Exploring Policy Options in Joint Intertemporal-Spatial Trade Models Using an Incomplete Markets Approach*

Hui Huang†
Victoria University of Wellington, New Zealand

John Whalley‡§
University of Western Ontario, Canada
NBER, USA
CES - ifo, Germany
CIGI, Canada

Shunming Zhang¶
Xiamen University

April 19, 2007

*This paper brings together materials from two earlier papers, "Financial Services Trade Liberalization in A Joint Spatial Intertemporal Multi-Country Model" by Huang, Whalley and Zhang (2004) and "A Simple Trade Model with An Optimal Exchange Rate Motivated by Discussion of a Renminbi Float" by Huang, Wang, Wang, Whalley and Zhang (2005).

†School of Economics and Finance, Victoria University of Wellington, Wellington, New Zealand. Email: hui.huang@vuw.ac.nz.

‡Department of Economics, Social Science Centre, The University of Western Ontario, London, Ontario, N6A 5C2, Canada. Email: jwhalley@uwo.ca.

§Corresponding author

¶Department of Finance, School of Economics, Xiamen University, Xiamen, Fujian, P.R.China 361005. Email: szhang@xmu.edu.cn.

Exploring Policy Options in Joint Intertemporal-Spatial Trade Models Using an Incomplete Markets Approach

Hui Huang, John Whalley, and Shunming Zhang

Abstract

In this paper we analyze some policy implications of incompleteness of markets in trade models, where there is both inter-spatial and intertemporal trade between countries. We interpret the absence of intertemporal trade as an absence of intermediation services provided by both domestic and foreign service providers. For simplicity, we consider extreme cases where intertemporal intermediation services can only be provided by domestic providers, so that when intertemporal trade in services is not allowed, markets are not complete. To our knowledge, this type of models is not used in the trade literature as general comparative statics results are unavailable. We use numerical simulation methods for insights. We first consider liberalization of financial services trade in a inter-spatial and intertemporal model of two countries, and we show how services liberalization can be welfare worsening in the presence of a tariff on goods trade spatially. We show that this can hold in a world with financial service trade autarky in which financial service trade liberalization involves both costless intertemporal intermediation provided by foreign service providers and in a more complex (and realistic) world where costly intermediation services can be provided by both within country and foreign providers. We then explore a model of inter-spatial and intertemporal trade for a single country in which there is a fixed exchange rate with a surrender requirement for foreign exchange generated by exports and money is non-neutral. The model incorporates intertemporal intermediation services which may or may not be liberalized across countries. We find that when services remain unliberalized there is an optimal trade intervention, even in the small open price taking economy case and there can be an optimal exchange rate.

1 Introduction

In this paper we discuss the policy implications of incompleteness of markets in trade models when there is both intertemporal and inter-spatial trade between countries. We interpret cases with no intertemporal trade as an absence of intertemporal intermediation services provided by both domestic and foreign service providers. For simplicity, we consider extreme cases where intertemporal intermediation services can only be provided by domestic providers so that when intertemporal trade in services is not allowed markets are incomplete in that consumers only face period by period budget constraints. We appeal directly to literature on multi-commodity intertemporal models of incomplete markets due to Radner(1972), Hart (1975), Duffie and Shafer (1985), Werner (1985), Duffie (1987), Geanakopolos (1990), Magill and Shafer (1991), and Magill and Quinzii (1996) in analyzing the effects of financial services liberalization in models. We use this incomplete markets literature without the added complication of uncertainty; most of this literature is concerned with existence issues; our focus here is comparative statics.

We first consider a series of 2 country, 2 good, and 2 period numerical simulation analyses using a simple general equilibrium structure, and consider cases in which tariffs distort trade within periods both before and after financial service liberalization. Initially there is intertemporal autarky (no intertemporal intermediation) in financial services, which, for simplicity, we characterize as no domestic provision of intermediation services. Using this framework we are able to separately consider both tariff liberalization (removing or reducing tariffs) and financial services liberalization which allows for foreign providers to enter domestic markets and relax intertemporal budget constraints for borrowers and lenders. We are thus able to consider financial services liberalization in the presence of tariffs, tariff liberalization in the presence of financial service trade restrictions, and joint liberalization of both goods and financial services.

We explore whether financial services liberalization need be welfare improving using numerical examples. Initially, we consider a simple world in which there is no domestic provision of intermediation services but liberalization permits foreign entry of costless service providers who, in effect, relax period by period budget constraints. This is in the spirit of Hart (1975), Duffie and Shafer (1985), Magill and Shafer (1990), but we do not explicitly consider uncertainty and concentrate on numerical solution and comparative static analyses rather than on existence. We then consider an extension to this model with costly interme-

diation and with both domestic and foreign financial service providers both before and after liberalization. These two service providers have differential costs. In this model, financial services trade liberalization typically increases the amount of intermediation; intertemporal intermediation services are used initially in both countries but after liberalization are provided in both countries by the relatively more efficient domestic service provider. We report on examples where with preexisting tariffs financial services liberalization can be welfare worsening.

In the contemporary global economy services trade is perhaps 1/3 of total goods and services trade, and services are more heavily restricted than goods, albeit by regulatory devices more so than by tariffs. The severity of existing service trade restrictions seemingly suggests that it is more likely that services liberalization may be welfare improving, but this remains a judgmentally based evaluation rather than a clearly established result. General results are probably unattainable for the simulation structure we explore numerically here, but the mere possibility that adding financial services liberalization to conventional goods liberalization in the presence of goods trade restrictions can be welfare worsening is important for the ways in which GATS and services liberalization in the WTO are currently discussed. Until such time that goods trade is free of restrictions the implication is that services trade liberalization in the GATS needs to be shown to be welfare improving in particular cases before it can be unequivocally advocated.

We next use a model of combined inter-spatial and intertemporal trade between countries with monetary structure and monetary non-neutralities in which there is a fixed exchange rate accompanied by a surrender requirement for foreign exchange generated by exporters. In the model presented here, under either auctioning of foreign exchange received by the central bank among importers, or some non auctioned foreign exchange allocation mechanism with domestic trading in foreign exchange, there will be a premium value on foreign exchange which is endogenously determined and operates akin to a tariff on imports. In simple models where income effects among consumers are assumed away, domestic monetary policy in such a model is non neutral, and trade liberalization (a tariff reduction) merely changes the premium value on foreign exchange, leaving trade unchanged. Since monetary policy is non-neutral, when services remain unliberalized there is an optimal trade intervention, even in the small economy case. This occurs because given monetary policy and an endogenously determined premium value on foreign exchange, an optimal setting of the

exchange rate can provide the optimal trade intervention. Under a freely floating exchange rate any departure from this optimal rate will typically inflict welfare losses. In a two country model extension, a retaliatory exchange rate game, related to well known tariff games could be constructed, for which a Nash equilibrium in exchange rates can be computed.

We present the model, and illustrate possible outcomes using numerical simulation, and discuss its relevance to the contemporary Chinese situation where services are unliberalized and tariffs are bound in the WTO. We do not pretend that this model realistically captures the relevant features of the financial and real sides of the Chinese economy, and hence may only be suggestive in its implications for current policy. Importantly, there is no foreign exchange premium in China since China is currently running a trade surplus rather than the balanced trade our model specifies and support this regime through reserve accumulation (see Wang and Whalley, 2007). Concerns over potential capital flight under a free float are also an important factor in current debates and they are not captured here. But the implication that if services remain largely unliberalized (as in China today) and tariff rates are bound in the WTO a move to a free float may be welfare worsening in our analysis seems both clear and relevant, and should be kept in mind by those currently advocating a free Renminbi float.

2 A Two-Country Model of Joint Spatial and Intertemporal Trade Used to Evaluate Financial Services Liberalization

Model Structure

To explore the impacts of financial services trade liberalization in the presence of goods market restrictions, we use a simple 2 period ($t = 0, 1$) 2 country ($i = 1, 2$) 2 good ($l = 1, 2$) pure exchange general equilibrium model. This we regard as the minimal model which can be used to explore the impact of simultaneous trade liberalization occurring in goods and services where the services at issue involve intermediation (banking services), and we motivate its use both by the desire to simplify and by the absence (to our knowledge) of prior literature of this form. Multi commodity intertemporal models exist in the literature, but not with multiple countries and international trade both in goods and in intermediation services. Other elements such as production, higher dimensionality in goods or number of periods can be added, but as our focus is exploring the possibility that liberalization in

services need not be welfare improving if goods trade remains unliberalized they merely add unnecessary complexity and to the structure.

In this model, each country has a single representative consumer, each with endowments of the two goods in each period (E^t_{il}; $t = 0, 1$, $i = 1, 2$, $l = 1, 2$). For simplicity, a time-additive utility function is used of the form

$$U_i = \sum_{t=0}^{1} \frac{1}{(1+\rho_i)^t} u_i^t(X^t_{i1}, X^t_{i2}) = u_i^0(X^0_{i1}, X^0_{i2}) + \frac{1}{1+\rho_i} u_i^1(X^1_{i1}, X^1_{i2}), \qquad i = 1, 2 \tag{2.1}$$

where $u_i^t(X^t_{i1}, X^t_{i2}) = [X^t_{i1}]^{\alpha^t_{i1}} [X^t_{i2}]^{\alpha^t_{i2}}$ for $t = 0, 1$ and $i = 1, 2$. This can be represented more explicitly in the Cobb-Douglas case as

$$U_i = [X^0_{i1}]^{\alpha^0_{i1}} [X^0_{i2}]^{\alpha^0_{i2}} + \frac{1}{1+\rho_i} [X^1_{i1}]^{\alpha^1_{i1}} [X^1_{i2}]^{\alpha^1_{i2}}, \qquad i = 1, 2 \tag{2.2}$$

where ρ_i is the intertemporal discount factor for individual i, X^t_{il} denotes the consumption of good l for country i at date t, and α^t_{il} is the share parameter for good l for country i at date t ($\sum_{l=1}^{2} \alpha^t_{il} = 1$). We can also consider CES preferences.

For any good l, in any period t, we define the seller's (net of tariff) price as P^t_l and we allow each country i to impose tariffs at rate T^t_{il} on each imported good l (i.e. if $X^t_{il} \geq E^t_{il}$, then $T^t_{il} \geq 0$). Tariffs are set to zero for any export i (i.e. if $X^t_{il} \leq E^t_{il}$, then $T^t_{il} = 0$). Internal (gross of tariff) prices for good l in country i at date t are thus

$$P^t_{il} = P^t_l (1 + T^t_{il}), \qquad t = 0, 1, \quad i = 1, 2, \quad l = 1, 2. \tag{2.3}$$

These are also sellers prices of good l in country i.

