ABSTRACT

Title of Dissertation: **ESSAYS IN INTERNATIONAL ECONOMICS**

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This dissertation consists of two essays. The first essay investigates the impact of capital account convertibility on the volatility of economic growth. Previous work has concentrated on the impact of convertibility on mean growth and has found contradictory results. Existing theoretical work suggests that impact of convertibility on volatility could differ across economies depending on their level of financial development. I test this hypothesis using a system of equations that allow for simultaneous determination of three endogenous variables: volatility, mean growth and financial development. I also allow for spillover effects in economic growth and its volatility. I find that financially developed economies are better able to handle capital account convertibility in the sense that convertibility does not lead to excess fluctuations in those economies. However less financially developed economies suffer a higher level of fluctuations with an open capital account. These results are robust to alternative measures of financial development and to removal of the top and bottom 10% of my sample. I also find significant spillovers from growth of trade partners on the mean growth of the domestic economy.

The second essay builds on Romer's (1994) idea that when there are fixed costs of entry into export markets, even low trade barriers can lead to the complete disappearance of some products and impose costs that are much larger than the conventional costs of protection. I incorporate Romer's insight into a fully specified general equilibrium model. In a two-country, differentiated goods model, assuming that firms are heterogeneous with respect to the costs of entry into the export market, I show that firms are divided into those that sell exclusively at home and those that also sell abroad. Larger firms export more and are also characterized by higher average productivity. The cost of protection is significantly higher when I allow products to disappear as a result of the tariff. My work is closely related to Melitz (2003) and Helpman, Melitz and Yeaple (2002) but differs in the mechanism underlying the results. Data from the Indian trade liberalization of the 1990s appears be in line with the results of the model.

ESSAYS IN INTERNATIONAL ECONOMICS.

By

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Chapter 1: Ready for Capital Account Convertibility?

Section 1 - Introduction

Empirical investigation of capital account liberalization has concentrated on its impact on mean growth and has yielded conflicting results. Rodrik (1998) found that capital account liberalization has an insignificant effect on growth rates. He used the International Monetary Fund indicator to measure capital account openness. Quinn (1997) constructed and used a more nuanced measure of capital controls in his study and found a significant positive impact of having a more open capital account. Edwards (2001) used the Quinn measure and found that having a liberal capital account regime has a positive impact in rich countries but a negative impact in poor countries.

Theoretical literature and anecdotal evidence, however, suggest another important route through which capital account convertibility impacts an economy - volatility. In this paper I test the hypothesis that the impact of capital account liberalization on the volatility of economic growth depends on the level of financial development of the economy.

This paper goes beyond previous studies in four important ways. First it studies the impact of capital account liberalization on volatility of economic growth. Second, it allows this impact to vary, depending on financial development of a country. Third, it uses three simultaneous equations, one each for volatility, economic growth and financial development, thus allowing explicitly for two-way links between these variables. Fourth, it allows international spillover effects to impact the domestic economy.

Capital Account Controls are the element of the external sector regime of a country that govern it in international financial markets. Controls on current payments and transfers and trade restrictions constitute the other elements of this regime and govern the country in international markets for goods and services.

Capital controls include restrictions relating to:

a. repatriation and surrender of proceeds from exports, invisibles and current transfers,

b. purchase and sale of capital and money market instruments,

c. derivatives and other instruments,

d. commercial and financial credit operations,

e. outward and inward direct foreign investment,

f. foreign and domestic real estate transactions,

g. liquidation of direct investment and

h. provision for commercial banks, other credit institutions and institutional investors.

Removing these restrictions allows capital to move freely into and out of a country, and that is known as capital account liberalization.

The history of international capital flows dates back to the 19th century, when the global capital market linked financial centers all over the world (Obstfeld, 1998). However most of these flows were inhibited after the two World Wars and the Great Depression. The current round of capital account liberalization dates back to the sixties in some industrialized countries and the early seventies in parts of the developing world. Table VI presents a time-line of liberalization in selected developing countries, as per the International Monetary Fund indicator of capital account openness.

There are several potential benefits of capital mobility. It allows allocation of resources to the most productive use; investors are able to diversify their portfolios and earn a higher risk adjusted rate of return; and investible funds are made available in developing countries. There is also evidence to suggest that international financial liberalization provides previously lacking incentives for accelerated reforms of domestic financial markets and institutions, especially in developing countries (Kaminsky and Schmukler, 2002). Moreover, since capital flows are sensitive to macroeconomic policies and to the health of the banking system, capital markets tend to enforce discipline (Fischer, 1998).

