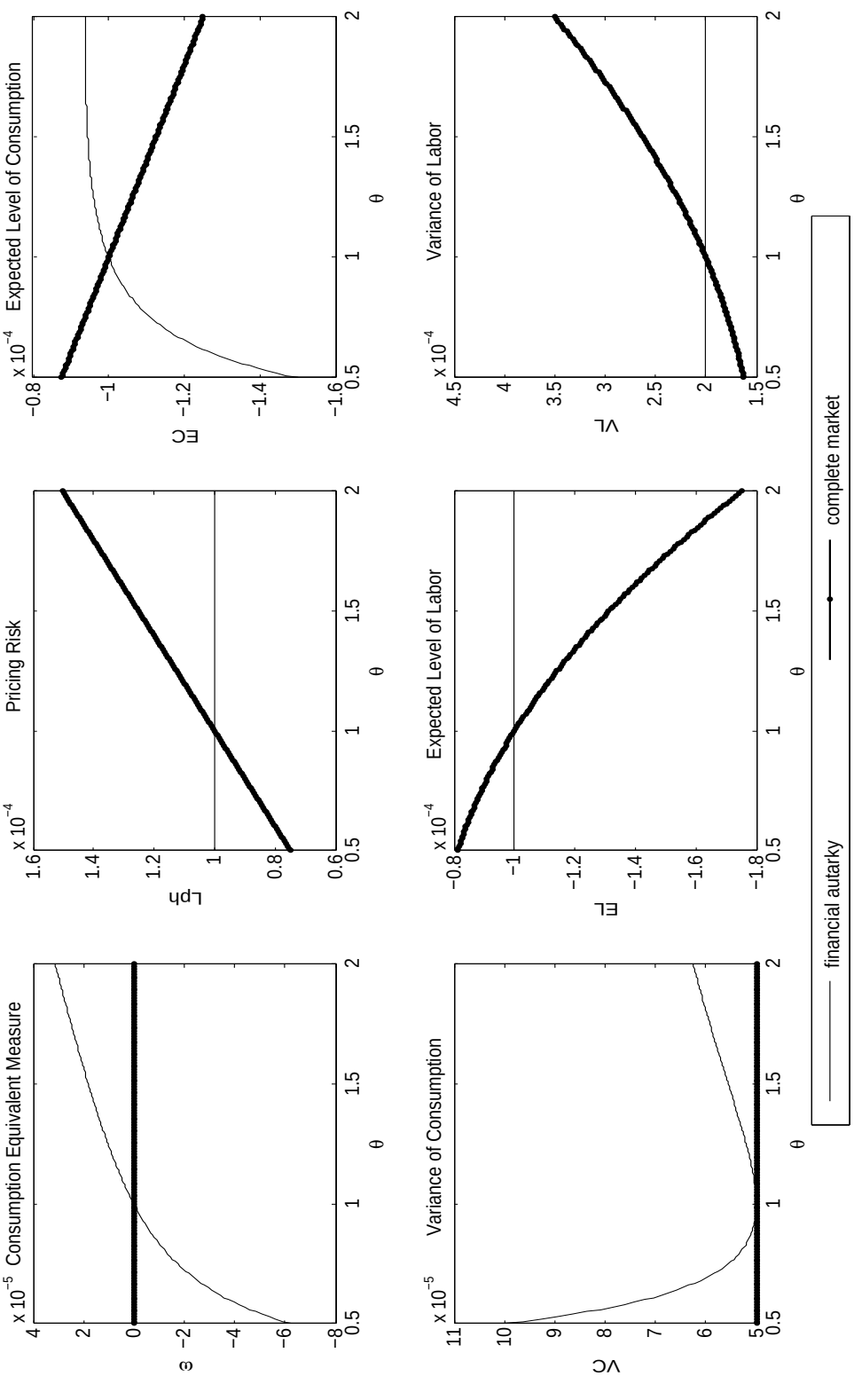

Figure 3: Exchange Rate Response Coefficients with Incomplete Markets

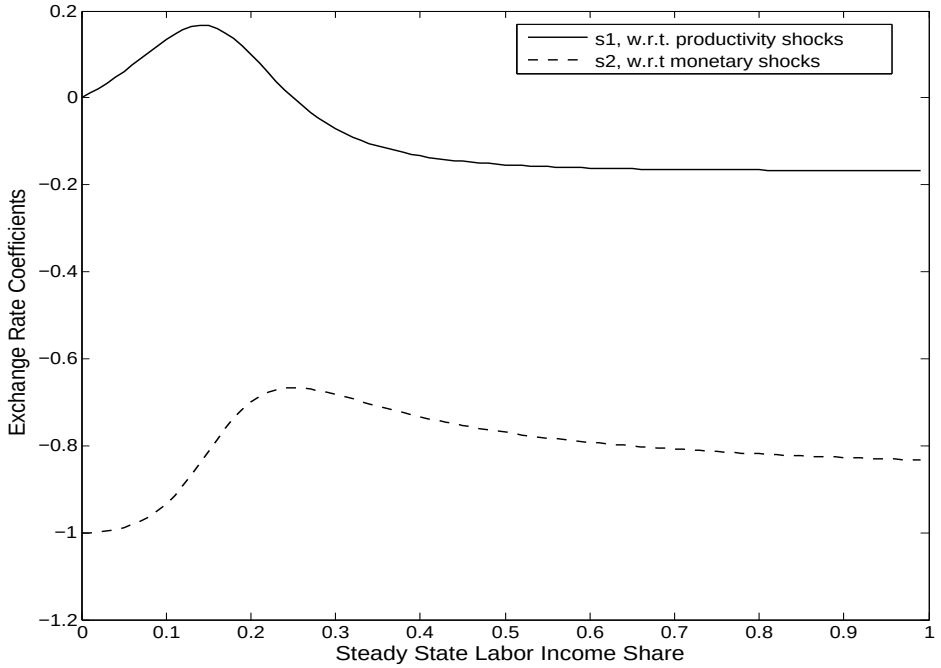

Figure 4: Consumption Equivalent Measures with Money Targeting Rules