Tariff revenues collected in country i in period t are

$$R^t_i = \sum_{l=1}^{2} P^t_l T^t_{il} (X^t_{il} - E^t_{il})^+, \qquad t = 0, 1, \quad i = 1, 2 \tag{2.4}$$

where E^t_{il} denotes the initial endowment of good l for country i, and the total income of country i in period t is given by

$$I^t_i = \sum_{l=1}^{2} P^t_{il} E^t_{il} + R^t_i, \qquad t = 0, 1, \quad i = 1, 2. \tag{2.5}$$

To simplify matters further, we initially assume that there is service autarky and that in this case (and as a strong assumption) there no intermediation provided by domestic service providers. This is clearly an artificial construct (which we relax later) whose main virtue

is simplicity. This enables us to appeal directly to relevant literature on multi-commodity intertemporal models from Radner(1972), Hart (1975), Duffie and Shafer (1985), Werner (1985), Duffie (1987), Geanakopolos (1990), Magill and Shafer (1991), and Magill and Quinzii (1996) in analysing the effects of service liberalization in a simple way. We do this without the added complication of uncertainty which is central to this literature. Most of this literature is concerned with existence issues; our focus here is comparative statics. We assume for now (and also for further simplicity) that under free trade in services, intermediation services are provided costlessly by foreign banks. [1]

In the initial autarky case, period by period budget constraints apply for each country i and in each period t, i.e.

$$\sum_{l=1}^{2} P_{il}^t X_{il}^t = I_i^t, \qquad t = 0, 1, \quad i = 1, 2.$$

These imply that

$$\sum_{l=1}^{2} P_l^t (1 + T_{il}^t) X_{il}^t = \sum_{l=1}^{2} P_l^t (1 + T_{il}^t) E_{il}^t + R_i^t, \qquad t = 0, 1; \quad i = 1, 2. \tag{2.6}$$

The combined budget constraint for country i over the two periods is

$$\sum_{t=0}^{1} \sum_{l=1}^{2} P_{il}^t X_{il}^t = \sum_{t=0}^{1} I_i^t, \qquad i = 1, 2$$

which implies

$$\sum_{t=0}^{1} \sum_{l=1}^{2} P_l^t (1 + T_{il}^t) X_{il}^t = \sum_{t=0}^{1} \sum_{l=1}^{2} P_l^t (1 + T_{il}^t) E_{il}^t + \sum_{t=0}^{1} R_i^t, \qquad i = 1, 2. \tag{2.7}$$

Our treatment of financial services liberalization allows us to consider two different types of equilibria. In one there are period by period budget constraints, and in the other only across period budget constraints. Moving from period by period budget constraints to an across period budget constraint can be thought of as allowing for intertemporal intermediation in consumption activities across periods where non previously occurred. The interpretation is that initially there is autarky in trade in intermediation services since none can be provided domestically. We then open up each economy to international trade in intermediation services which are costlessly provided, a simple form of liberalization in intertemporal

[1] The discussion of barriers to trade in intermediation services in practice in Chen and Schembri (2002), Francois and Schuknecht (2000), Kalirajan, McHuire, Nguyen and Schuele (2001), and Mattoo (1999), clearly indicates this is a strong simplification, which are adopt here to simplify the analysis.

intermediation services. In this case we can thus consider goods trade liberalization as a reduction in tariffs where no service liberalization occurs, or service liberalization where no tariff liberalization occurs. We can also consider services liberalization in a tariff-free world, and tariff liberalization in a world either with or without service restrictions. Finally, we can consider joint tariff and services liberalization. Comparisons of welfare outcomes across all these equilibriums can be made and implication for policy drawn.

This joint spatial intertemporal economy can also be thought of as one in which there are a series of spot markets in goods, and in the presence of services liberalization a system of asset markets which permit the transfer of income among spot markets in the sense first analyzed by Arrow (1964) and later by Hart (1975), Werner (1985), and Magill and Shafer (1991). [2] It contrasts with earlier intertemporal equilibrium formalizations of a set of Arrow-Debreu contingent commodity markets as in Debreu (1959).

The two types of equilibria we consider for this structure are.

General Equilibrium with Period by Period Budget Constraints

A general equilibrium for this economy with period by period budget constraints is characterized by a price system and consumption of goods by countries $((P_l^t : t = 0, 1; l = 1, 2), (X_{il}^t : t = 0, 1; i = 1, 2; l = 1, 2))$ such that

[1] given $(P_l^t; t = 0, 1, l = 1, 2)$, for i = 1, 2, $(X_{il}^t; t = 0, 1, l = 1, 2)$ solve the utility maximization problem subject to the period by period budget constraints (2.6),

$$\begin{aligned} max \quad & U_i = u_i^0(X_{i1}^0, X_{i2}^0) + \frac{1}{1+\rho_i} u_i^1(X_{i1}^1, X_{i2}^1) \\ s.t. \quad & \sum_{l=1}^{2} P_l^t(1+T_{il}^t)X_{il}^t = \sum_{l=1}^{2} P_l^t(1+T_{il}^t)E_{il}^t + R_i^t, \qquad t = 0, 1; \end{aligned}$$

and [2] markets clear

$$\sum_{i=1}^{2} X_{il}^t = \sum_{i=1}^{2} E_{il}^t, \qquad t = 0, 1; \quad l = 1, 2.$$

General Equilibrium with Across Period Budget Constraints

[2] Hart (1975) showed, with uncertainty and hence incomplete markets, an equilibrium may not exist, or an inefficient equilibrium may result. Werner (1985) discusses the general issue of existence for such economies; Magill and Shafer (1991) show among others results how in the certainty case the multi-commodity intertemporal equilibrium is equivalent to one in which an interest rate is endogenously determined and equals the ratio of the shadow prices of period by period budget constraints for each of the individuals in the economy.

A general equilibrium for this economy with combined budget constraints over periods is characterized by a price system and consumption of goods by countries $((P_l^t : t = 0, 1; l = 1, 2), (X_{il}^t : t = 0, 1; i = 1, 2; l = 1, 2))$ such that

[1] given $(P_l^t; t = 0, 1, l = 1, 2)$, for i = 1, 2, $(X_{il}^t; t = 0, 1, l = 1, 2)$ solves the utility maximization problem subject to the combined across period budget constraint (2.7),

$$\begin{aligned} max \quad & U_i = u_i^0(X_{i1}^0, X_{i2}^0) + \frac{1}{1+\rho_i} u_i^1(X_{i1}^1, X_{i2}^1) \\ s.t. \quad & \sum_{t=0}^{1}\sum_{l=1}^{2} P_l^t(1+T_{il}^t)X_{il}^t = \sum_{t=0}^{1}\sum_{l=1}^{2} P_l^t(1+T_{il}^t)E_{il}^t + \sum_{t=0}^{1} R_i^t; \end{aligned}$$

and [2] markets clear

$$\sum_{i=1}^{2} X_{il}^t = \sum_{i=1}^{2} E_{il}^t, \qquad t = 0, 1; \quad l = 1, 2.$$

The combined across periods budget constraint (2.7) for each individual in each country can also be written as

$$\sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \tag{2.8}$$

$$\sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + F_i \tag{2.9}$$

where F_i represents the amount borrowed by individual i from the other in period 0 and repaid in period 1.

The across period budget constraint equilibrium is the same as an equilibrium characterized by a price system and consumption of goods by countries $((P_l^t : t = 0, 1; l = 1, 2), (X_{il}^t : t = 0, 1; i = 1, 2; l = 1, 2))$ such that

[1] given $(P_l^t; t = 0, 1, l = 1, 2)$, for i = 1, 2, $(X_{il}^t; t = 0, 1, l = 1, 2)$ solve the utility maximization problem subject to the budget constraints (2.8) - (2.9), i.e.

$$\begin{aligned} max \quad & U_i = u_i^0(X_{i1}^0, X_{i2}^0) + \frac{1}{1+\rho_i} u_i^1(X_{i1}^1, X_{i2}^1) \\ s.t. \quad & \sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \\ & \sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + F_i \end{aligned}$$

and [2] markets clear

$$\sum_{i=1}^{2} X_{il}^t = \sum_{i=1}^{2} E_{il}^t \quad for \quad t = 0, 1 \quad and \quad l = 1, 2 \qquad and \qquad \sum_{i=1}^{2} F_i = 0.$$

Denoting an interest rate (for both lenders and borrowers) in the two countries as r, the combined budget constraints become

$$\sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \tag{2.10}$$

$$\sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + [1+r]F_i \tag{2.11}$$

Thus, the across period equilibrium is equivalent to an equilibrium characterized by the same lending and borrowing interest rate r, and a price system and consumption of goods by countries $((P_l^t : t = 0,1; l = 1,2), (X_{il}^t : t = 0,1; i = 1,2; l = 1,2))$ such that

[1] given $(P_l^t; t = 0,1, l = 1,2)$, for i = 1, 2, $(X_{il}^t; t = 0,1, l = 1,2)$ solve the utility maximization problem subject to the budget constraints (2.10) - (2.11)

$$\begin{aligned} max \quad & U_i = u_i^0(X_{i1}^0, X_{i2}^0) + \frac{1}{1+\rho_i} u_i^1(X_{i1}^1, X_{i2}^1) \\ s.t. \quad & \sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \\ & \sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + [1+r]F_i \end{aligned}$$

and [2] markets clear

$$\sum_{i=1}^{2} X_{il}^t = \sum_{i=1}^{2} E_{il}^t \quad for \quad t = 0,1 \quad and \quad l = 1,2 \qquad and \qquad \sum_{i=1}^{2} F_i = 0.$$

If tariff rates are zero on both products in both countries at both dates ($T_{il}^t = 0$ for $t = 0,1$ and $i = 1,2$ and $l = 1,2$), then these equilibria are also free trade competitive equilibria.

Comparing across these equilibria in this simplified world enables us to consider the effects of financial services liberalization (in the sense assumed here) in the presence of restrictions on goods trade.

Numerical Analysis

We can use the equilibrium structures set out in the previous section in numerical equilibrium analyses which compare across equilibria for particular parameterizations and assess the welfare effects of alternative trade liberalizations. To compute equilibria for these we need to assume that the direction of trade is predetermined. This may be that country

1 imports good 1 ($X_{11}^t \geq E_{11}^t$ and $T_{11}^t \geq 0$) and exports good 2 ($X_{12}^t \leq E_{12}^t$ and $T_{12}^t = 0$), while country 2 exports good 1 ($X_{21}^t \leq E_{21}^t$ and $T_{21}^t = 0$) and imports good 2 ($X_{22}^t \geq E_{22}^t$ and $T_{22}^t \geq 0$). In this case the price of good 1 is $P_{11}^t = P_1^t(1 + T_{11}^t)$ for buyers in country 1 and $P_{21}^t = P_1^t$ for sellers from country 2, and the price of good 2 is $P_{12}^t = P_2^t$ for sellers from country 1 and $P_{22}^t = P_2^t(1 + T_{22}^t)$ for buyers in country 2. In this case tariff revenues at date t are given by

$$R_1^t = P_1^t T_{11}^t (X_{11}^t - E_{11}^t) \qquad and \qquad R_2^t = P_2^t T_{22}^t (X_{22}^t - E_{22}^t). \tag{2.12}$$

Table 2.1 sets out a parameterization for a Cobb - Douglas intertemporal spatial 2 country economy with and without tariffs. We also consider CES cases. The parameter values used here have been selected to show cases can be found for which services liberalization is welfare worsening. Except for the share parameters this is a symmetric specification across countries including the intertemporal discount factors used in the two countries. Tariff rates are specified as positive when the direction of trade implies an import by that country. We later perform parametric variation around this specification in an effort to explore the likelihood of such an outcome occurring.

In Table 2.2 we report Hicksian Equivalent Variation money metric welfare measures of the impacts of various liberalizations both for individual economies and for the world using the parametric specification in Table 2.1. In this table Hicksian measures are expressed as a percentage of reference equilibrium (pre-liberalization) incomes. Here, results show that goods liberalization yields a welfare gain, while services liberalization in the presence of tariffs yields a welfare loss. Larger gains occur if tariffs and services are jointly removed, implying these two liberalization have non additive effects. Services liberalization if tariffs are already zero yields gains instead of losses. Goods liberalization when services are already liberalized yields considerably larger gains.

The size of welfare effects moving from the base case equilibrium to service liberalization using different parameter settings for the base case varies. If we increase all initial tariff rates by good and by country welfare losses from service liberalization increases, lowering initial tariff rates causes them to fall. Increasing the discount rate only in country 2 to increase gains from intertemporal intermediation produces smaller losses, while lowering the discount rate in country 2 has a similar affect since it is asymmetry in discount factors that determines gains from intertemporal intermediation. Finally more extreme endowments or share parameters yield larger losses since the trade impacts of incremental financial

intermediation are larger.

These point in the direction that while it is the interaction between intertemporal intermediation and trade that determines whether a loss from financial services liberalization occurs, this outcome is made more or less likely by various features. One is the size of the trade restrictions with higher restriction raising the likelihood of loss. Another is features of the parameterization which increase the size of commodity trade, such as endowment or share specifications. In contrast, differences in factors across countries which increase the size of intermediation gains will reduce the likelihood of loss, since the direct intermediation gain is more likely to dominate the interaction effect with commodity trade.

We have used parametric variation around this base case specification to explore how welfare impacts vary continuously in parametric change, and find changes in sign of effect. The first part of Figure 2.1 reports the same welfare measures change if we continuously vary the value of ρ_2 (the intertemporal discount rate in country 2). For low values less than 0.0447 and higher than 0.2116 a gain occurs, indicating the parametric sensitivity of the sign of the welfare impact of financial services liberalization. In the lower panel when the same discount factor in both countries is varied, for all ρ values there is a loss, with the loss larger for lower values of ρ. This occurs since with lower values of ρ there is more intertemporal trade and hence more international trade, which in turn worses the welfare losses imposed by the tariffs on goods trade. As we vary only the value of ρ_2 in further cases (not shown in Figure 1), the EV as a % of reference equilibrium incomes remains positive for the other four cases: (1) moving from base case to goods liberalization, (2) moving to services liberalization when goods are already liberalized, (3) moving to goods liberalization when services are already liberalized, and (4) moving from base case to joint goods and services liberalization. In the lower part of Figure 2.1, when we vary the value of ρ for both countries, the EV as a % of reference equilibrium incomes in the case of services liberalization remains negative. For the other three cases: (1) moving from base case to goods liberalization, (2) moving to goods liberalization when services are already liberalized, and (3) moving from base case to joint goods and services liberalization, the country 1 EV impacts change from gain to loss, and country 2 and the world (2 countries) gain.

Table 2.1 A Parameterization of a Cobb - Douglas Spatial and Intertemporal Economy Used to Analyze Joint Goods and Services Liberalization

Intertemporal Discount Factor by Country $\rho_1 = 0.10$ and $\rho_2 = 0.10$

Share Parameters α_{il}^t	Period 0		Period 1	
	Good 1	Good 2	Good 1	Good 2
Country 1	0.70	0.30	0.60	0.40
Country 2	0.40	0.60	0.30	0.70

Initial Endowments E_{il}^t	Period 0		Period 1	
	Good 1	Good 2	Good 1	Good 2
Country 1	40	80	40	80
Country 2	80	40	80	40

Initial Tariff Rates T_{il}^t	Period 0		Period 1	
	Good 1	Good 2	Good 1	Good 2
Country 1	0.10	0.00	0.05	0.00
Country 2	0.00	0.05	0.00	0.10

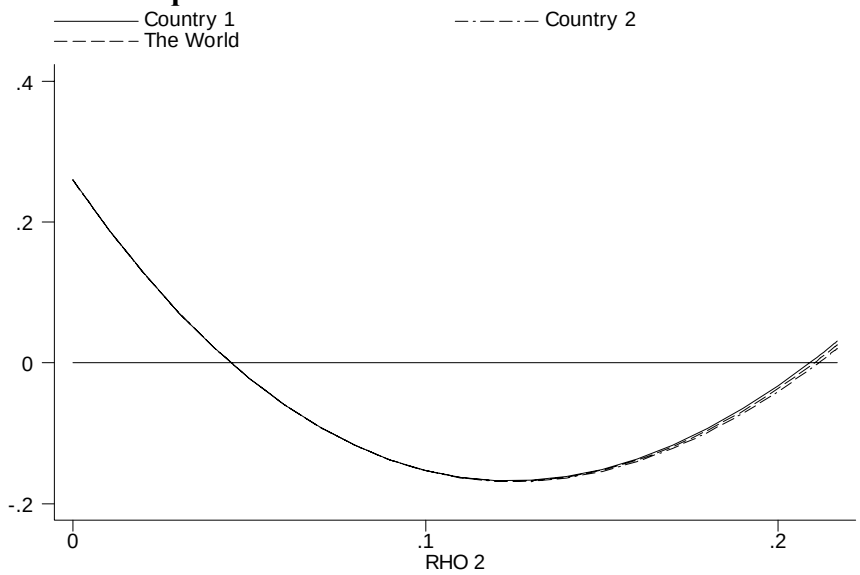
Table 2.2 Impacts of Alternative Liberalizations Using the Cobb - Douglas Economy Parameterization from Table 1

	Hicksian Equivalent Variation as % of Original Equilibrium Income from		
	Country 1	Country 2	Both Countries (The World)
Moving from Base Case to Goods Liberalization	0.0373	0.0766	0.0570
Moving to Services Liberalization when Goods Are Already liberalized	0.0069	0.0070	0.0070
Moving from Base Case to Services Liberalization	-0.1530	-0.1535	-0.1533
Moving to Goods Liberalization when Services Are Already Liberalized	0.1975	0.2375	0.2175
Moving from Base Case to Joint Goods and Services Liberalization	0.0442	0.0837	0.0640

Figure 2.1 Sensitivity of Welfare Measures of Services Liberalization in Simple Cobb - Douglas Model to Inter-Temporal Discount Factors (ρ)

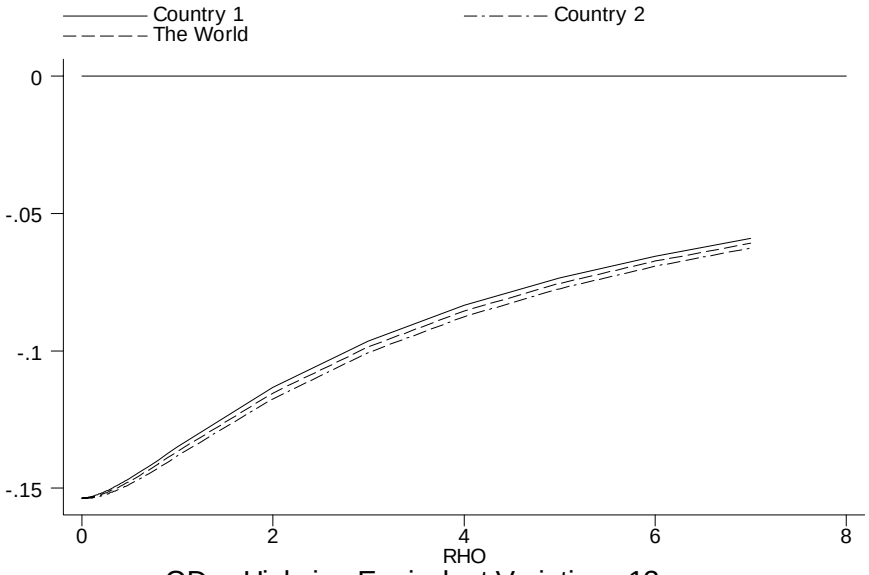
2.1.1 Varying Only the Discount Factor (ρ_2) in Country 2

EV as % of Reference Equilibrium Income



2.1.2 Varying the Discount Factor ($\rho_1 = \rho_2$) in Both Countries

EV as % of Reference Equilibrium Income



A Model with Costly Intermediation Services

The model used in the previous two sections is highly simplified in that it considers a case with no intermediation in autarky and costless foreign supplied intermediation services under financial service trade liberalization. Where intermediation occurs under liberalization, the same interest rate for lenders and borrowers applies in both countries: equivalent to an across period budget constraint equilibrium for the two countries combined. A more realistic case involves costly intermediation with different costs faced by service providers in the two countries. Under liberalization of service trade more efficient foreign service providers then displace domestic service providers in one of the country markets. Developing such a structure in which interest rates differ between borrowers and lenders is more complex since the use of intermediation services will now use real resources which in turn will impact the incomes of consumers which, in turn, will affect both commodity demands and intertemporal trade. To deal with the simultaneities involved, unlike in the costless intermediation case, either the amount of borrowing (lending) must be exogenously specified with the borrowing and lending rates endogenously determined, or borrowing and lending rates are exogenous and the amounts involved are endogenous.

If intermediation across countries within the period is allowed up to some level F_i, but when a separate and different interest rate applies in each country to be paid by borrowers,, the budget constraint for each country i then becomes

$$\sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = I_i^0 = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \tag{2.13}$$

$$\sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = I_i^1 + [1+r_i]F_i = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + [1+r_i]F_i \tag{2.14}$$

where F_i is the amount borrowed by a consumer in one country from the other country consumer via banks supplying intermediation services. With costless intermediation, r_i is the lending and borrowing interest rate in country i. In this structure, F_i can be set by policy (allowable credit, or money issuance) with the r_i endogenously determined, or the r_i can be set with F_i endogenously determined. The difference from the previous section is the use of different interest rates in each country.

In this costless intermediation case, a general equilibrium for this economy (with the interest rate for lending and borrowing r_i for $i = 1, 2$) is characterized by a price system and consumption of goods by countries $((P_l^t : t = 0, 1; l = 1, 2), (X_{il}^t : t = 0, 1; i = 1, 2; l = 1, 2))$

such that

[1] given $(P_l^t; t = 0, 1, l = 1, 2)$, for i = 1, 2, $(X_{il}^t; t = 0, 1, l = 1, 2)$ solve the utility maximization problem subject to the budget constraints (2.13) - (2.14)

$$\begin{aligned} max \quad & U_i = u_i^0(X_{i1}^0, X_{i2}^0) + \frac{1}{1+\rho_i} u_i^1(X_{i1}^1, X_{i2}^1) \\ s.t. \quad & \sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \\ & \sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + [1+r_i]F_i \end{aligned}$$

and [2] markets clear

$$\sum_{i=1}^{2} X_{il}^0 = \sum_{i=1}^{2} E_{il}^0 \;\; and \;\; \sum_{i=1}^{2} X_{il}^1 \leq \sum_{i=1}^{2} E_{il}^1 \;\; for \;\; l = 1, 2$$

$$\sum_{i=1}^{2} F_i = 0.$$

We can then move on to consider the case of costly intermediation services with (in the no services trade case) different interest rates for lending and borrowing for each country and the budget constraints for each country i are

$$\sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = I_i^0 = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \tag{2.15}$$

$$\sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = I_i^1 + [1+r_i(F_i)]F_i = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + [1+r_i(F_i)]F_i \tag{2.16}$$

If we represent deposit and borrowing rates as

$$r_i(F_i) = \begin{cases} r_i^D, & if \;\; F_i \geq 0 \\ r_i^B, & if \;\; F_i \leq 0 \end{cases} \tag{2.17}$$

where r_i^D and r_i^B are the interest rates for lending (deposits or saving) and borrowing in country i, and $[1 + r_i(F_i)]F_i = [1 + r_i^D]F_i^+ - [1 + r_i^B]F_i^-$. The budget constraints (2.15) - (2.16) can then be written as

$$\sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \tag{2.18}$$

$$\sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + [1+r_i^D]F_i^+ - [1+r_i^B]F_i^- \tag{2.19}$$

Since in the presence of costly intermediation, $r_i^B \geq r_i^D$ for $i = 1, 2$, we can represent intermediation costs in country i by a parameter λ_i such that $r_i^B = (1 + \lambda_i) r_i^D$. If intermediation services are provided by banks in country i, $\lambda_1 > \lambda_2$ implies that banks in country 2 are more efficient than in country 1; while $\lambda_2 > \lambda_1$ implies that banks in country 1 are more efficient than in country 2.

This then allow us to again characterize two equilibria but now in the presence of costly banking services; one with no trade in banking services (autarky in banking) and one with free trade in banking services. Now the F_i will be parameters rather than endogenous variables.

Equilibrium with Autarky in Intermediation Services (Intermediation Services Are Only Provided by Domestic Banks)

If we assume that depositors can deposit money in any bank, they receive the same interest rate in both countries, i.e. $r^D = r_1^D = r_2^D$. But if borrowers can only borrow from domestic banks, $r_1^B \neq r_2^B$. In autarky, intermediation services are only provided by domestic banks and the intermediation costs are $IC_i = r_i^B - r^D = \lambda_i r^D$. If $IC_1 > IC_2$, then banking services cost more in country 1; if $IC_2 > IC_1$, then banking services cost more in country 2. The value (cost) of intermediation services is given by $(r_i^B - r^D)F_i = \lambda_i r^D F_i$ for $i = 1, 2$.

A general equilibrium with autarky in intermediation services and different interest rates for lending and borrowing (related through λ_i for $i = 1, 2$) is then characterized by a price system and consumption of goods by countries $(r^D, (P_l^t : t = 0, 1; l = 1, 2), (X_{il}^t : t = 0, 1; i = 1, 2; l = 1, 2))$ such that

[1] given r^D and $(P_l^t; t = 0, 1, l = 1, 2))$, for i = 1, 2, $(X_{il}^t; t = 0, 1, l = 1, 2)$ solve the utility maximization problem subject to the budget constraints (2.15) - (2.16)

$$
\begin{aligned}
max \quad & U_i = u_i^0(X_{i1}^0, X_{i2}^0) + \frac{1}{1+\rho_i} u_i^1(X_{i1}^1, X_{i2}^1) \\
s.t. \quad & \sum_{l=1}^{2} P_l^0(1 + T_{il}^0) X_{il}^0 + F_i = \sum_{l=1}^{2} P_l^0(1 + T_{il}^0) E_{il}^0 + R_i^0 \\
& \sum_{l=1}^{2} P_l^1(1 + T_{il}^1) X_{il}^1 = \sum_{l=1}^{2} P_l^1(1 + T_{il}^1) E_{il}^1 + R_i^1 + [1 + r_i(F_i)] F_i
\end{aligned}
$$

and [2] markets clear

$$
\sum_{i=1}^{2} X_{il}^0 = \sum_{i=1}^{2} E_{il}^0 \quad and \quad \sum_{i=1}^{2} X_{il}^1 \leq \sum_{i=1}^{2} E_{il}^1 \quad for \quad l = 1, 2
$$

Equilibrium with Free Trade in Intermediation Services (Intermediation Services Are Provided by Either Domestic or Foreign Banks)

If we allow trade to occur in intermediation services, this also yields a different equilibrium concept to that used earlier in the costless intermediation case. If depositors receive the same interest rate anywhere, once again $r^D = r_1^D = r_2^D$, since individuals can deposit money in any bank. But with free trade in banking services, borrowers can borrow from either domestic or foreign banks, which implies that the same borrowing rate applies anywhere, i.e. $r^B = \min\{r_1^B, r_2^B\} = [1+\lambda]r^D$, where $\lambda = \min\{\lambda_1, \lambda_2\}$. Intermediation services in this case can be provided by either domestic or foreign banks. Intermediation costs are $IC = r^B - r^D = \lambda r^D$ across the two countries, which means that the more efficient country suppliers provide intermediation services to both of the two countries. The value (cost) of intermediation services is $(r^B - r^D)F_i = \lambda r^D F_i$ for $i = 1, 2$.

A general equilibrium for this economy with different interest rates for lending and borrowing (related through λ_i for $i = 1, 2$) is characterized by a price system and consumption of goods by countries $(r^D, (P_l^t : t = 0, 1; l = 1, 2), (X_{il}^t : t = 0, 1; i = 1, 2; l = 1, 2))$ such that

[1] given r^D and $(P_l^t; t = 0, 1, l = 1, 2)$, for i = 1, 2, $(X_{il}^t; t = 0, 1, l = 1, 2)$ solve the utility maximization problem subject to the budget constraints (2.15) - (2.16)

$$
\begin{aligned}
max \quad & U_i = u_i^0(X_{i1}^0, X_{i2}^0) + \frac{1}{1+\rho_i} u_i^1(X_{i1}^1, X_{i2}^1) \\
s.t. \quad & \sum_{l=1}^{2} P_l^0(1+T_{il}^0)X_{il}^0 + F_i = \sum_{l=1}^{2} P_l^0(1+T_{il}^0)E_{il}^0 + R_i^0 \\
& \sum_{l=1}^{2} P_l^1(1+T_{il}^1)X_{il}^1 = \sum_{l=1}^{2} P_l^1(1+T_{il}^1)E_{il}^1 + R_i^1 + [1+r(F_i)]F_i
\end{aligned}
$$

and [2] markets clear

$$
\sum_{i=1}^{2} X_{il}^0 = \sum_{i=1}^{2} E_{il}^0 \quad and \quad \sum_{i=1}^{2} X_{il}^1 \leq \sum_{i=1}^{2} E_{il}^1 \quad for \quad l = 1, 2
$$

where

$$
r_i(F_i) = \begin{cases} r^D, & if \ F_i \geq 0 \\ r^B, & if \ F_i \leq 0 \end{cases}
$$

Table 2.3 sets out a parameterization for a Cobb - Douglas economy with tariffs for this model, which is the same as Table 2.1 except that the F_i are exogenous and set (arbitrarily) at 32 and intermediation cost factors are specified in each country. The intermediation cost factors are assumed to be $\lambda_1 = 0.25$ and $\lambda_2 = 0.50$. The value of interest rates are

$r^D = r_1^D = r_2^D = 0.03995$, $r_1^B = 0.04994$ and $r_2^B = 0.05993$ in the equilibrium with autarky in intermediation services, and $r^D = r_1^D = r_2^D = 0.08032$, $r_1^B = 0.10040$ and $r_2^B = 0.12049$ in the equilibrium with free trade in intermediation services.

In Table 2.4 we report Hicksian Equivalent Variation money metric welfare measures of the impacts of goods and services liberalization both for individual countries and the world for this model. Hicksian measures are expressed as a percentage of reference equilibrium (pre-liberalization) incomes. This is a more complex structure to work with computationally and so we only consider incomplete goods liberalization and changes tariff rates from $T_{11}^0 = T_{22}^1 = 0.10$ and $T_{22}^0 = T_{11}^1 = 0.05$ to $T_{11}^0 = T_{22}^1 = 0.05$ and $T_{22}^0 = T_{11}^1 = 0.00$. In this case results are different from those in Table 2.2 and show that moving to services liberalization even when goods trade is liberalized implies a welfare loss. A result is similar to that in Chia and Whalley (1997) for the one good case. This result occurs due to the real resources involved in providing intermediation services, which from Foley (1970) imply the two fundamental theorems need not hold and hence even without trade restrictions financial service liberalization can be welfare worsening.

We once again conduct parametric variation around this base case specification and reevaluate the gains from alternative liberalizations. Figure 2.2 shows how welfare measures of the global impact of liberalization in goods or services behave if we only vary the value of ρ_2 (the intertemporal discount rate in country 2). The pattern is now again different from Figure 1, and there are losses for country 1 and the world. However, welfare effects change from a loss to a gain for country 2 above a critical value of ρ_2.

Table 2.3 A Parameterization of a Cobb - Douglas Spatial and Intertemporal Economy with Costly Intermediation Used to Analyze Joint Goods and Services Trade Liberalization

Intertemporal Discount Factor by Country $\rho_1 = 0.10$ and $\rho_2 = 0.10$

Share Parameters α_{il}^t	Period 0		Period 1	
	Good 1	Good 2	Good 1	Good 2
Country 1	0.70	0.30	0.60	0.40
Country 2	0.40	0.60	0.30	0.70

Initial Endowments E_{il}^t	Period 0		Period 1	
	Good 1	Good 2	Good 1	Good 2
Country 1	40	80	40	80
Country 2	80	40	80	40

Initial Tariff Rates T_{il}^t	Period 0		Period 1	
	Good 1	Good 2	Good 1	Good 2
Country 1	0.10	0.00	0.05	0.00
Country 2	0.00	0.05	0.00	0.10

Amount Borrowed / Lent $F_1 = 32$ and $F_2 = -32$

Intermediation Cost Factor $\lambda_1 = 0.25$ and $\lambda_2 = 0.50$

Table 2.4 Welfare Consequences of Alternative Liberalizations[1] Using the Cobb - Douglas Economy Parameterization from Table 1, but with Costly Intermediation

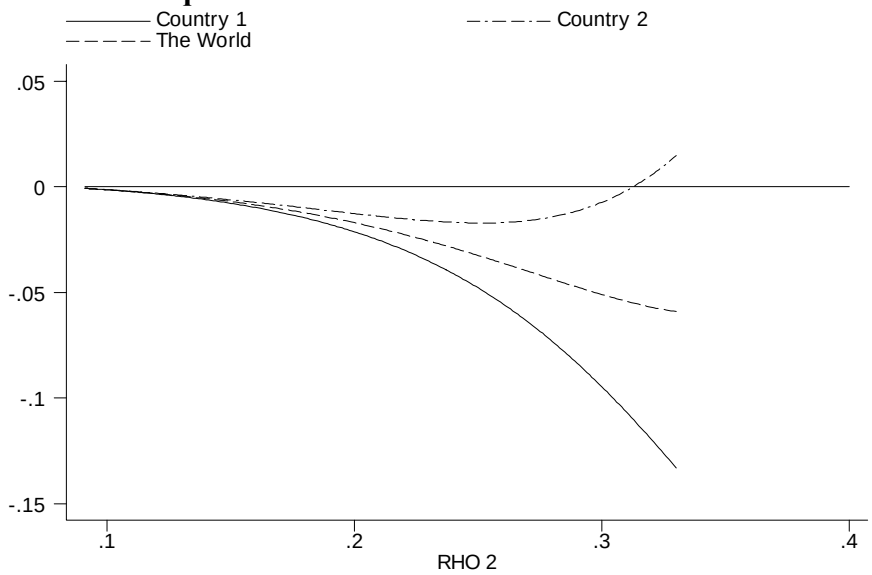
	Hicksian Equivalent Variation as % of Original Equilibrium Income from		
	Country 1	Country 2	Both Countries (The World)
Moving from Base Case to Goods Liberalization	0.0933	0.0792	0.0863
Moving to Services Liberalization when Goods Are Already liberalized	-0.0003	-0.0003	-0.0003
Moving from Base Case to Services Liberalization	-0.0015	-0.0014	-0.0014
Moving to Goods Liberalization when Services Are Already Liberalized	0.0945	0.0803	0.0874
Moving from Base Case to Joint Goods and Services Liberalization	0.0931	0.0789	0.0860

1. The goods liberalization here involves tariff rates which only change from $T_{11}^0 = T_{22}^1 = 0.10$ and $T_{22}^0 = T_{11}^1 = 0.05$ to $T_{11}^0 = T_{22}^1 = 0.05$ and $T_{22}^0 = T_{11}^1 = 0.00$, for case of numerical solution of the model.

Figure 2.2 Sensitivity of Welfare Measures of Services Liberalization in Simple Cobb - Douglas Model to Inter-Temporal Discount Factors (ρ)

2.2.1 Varying Only the Discount Factor (ρ_2) in Country 2

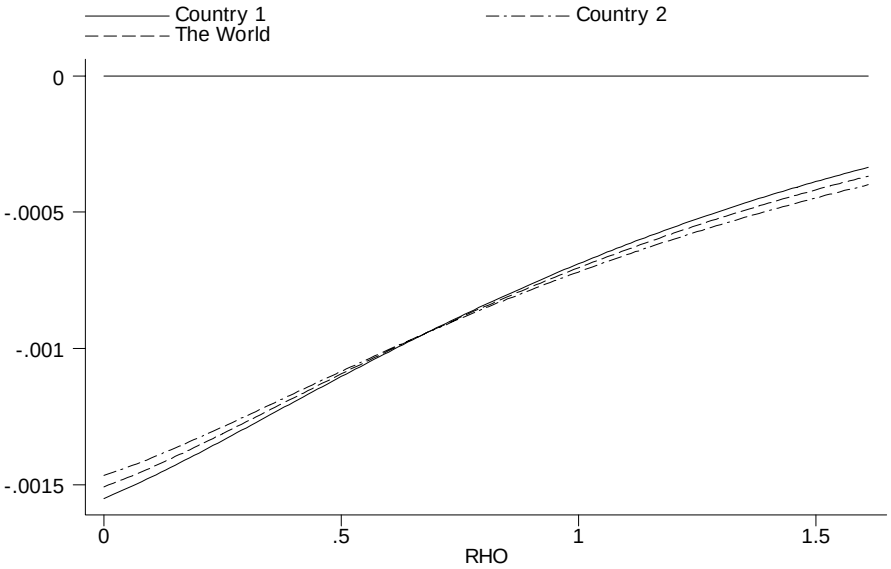
EV as % of Reference Equilibrium Income



CD -- Hicksian Equivalent Variations 13

2.2.2 Varying the Discount Factor ($\rho_1 = \rho_2$) in Both Countries

EV as % of Reference Equilibrium Income



CD -- Hicksian Equivalent Variations 13

The background to this discussion of financial services liberalization is the wider issue of whether broader services trade liberalization in the WTO under the GATS need necessarily be globally welfare improving if free trade in goods does not already apply. The results reported on above do not use data on actual trade patterns in goods and services in the global economy, nor do they use data on actual barriers in place today, and so how our discussion relates to actual GATS liberalization remains unresolved. As we note in the introduction GATS liberalization involves more than banking liberalization, although similar arguments may well apply in the case of insurance (liberalizing trade across risk pools) and transportation (trade across space). Also GATS liberalization is far from being a move to free trade. However, the suggestion that in the presence of remaining trade barriers in goods free trade in services need not be desirable is important to the debate on services liberalization and (to our knowledge) has not been argued thus far.

There is no prior trade literature on multi-period / multi-good models in part because general results are not easily obtained. Here we use a numerical simulation approach which we apply to two models which differ in their complexity. They each involve joint liberalization of spatial and intertemporal trade in a multi-good multi-period numerical model. In our first model there is costless banking and we consider services liberalization to imply foreign banking entry where in autarky no domestic banks exist. Their entry relaxes period by period budget constraints. A more complex model considers domestic and foreign service providers with different (but constant) costs. Liberalization in banking service trade allows domestic residents full access to foreign banks. We consider cases with both Cobb - Douglas and CES preferences over goods within the period, and draw on a formalization on asset and spot market equilibrium literature originating with Arrow. We are relatively easily able to produce examples where in the presence of tariffs banking liberalization can be welfare worsening. The intuition is that banking liberalization increases intertemporal trade when in turn increases international trade in goods, which, can increase the welfare cost of a pre-existing tariff.

Estimates of international trade in services are notoriously imprecise (see the discussion of measurement of trade in banking services in St. Hilaire and Whalley (1995)), but a commonly used figure based WTO Annuals Reports suggests that services now account for perhaps 1/3 of combined trade in goods and services. They are also growing at twice the rate of trade in goods. Tariffs on goods post Uruguay Round are low on most goods

(with a few peaks in areas such as textiles), with other restrictions applying through anti dumping duties, quotas (textiles), standards, and other non tariff measures. Services are generally thought to be much more heavily restricted through domestic regulation, licensing requirements, conduct and performance restrictions for foreign entities, and related devices. The tariff rates we use on goods in our examples and autarky as it seemingly nearly applies in banking services may thus not be extreme.

Under this view of the world, then, depending on cost differentials across domestic and foreign services providers there could be net benefits from significant global liberalization in financial services independently of further tariff liberalization. But whether this is so needs to be more firmly established rather than simply asserted as at present.

3 A Single-Country Model of Spatial and Intertemporal Trade with a Fixed Exchange Rate and Non-Neutral Monetary Policy

Model Structure

We next consider the operation of exchange rates and monetary non-neutralities in a world in which two types of trade are possible, but because of the added structure restrict it to a single price-taking economy. One is inter-spatial trade between countries in commodities, and the other intertemporal trade facilitated by providers of intermediation services. To simplify things, we again further assume that intermediation services, when they are provided, are supplied at zero cost to users of services, and also that such services can only be provided by foreign service providers. This gross simplification implies that all intertemporal trade implies international trade in intermediation services, but adopting it means that we can consider autarky in services to be a case where no intertemporal intermediation occurs, and free trade in services to be the case where full intertemporal intermediation occurs. If services remains unliberalized budget constraints within each period hold when we consider changes in exogenous variable (such as fixed exchange rates) in the model. We do not claim that this is a realistic representation of how service sectors operate in actual economies, but it is a useful analytical simplification.

We assume a fixed exchange rate regime with resulting monetary non-neutralities. We

assume domestic currency is needed to execute domestic transactions while foreign currency is both needed for purchases of imports and yielded by the sale of exports. We only consider the transaction demand for money and in our formulation all foreign exchange earnings of exporters are surrendered to the central bank at the fixed exchange rate, while foreign exchange received by the bank is auctioned among importers at a premium to the official exchange rate. This premium value is endogenously determined given monetary policy, and operates akin to a tariff. (Also see Clarete and Whalley (1991)).

As noted above and for simplicity, we consider the 2 period ($t = 0, 1$), 1 country, 2 good ($l = 1, 2$) pure exchange international trade case of a small open price taking economy. Adding additional features such as production, or more periods or goods, merely complicates the analysis while the themes remain the same.

The model can be presented as follows. The country has a single representative consumer, with endowments of the two goods in each period (E_l^t; $t = 0, 1$, $l = 1, 2$), and intertemporal preferences written as

$$U = \sum_{t=0}^{1} \frac{1}{(1+\rho)^t} u^t(X_1^t, X_2^t) = u^0(X_1^0, X_2^0) + \frac{1}{1+\rho} u^1(X_1^1, X_2^1) \tag{3.1}$$

where ρ is intertemporal discount factor and X_l^t denotes consumption of good l at date t.

If a time-additive Cobb-Douglas utility function of the form $u^t(X_1^t, X_2^t) = [X_1^t]^{\alpha_1^t}[X_2^t]^{\alpha_2^t}$ for $t = 0, 1$ is used, (3.1) can be represented more explicitly as

$$U = [X_1^0]^{\alpha_1^0}[X_2^0]^{\alpha_2^0} + \frac{1}{1+\rho}[X_1^1]^{\alpha_1^1}[X_2^1]^{\alpha_2^1} \tag{3.2}$$

where α_l^t is the share parameter for good l at date t ($\sum_{l=1}^{2} \alpha_l^t = 1$). We can also consider CES preferences.

For good l in each period t, the exogenous world price is Π_l^t. We allow the country to impose tariffs at rate T_l^t on each imported good l (i.e. if $X_l^t \geq E_l^t$, then $T_l^t \geq 0$). Tariffs are set to equal zero if good l is exported (i.e. if $X_l^t \leq E_l^t$, then $T_l^t = 0$). Internal (gross of tariff) prices for good l at date t are thus

$$P_l^t = \Pi_l^t(1 + T_l^t), \qquad t = 0, 1, \quad l = 1, 2. \tag{3.3}$$

These are also sellers prices of good l.

Tariff revenues collected in period t are

$$R^t = \sum_{l=1}^{2} \Pi_l^t T_l^t (X_l^t - E_l^t)^+, \qquad t = 0, 1 \tag{3.4}$$

where E_l^t denotes the initial endowment of good l. Income in period t is given by

$$I^t = \sum_{l=1}^{2} P_l^t E_l^t + R^t, \qquad t = 0, 1. \tag{3.5}$$

We consider the case in which both goods are traded, and there is both a fixed exchange rate and rationed foreign exchange. We assume that the government fixes the exchange rate at e^t, and requires all foreign exchange earned by exporters to be surrendered to the Central Bank at the rate e^t. It then allocates rights to purchase available foreign exchange to importers at the same rate e^t. We will assume that exporters comply with this policy and fully meet the surrender requirement, even though there are obvious incentives for exporters to conceal foreign exchange and attempt to sell it on parallel (black) markets rather than surrender it at the lower fixed rate. The allocation process of foreign exchange among importers assumes that the government auctions (or sells) foreign exchange. In practice, allocation schemes actually followed are more complex than this involving priority allocation of various forms, but we abstract from these. But under such a simple auctioning scheme, if desired imports require more foreign exchange than the government offers for sale, the price of foreign exchange paid by importers will be bid up. This price will thus include a foreign exchange premium above the fixed rate e^t, which we designate as λ^t. This premium acts as a surcharge on foreign exchange bought by importers, and adjusts so as to clear the foreign exchange market.

In this formulation the net effect of foreign exchange rationing is similar to a tariff on all imports, since the exchange rate received by exporters differs from the gross of premium value exchange rate paid by importers. The difference from a tariff is that the premium rate (or tariff equivalent rate) is endogenously determined. Also, under an auctioning scheme, the foreign exchange premium accrues to the government, but if rights to purchase foreign exchange at the rate e^t were instead allocated by the government without charge, the premium would instead go directly to importers.

The world prices for the 2 goods are given as Π_l^t for $t = 0, 1$ and $l = 1, 2$. Domestic prices (gross of tariff and gross of the foreign exchange premium for imports) for the 2 goods are again denoted as P_l^t for $t = 0, 1$ and $l = 1, 2$, and are defined below by (3.7).

Assuming unitary velocity of circulation and that the only demand for money is for transaction purposes, the demand for domestic currency M_D^t at date t is given by the value

of domestic demands in domestic currency, i.e.

$$M_D^t = \sum_{l=1}^{2} P_l^t X_l^t, \qquad t = 0, 1 \tag{3.6}$$

Implicitly, we assume that imports are bought by middle men (imports) using foreign currency, who then import costlessly and sell imports at domestic prices. The supply of domestic currency at date t is assumed to be set by the domestic monetary authorities and is given by M_S^t.

Because of the foreign exchange premium, relative domestic prices of the 2 traded goods will now differ from world prices both due to the premium on foreign exchange and the tariff, depending upon whether the good is imported or exported. Domestic prices P_l^t gross of the foreign exchange premium are thus now given by

$$P_l^t = \begin{cases} e^t \Pi_l^t, & if\ X_l^t - W_l^t \leq 0 \\ (1+\lambda^t) e^t \Pi_l^t, & if\ X_l^t - W_l^t \geq 0 \end{cases} \tag{3.7}$$

where $X_l^t - W_l^t$ denotes the net import of goods l, and λ^t is the premium value over the official exchange rate paid by purchasers of imports.

The demand for foreign currency N_D^t at date t is given by the value of imports at world prices

$$N_D^t = \sum_{l=1}^{2} \Pi_l^t [X_l^t - W_l^t]^+, \qquad t = 0, 1. \tag{3.8}$$

The supply of foreign currency N_S^t at date t is given by the value of exports at world prices

$$N_S^t = \sum_{l=1}^{2} \Pi_l^t [X_l^t - W_l^t]^-, \qquad t = 0, 1. \tag{3.9}$$

We consider two types of equilibria. One of these is characterized by no provision of intermediation services by foreign services providers, and since we assume them to be the only potential service providers, no intertemporal intermediation. In this equilibrium, period by period budget constraints apply for the economy, and we associate such an equilibrium with autarky in services trade. The other type of equilibrium is characterized by costless international flows of intermediation services (or free trade in services), and in this case combined period by period budget constraints hold. The only role for foreign services providers in the model is to costlessly facilitate intermediation within the price taking economy.

If there is no trade in intermediation services trade balance holds in each period, which implies that the value of imports goods is equal to the value of export and hence $N_D^t = N_S^t$ for $t = 0, 1$. Trade balance implies that

$$\sum_{l=1}^{2} \Pi_l^t [X_l^t - W_l^t] = 0. \tag{3.10}$$

which also implies that total revenues accruing to sellers of rights to purchase foreign exchange at the rate e^t are

$$R^t = \lambda^t e^t \sum_{l=1}^{2} \Pi_l^t [X_l^t - W_l^t]^+, \qquad t = 0, 1 \tag{3.11}$$

These revenues accrue either directly to the household sector as additional income of importers who are given allocations of foreign exchange by the government which they resell on premium markets, or indirectly as recycled government revenues. Because anticipated revenues L^t from rights of access to foreign exchange affect commodity demands and are a component of income for at least one of the agents in the model, market demand functions have to be rewritten to reflect this. Both L^t and R^t are each endogenously determined, and $L^t = R^t$ only in equilibrium.

The budget constraint for the household sector in this case includes initial holdings of money balances, and is given by

$$I^t = \sum_{l=1}^{2} P_l^t W_l^t + M_S^t + L^t, \qquad t = 0, 1 \tag{3.12}$$

General Equilibrium with Service Trade Autarky (Period by Period Budget Constraints)

When there is service trade autarky no intermediation services are provided since by assumption there are no domestic service providers. [3] This means that there is incompleteness in the coverage of markets in the sense that in service trade autarky intertemporal markets are missing. This enables us to appeal directly to literature on multi-commodity intertemporal models of incomplete markets in analyzing the effects of service liberalization in this model. In services trade autarky there is no intertemporal trade, while with costless intertemporal trade in services intertemporal markets are complete.

[3] See the discussion of barriers to trade in intermediation services in practice in Chen and Schembri (2002), Francois and Schuknecht (2000), Kalirajan, McHuire, Nguyen and Schuele (2001), and Mattoo (1999).

In the absence of trade in financial intermediation services the total value of expenditures must satisfy the household budget constraint in each period, i.e.,

$$\sum_{l=1}^{2} P_l^t X_l^t + M_D^t = I^t, \qquad t = 0, 1 \tag{3.13}$$

that is,

$$\sum_{l=1}^{2} P_l^t X_l^t + M_D^t = \sum_{l=1}^{2} P_l^t W_l^t + M_S^t + L^t, \qquad t = 0, 1 \tag{3.14}$$

or

$$e^t \sum_{l=1}^{2} \Pi_l^t [X_l^t - W_l^t] + (M_D^t - M_S^t) + (R^t - L^t) = 0, \qquad t = 0, 1 \tag{3.15}$$

A single country equilibrium in this case is given by values of (λ^t, L^t) which satisfy the conditions:

[1] $(X_l^t : t = 0, 1; l = 1, 2)$ solves

$$\begin{aligned} &max && U \\ &s.t. && \textstyle\sum_{l=1}^{2} P_l^t X_l^t + M_D^t = \sum_{l=1}^{2} P_l^t W_l^t + M_S^t + L^t, \qquad t = 0, 1 \end{aligned} \tag{3.16}$$

[2] For $t = 0, 1$, trade balance, premium revenue balance, and money demand and supply equalities hold in each period.

$$e^t \sum_{l=1}^{2} \Pi_l^t [X_l^t - W_l^t] = 0 \qquad and \qquad R^t - L^t = 0 \qquad and \qquad M_D^t - M_S^t = 0 \tag{3.17}$$

[2] implies that $N_D^t = N_S^t$ for $t = 0, 1$.

General Equilibrium with Free Trade in Services (Across Period Budget Constraints)

If costlessly provided foreign supplied intermediation services are allowed in the model, then we can characterize a free trade in services equilibrium as a case where across period budget constraints hold rather than period by period budget constraints. In this model form, we assume the interest rate r is endogenously determined on the country capital market to clear demand for and supply of loans. The economy is then only a price taker in goods markets, and foreign financial intermediaries only provide their services to the single country.

In this case, the demand for foreign currency is $N_D = \sum_{t=0}^{1} \frac{N_D^t}{(1+r)^t}$. The supply of foreign currency is $N_S = \sum_{t=0}^{1} \frac{N_S^t}{(1+r)^t}$. Trade balance now implies that the value of

imports equals the value of exports and $N_D = N_S$, i.e.

$$\sum_{t=0}^{1} \frac{1}{(1+r)^t} \sum_{l=1}^{2} \Pi_l^t [X_l^t - W_l^t] = \sum_{l=1}^{2} \Pi_l^0 [X_l^0 - W_l^0] + \frac{1}{1+r} \sum_{l=1}^{2} \Pi_l^1 [X_l^1 - W_l^1] = 0. \quad (3.18)$$

With trading now allowed across the 2 periods under liberalized trade in financial intermediation services, the total value of expenditures satisfy the household budget constraint in each period, including borrowing and lending across periods, i.e.,

$$\begin{cases} \sum_{l=1}^{2} P_l^0 X_l^0 + M_D^0 + F = I^0 \\ \sum_{l=1}^{2} P_l^1 X_l^1 + M_D^1 = I^1 + (1+r)F \end{cases} \quad (3.19)$$

where following the literature on incomplete markets F is the amount of credit extended across periods by foreign finance service providers. (3.19) can be rewritten as

$$\begin{cases} \sum_{l=1}^{2} P_l^0 X_l^0 + M_D^0 + F = \sum_{l=1}^{2} P_l^0 W_l^0 + M_S^0 + L^0 \\ \sum_{l=1}^{2} P_l^1 X_l^1 + M_D^1 = \sum_{l=1}^{2} P_l^1 W_l^1 + M_S^1 + L^1 + (1+r)F \end{cases} \quad (3.20)$$

or

$$\begin{cases} e^0 \sum_{l=1}^{2} \Pi_l^0 [X_l^0 - W_l^0] + (M_D^0 - M_S^0) + (R^0 - L^0) + F = 0 \\ e^1 \sum_{l=1}^{2} \Pi_l^1 [X_l^1 - W_l^1] + (M_D^1 - M_S^1) + (R^1 - L^1) = (1+r)F \end{cases} \quad (3.21)$$

or

$$e^0 \sum_{l=1}^{2} \Pi_l^0 [X_l^0 - W_l^0] + \frac{1}{1+r} e^1 \sum_{l=1}^{2} \Pi_l^1 [X_l^1 - W_l^1] + (M_D - M_S) + (R - L) = 0 \quad (3.22)$$

where $M_D = M_D^0 + \frac{1}{1+r} M_D^1$ is the value of demands in present value terms for domestic currency, $M_S = M_S^0 + \frac{1}{1+r} M_S^1$ is the value of supply in present value terms for domestic currency, $R = R^0 + \frac{1}{1+r} R^1$ are the revenues across periods accruing to sellers of rights to purchase foreign exchange, and $L = L^0 + \frac{1}{1+r} L^1$ are anticipated revenues across periods distributed to consumers from auctioned foreign exchange.

A simple country equilibrium in this case is given by values of (λ^t, L^t, F, r) which satisfy the conditions:

[1] $(X_l^t : t = 0, 1; l = 1, 2)$ solve

$$\begin{aligned} max \quad & U \\ s.t. \quad & \sum_{l=1}^{2} P_l^0 X_l^0 + M_D^0 + F = \sum_{l=1}^{2} P_l^0 W_l^0 + M_S^0 + L^0 \\ & \sum_{l=1}^{2} P_l^1 X_l^1 + M_D^1 = \sum_{l=1}^{2} P_l^1 W_l^1 + M_S^1 + L^1 + (1+r)F \end{aligned} \quad (3.23)$$

and [2]

$$\sum_{t=0}^{1} \frac{1}{(1+r)^t} e^t \sum_{l=1}^{2} \Pi_l^t [X_l^t - W_l^t] = 0, \qquad R - L = 0 \qquad and \qquad M_D^t - M_S^t = 0 \; for \; t = 0, 1 \tag{3.24}$$

[2] in this case implies $\sum_{t=0}^{1} \frac{1}{(1+r)^t} N_D^t = \sum_{t=0}^{1} \frac{1}{(1+r)^t} N_S^t$. In this model, goods flows and intermediation services interact as follows. With liberalized service flows there is intertemporal intermediation and more specialization in consumption by period and hence more international trade. For given monetary policy and a given fixed exchange rate, liberalized service flows result in a higher value of and hence more severely distorted goods trade internationally. If alternatively, the fixed exchange rate is raised, then there is less distortion of trade but the unliberalized service trade implies that gains from intertemporal intermediation go unrealized. The first best policy combination is for liberalized services trade and a floating exchange rate. But if services trade remains unliberalized there is an optimal trade intervention even for a small open economy. In the case where period by period budget constraints apply, there will be an optimal trade intervention and, for given monetary policy, an optimal exchange rate. If instead across period budget constraints apply (with free trade in services) there will be no optimal exchange rate. The implication is that if tariffs are bound under WTO/GATT and services remain unliberalized (as in China) either monetary or exchange rate policy provide instruments for achieving the optimal trade intervention. If monetary policy is given, an optimal exchange rate will exist, and any departure from this via a free float will impose welfare losses. The possibility of such outcomes in the model can be explored by numerical simulation in which fixed exchange rates are parametrically varied.

Numerical Simulation Results

We again use numerical simulation to explore whether in the presence of given monetary policy (money supply fixed in each period), bound tariffs on goods traded internationally (assumed to be zero), and service trade remaining unliberalized there can be an optimal exchange rate. Depending on where any given exchange rate is relative to the optimal exchange rate,losses or gains can occur with a move to a free float. If the initial fixed exchange rate is by chance equal to the optimal exchange rate, losses must necessarily occur.

The size of the effects involved depends critically on the numerical example chosen,

and in Table 3.1 we provide a sample parameterization for a model with Cobb-Douglas preferences in which the combination of fixed exchange rates and domestic money supply imply premium values on foreign exchange and hence distortion of goods trade. We also consider a case with different preferences across periods, so that gains from intertemporal intermediation will also occur. To simplify, world prices are unity, as are fixed exchange rate.

We have used the structure set out above to perform some numerical simulations for a simple economy which show how in the presence of given monetary policy (in the form of a setting of the money supply), WTO bound tariffs on goods flows, and service trade remaining unliberalized, there will be an optimal exchange rate. In such cases depending on the setting of the fixed exchange rate, welfare losses may occur with any move to a freely floating exchange rate, raising questions as to the desirability of a free Renminbi float in China. Losses will necessarily occur if the fixed exchange rate equals its optimal value.

In the simulations we perform, we assume for simplicity Cobb-Douglas preferences and consider a case where period by period budget constraints apply reflecting unliberalized services trade. The model parameter settings we use in our simulations are given in Table 3.1. For this parametrization, we take monetary policy as given and then compute equilibrium solutions for alternative settings of the exchange rate to explore the behaviour of the optimal exchange rate. Table 3.2 presents an equilibrium solution for this model, given the exchange rate and monetary policy in Table 3.1.

For the case where no trading is allowed across periods $F = 0$, and the equilibrium is given in the first column of Table 3.2 (the model parametrization set out in Table 3.1). In this case when such trading is allowed, the foreign exchange premium value is the same in both periods and equals 0.413. Utility increases from 94.641 to 95.125. Imports equals exports in each period and fall from 26.66 to 17.47 in period 0 and increase from 21.66 to 31.62 in period 1. Transactions across the period include borrowing and lending of 13.379.

Table 3.3 reports the optimal exchange rate for this model parameterization, along with the welfare impacts which would follow with a move to a freely floating exchange rate under which the premium value on foreign exchange is eliminated. Utility reaches its maximal value of 96.3851 when the common exchange rate $e^0 = e^1 = 1.770$ is used in both periods. If, instead the exchange rate is only varied in period 0, a similar utility gain occurs and utility across the two periods is 96.207. In this case the loss is relative small, but this

nonetheless establishes the presumption in favour of a fixed over a floating exchange rate in this case when the rate is varied across both periods. Table 3.3 reports a utility loss relative to the optimal exchange rate in both periods when a freely floating exchange rate occurs.

Table 3.4 reports the relationship between utility and domestic money supply changes, since changed monetary policy provides a substitute instrument for exchange rate policy in this model. Utility reaches its maximal value of 96.418 when the money supply M_S^0 in period 0 equals 112.000. Results in Table 3.4 also shows the utility loss relative to optimal monetary policy when monetary policy is used to eliminate the foreign exchange premium. In this case once again the difference is relatively small, but clearly present.

A difference between Tables 3.3 and 3.4 is the impact on results of only allowing optimal policy interventions in one period. In the case of exchange rate policy, optimal intervention generates welfare effects which are smaller than those under a free float, and only with optimal common exchange rates across the two periods is the gain larger than that under free float. In contrast, the gain from optimal monetary policy only in period 1 exceeds that from optimal policy across the two periods. These outcomes reflect both direct gains from additional intermediation across time and the indirect effects between trade in goods and over time, and which one dominates varies from case to case.

These results thus suggest that a fixed exchange rate can dominate a floating rate if monetary policy is not available as the instrument to achieve the optimal trade intervention.

Table 3.1. Parameters Values Used in 1 Country 2 Period 2 Good Numerical Simulation Exploration of Optimal Exchange Rates

3.1.1. Model Characteristics

- Small Open Price Taking Economy
- 1 Country 2 Period 2 Good
- Cobb Douglas utility functions within the period

3.1.2. Model Parameterization

- Utility Intertemporal Discount Rate

$$\rho = 0.10$$

- Share Parameter in Preferences

$\alpha_1^0 = 0.50$	$\alpha_2^0 = 0.50$
$\alpha_1^1 = 0.60$	$\alpha_2^1 = 0.40$

- Initial Endowments

$W_1^0 = 20$	$W_2^0 = 80$
$W_1^1 = 25$	$W_2^1 = 75$

- World Prices

$\Pi_1^0 = 1.00$	$\Pi_2^0 = 1.00$
$\Pi_1^1 = 1.00$	$\Pi_2^1 = 1.00$

- Initial Fixed Exchange Rate in Each Period

$$e^0 = e^1 = 1.50$$

- Domestic Money Supply in Each Period

$$M_S^0 = 160 \text{ and } M_S^1 = 200$$

Table 3.2. General Equilibrium for the Model Parameterization Set Out in Table 3.1

Period by Period Budget Constraints	Across Period Budget Constraints
Interest Rate	
	$r = 0.116$
Exchange Rate Premium Value	
$\lambda^0 = 0.143$ and $\lambda^1 = 0.714$	$\lambda^0 = \lambda^1 = 0.413$
Domestic Prices	
$P_1^0 = 1.714$	$P_1^0 = 2.119$
$P_2^0 = 1.500$	$P_2^0 = 1.500$
$P_1^1 = 2.571$	$P_1^1 = 2.119$
$P_2^1 = 1.500$	$P_2^1 = 1.500$
Utility Levels in Each Period, and Across Periods	
$U^0 = 49.889$	$U^0 = 44.868$
$U^1 = 49.227$	$U^1 = 55.282$
$U = 94.641$	$U = 95.125$
Consumption	
$X_1^0 = 46.667$	$X_1^0 = 37.747$
$X_2^0 = 53.333$	$X_2^0 = 53.333$
$X_1^1 = 46.667$	$X_1^1 = 56.621$
$X_2^1 = 53.333$	$X_2^1 = 53.333$
Imports of Good 1	
$H_1^0 = 26.667$	$H_1^0 = 17.747$
$H_1^1 = 21.667$	$H_1^1 = 31.621$
Exports of Good 2	
$H_2^0 = 26.667$	$H_2^0 = 26.667$
$H_2^1 = 21.667$	$H_2^1 = 21.667$
Foreign Currency Demand	
$N_D^0 = 26.667$	$N_D^0 = 17.747$
$N_D^1 = 21.667$	$N_D^1 = 31.621$
	$N_D = 46.081$
Foreign Currency Supply	
$N_S^0 = 26.667$	$N_S^0 = 26.667$
$N_S^1 = 21.667$	$N_S^1 = 21.667$
	$N_S = 46.081$
Foreign Exchange Premium Revenues in Each Period	
$R^0 = 5.714$	$R^0 = 10.992$
$R^1 = 23.214$	$R^1 = 19.585$
	$R = 28.541$
Income in Each Period	
$I^0 = 320.000$	$I^0 = 333.379$
$I^1 = 400.000$	$I^1 = 385.069$
Money Deposit	
$F = 0.000$	$F = 13.379$

Table 3.3. Maximum Utility under An Optimal Exchanges Rate
(Across Period Budget Constraint Equilibria in All Cases)

Base Case Equilibrium	Optimal Exchange Rate Equilibrium (Same Exchange Rate both Periods)	Free Float Equilibrium (Same Exchange Rate both Periods)	Optimal Exchange Rate Equilibrium (Changing Only Exchange Rate in Period 1)
3.3.1. Domestic Monetary Supply			
$M_S^0 = 160$	$M_S^0 = 160$	$M_S^0 = 160$	$M_S^0 = 160$
$M_S^1 = 200$	$M_S^1 = 200$	$M_S^1 = 200$	$M_S^1 = 200$
3.3.2. Exchange Rate			
$e^0 = 1.500$	$e^0 = 1.770$	$e^0 = 1.792$	$e^0 = 1.5000$
$e^1 = 1.500$	$e^1 = 1.770$	$e^1 = 1.792$	$e^1 = 1.7857$
3.3.3. Exchange Rate Premium Value			
$\lambda^0 = 0.413$	$\lambda^0 = 0.023$	$\lambda^0 = 0.000$	$\lambda^0 = 0.1783$
$\lambda^1 = 0.413$	$\lambda^1 = 0.023$	$\lambda^1 = 0.000$	$\lambda^1 = 0.1783$
3.3.4. Utility Across Periods			
95.125	96.385	96.379	96.207

Table 3.4. Maximum Utility under An Optimal Monetary Policy
(Across Period Budget Constraint Equilibria in All Cases)

Base Case Equilibrium	Optimal Monetary Policy in Period 0	Optimal Monetary Policy in both Periods	Monetary Policy Set so as to Eliminate Foreign Exchange Premium
3.4.1. Domestic Monetary Supply			
$M_S^0 = 160$	$M_S^0 = 112.000$	$M_S^0 = 135.560$	$M_S^0 = 103.621$
$M_S^1 = 200$	$M_S^1 = 200.000$	$M_S^1 = 169.450$	$M_S^1 = 200.000$
3.4.2. Exchange Rate			
$e^0 = 1.500$	$e^0 = 1.500$	$e^0 = 1.500$	$e^0 = 1.500$
$e^1 = 1.500$	$e^1 = 1.500$	$e^1 = 1.500$	$e^1 = 1.500$
3.4.3. Exchange Rate Premium Value			
$\lambda^0 = 0.413$	$\lambda^0 = 0.051$	$\lambda^0 = 0.0225$	$\lambda^0 = 0.000$
$\lambda^1 = 0.413$	$\lambda^1 = 0.051$	$\lambda^1 = 0.0225$	$\lambda^1 = 0.000$
3.4.4. Utility Across Periods			
95.125	96.418	96.385	96.379

This section presents a model of international trade with both intertemporal and spatial trade motivated by current debate on both Renminbi revaluation and a possible Renminbi free float in China. In this model if intertemporal trade is restricted by service regulation and tariff rates are bound in the WTO, even for a small open price taking economy free trade in goods will typically not be the best policy. A fixed exchange rate policy with a surrender requirement on exporters and rationing (or auctioning) of foreign exchange among importers can be a welfare improving intervention compared to a free floating exchange rate. This analysis seems relevant to the present debate in China where services unliberalized until the terms of China's WTO accession fully apply and tariff rates are bound under China's WTO accession terms.

While this analysis may not be fully realistic of the situation in economies such as China under international pressure to liberalize their exchange rate regime, it provides possible intellectual coherence to a position that best policy may not be to move to a free float prior to full financial services liberalization. In China, unlike in our analysis, there is no foreign exchange premium and China runs a trade surplus in goods trade. However, to the extend that concerns over possible capital flight motivate the maintenance of the present exchange rate regime which limits convertibility, the broad themes of the analysis still seem relevant. The policy implications thus run counter to accepted international conventional wisdom and point to possible advantages of not freely floating.

4 Concluding Remarks

International trade literature in which there is trade both spatially in commodities and intertemporally, from our reading of literature, seems to be limited and hence we develop some simple prototypes appealing to literature on incomplete markets to analyze the implications of both trade liberalization in goods and international liberalization of financial services. While it may seem a standard second best implication that with unliberalized goods trade, full services liberalization may not be Pareto preferred, it has the obvious implication that appending the General Agreement on Services (GATS) to the GATT in 1994 when the WTO was founded could have been welfare worsening measure. We also show how in a model with monetary structure and monetary non-neutrality, in the presence of unliberalized services an optimal exchange rate can exist and can be computed. We discuss loose relevance to the current situation in China. These models do not seem amenable to

analytical results, and so we rely on numerical simulations, and so their further development would seem to be simulation oriented rather than analytic.

References

[1] Abrego, L. and J.Whalley (2003) *Decomposing Wage Inequality Change Using General Equilibrium Models.* Forthcoming in T.J.Kehoe, T.N.Srinivasan, and J.Whalley ed. **New Frontier in Equilibrium Modelling**, Cambridge University Press.

[2] Arrow, K.J. (1964) *The Role of Securities in the Optimal Allocation of Risk-bearing*, The Review of Economic Studies, 31, 91-96.

[3] Chang, G. and Q. Shao (2004) *How Much Is the Chinese Currency Undervalued? A Quantitative Estimation.* China Economic Review 15, 366 - 371.

[4] Chen, Z. and L. Schembri (2002) *Measuring the Barriers to Trade in Services: Literature and Methodologies.* in J.M.Curtis and D.C.Ciuriak ed. **Trade Policy Research**, Development of Foreign Affairs and International Trade, Canada 2002.

[5] Chia, N.C. and J.Whalley (1997) *A Numerical Example Showing Globally Welfare Worsening Liberalization of International Trade in Banking Services.* Journal of Policy Modeling, 19, 119-127.

[6] Clarete, R. and J. Whalley (1991) *Foreign Exchange Premia and Non-Neutrality of Monetary Policy in General Equilibrium Models.* Journal of International Economics 30, 153 - 166.

[7] Dee, P. and K.Hanslow (2000) *Multilateral Liberalization of Services Trade.* Productivity Commission Staff Research Paper, Ausinfo, Canberra.

[8] Duffie, D. (1987) *Stochastic Equilibria with Incomplete Financial Markets.* Journal of Economic Theory 41, 405–416

[9] Duffie, D. and W.Shafer (1985) *Equilibrium in Incomplete Markets: I – A Basic Model of Generic Existence.* Journal of Mathematical Economics, 14, 285-300.

[10] Foley, D.K. (1970) *Equilibrium with Costly Marketing.* Journal of Economic Theory, 2, 276-291.

[11] Francois, J. and L. Schuknecht (2000) *International Trade in Financial Services, Competition and Growth Performance.* Centre for International Economic Studies, No. 6.

[12] Friedman, M (1956) **Essays in Positive Economics**. Chapter on the Case for Flex Exchange Rate.

[13] Geanakoplos, J.D. (1990) *An Introduction to General Equilibrium with Incomplete Asset Markets.* Journal of Mathematical Economics, 19, 1-38.

[14] Harberger, A.C. (1964) *Taxation, Resource Allocation and Welfare.* in The Role of Direct and Indirect Taxes in the Federal Revenue System, a conference report of the National Bureau of Economic Research and Brookings Institution (Princeton University Press for National Bureau of Economic Research and Brookings Institution, 1964), 25-80.

[15] Hart, O.D. (1975) *On the Optimality of Equilibrium when the Market Structure is Incomplete.* Journal of Economic Theory, 11, 418-443.

[16] Hatta, T. (1977) *A Theory of Piecemeal Policy Recommendations.* Review of Economic Studies, 44, 1-21.

[17] Hindley, B. and A.Smith (1984) *Comparative Advantage and Trade in Services.* The World Economy, 7, 368-389.

[18] Hoekman, B. (1995) *Assessing the General Agreement on Trade in Services.* in W.Martin and L.A.Winters ed. **The Uruguay Round and the Developing Economies**, Discussion Paper No. 307, World Bank, Washington DC, 327-364.

[19] Huang, H, J. Whalley and S. Zhang (2004) *Trade Liberalization in A Joint Spatial Intertemporal Trade Model.* Research Paper, The University of Western Ontario.

[20] Huang, H, Y. Wang, Y. Wang, J. Whalley and S. Zhang (2005) *A Simple Trade Model with An Optimal Exchange Rate Motivated by Discussion of a Renminbi Float.* Research Paper, The University of Western Ontario.

[21] Kalirajan, K., G. McHuire, D. Nguyen-Hong and M. Schuele (2001) *The Price Impact of Restrictions on Banking Services.* in C.Findlay and T.Warren ed. **Impediments**

to trade in Services: Measurement and Policy Implications, New York: Routledge.

[22] Magill, M. and M. Quinzii (1996) **Theory of incomplete markets**. Publisher Cambridge, Massachusetts, MIT Press.

[23] Magill, M. and W. Shafer (1991) *Incomplete Markets*. in W. Hildenbrand and H. Sonnenschein eds. **Handbook of Mathematical Economics**. Volume 4. Elsevier Science, New York, 1523-1614

[24] Mattoo, A. (1999) *Financial Services and the WTO: Liberalization Commitments of the Developing and Transition Economies*. Policy Research Working Paper No. 2184, Developing Research Group, World Bank, Washington DC, 1999.

[25] McCulloch, R. (1990) *Services and Uruguay Round*. The World Economy, 13, 329-340.

[26] Pan, Z. and F. Zhang (2004) *Determination of China's Long-Run Nominal Exchange Rate and Official Intervention*. China Economic Review 15, 360 - 365.

[27] Radner, R. (1972) *Existence of Equilibrium of Plans, Prices and Price Expectations in a Sequence of Markets*. Econometrica, 40, 289-303.

[28] Ryan,C. (1990) *Trade Liberalization and Financial Services*, The World Economy, 13, 349-366.

[29] St-Hilaire, F. and J.Whalley (1995) *Some Estimates of Trade Flows in Banking Services*. Review of Income and Wealth, 41, 471-479.

[30] Taylor, M.P. (1995) *The Economics of Exchange Rates*. Journal of Economic Literature, 33, 13-47.

[31] Wang, L., and J.Whalley (2007) *The Joint Effects of Reminbi Revaluation on Trade Flows and Reserve Accumulation in a Simple Monetary Trade Model*. Research Paper, The University of Western Ontario.

[32] Werner, J. (1985) *Equilibrium in Economies with Incomplete Financial Markets*. Journal of Economic Theory, 36, 110-119.

[33] Whalley, J. (2003) *Liberalization in China's Key Sectors Following WTO Accession: Some Scenarios and Issues of Measurement.* NBER Working Paper 10143.