At the same, there is a downside to liberalization. Reinhart and Tokatlidis (2001) investigate the impact of financial liberalization (domestic and external) on macroeconomic variables and find that most of the benefits of liberalization occur only in high income countries. Also an open capital account brings the risk of volatility. It has been argued that, due to lack of information or lack of incentive for gathering information, foreign investors in emerging markets exhibit herd behavior. This leads to very volatile movements of capital across borders, where these movements are not necessarily related to economic fundamentals, resulting in real damage to the domestic economy (Calvo, 1996). Another reason for volatile capital flows is spillover effects, for example, via common lenders (Kaminsky and Reinhart, 1999). In this case, a country experiences capital outflows as loans are called back by lenders that have also lent to countries that are in crisis. These lenders need to rebalance their portfolio and recapitalize. Countries that borrowed predominantly from Japanese commercial banks are an example of a common bank creditor cluster. This particular cluster included Indonesia, Malaysia, Thailand, China and Korea. The evidence in the Kaminsky and Reinhart paper suggests that this sort of financial link might have been important in spreading the contagion.

Aghion et. al. (2000) present a theoretical model which produces a differential impact of capital account liberalization based on the level of financial development. In their model of a small open economy with credit constrained firms, as the capital account is opened, higher investment, output and profits result as capital flows in. The credit constraint is of the form that firms can borrow a maximum of μ times their current wealth. With higher profits, borrowing capacity improves and leads to higher investment. Subsequently however, input prices are bid up leading to lower profits and lower borrowing capacity. This results in lower output. An economy with a low level of μ ends up experiencing these fluctuations repeatedly. With high financial development (high μ) there is no volatility as firms' investment is not constrained by their current wealth and so the shock to their cash flow resulting from higher prices of the country specific factor does not impact their investment or output.

Others such as Paasche (2001) have emphasized how credit constraints play a role in amplifying the impact of terms of trade shocks in an open economy. Cespedes, Chang and Velasco (2000) show that financial frictions strongly magnify adverse foreign shocks through the presence of balance sheet effects.

The liberalization of capital accounts has been one of the major factors in the surge of capital flows into emerging markets. At the same time, most of the countries that have experienced rather large inflows compared to the relative size of their capital stock have also subsequently suffered huge capital flow reversals (Bacchetta & Wincoop, 2000). Emerging markets seem to be different in the way that they react to external financial liberalization compared to markets in developed countries.

In my empirical model, I specifically account for differences in the level of financial development. I formally test the hypothesis that differences in financial development lead to different impacts of capital account liberalization.

The model uses a system of equations that allow for simultaneous determination of three endogenous variables: volatility, mean growth and financial development. It also allows for spillover effects in economic growth and its volatility from major trade partners of each country.

The reason for using a system of three equations is that estimating a single equation for volatility would not allow me to account for the joint determination of growth, volatility and financial development. There exists theoretical and empirical work that suggests a positive relationship between economic growth and financial development (King and Levine 1993, Patrick 1966, Greenwood and Jovanovic 1990 and Greenwood and Smith 1997). There also exists literature to suggest that volatility has a negative impact on growth (Ramey and Ramey 1995, Mobarak 2001) and might in turn be influenced by it. An instance of the latter is the potential positive influence of growth on political stability (Londeregan and Poole 1989). The volatility equation that I seek to estimate is thus interrelated with other equations in the more complete model. Therefore, I estimate a set of three simultaneous equations.

Also I account for spillover effects of volatility and growth in other countries. Kaminsky and Reinhart (2001) use crisis episodes to compare trade and financial linkages as channels for the spread of contagion. In this paper I consider bilateral trade as a channel for spillover effects. I weight the importance of the spillover from any economy to the domestic economy based on its share in the trade of the domestic economy. Thus the weighted average of the volatility and growth of countries that rank among the top 20 major trading partners of a country enter as explanatory variables. Since trade shares are most likely to be endogenous in the system of equations, we instrument for them using their lag, populations of the two trading countries normalized by the total population of the world, lagged gross domestic product of the two trading countries normalized by the total gross domestic product of the world and the physical distance between them normalized by the longest distance in my sample. This is in the spirit of gravity models, where the size of the two trading partners determines the trade between them. The use of the instrumental variables approach in this context follows the procedure suggested in Kelejian and Prucha (2002). The fact that trade shares might be endogenous has been largely ignored in the past literature (Moreno and Trehan - JEG, 1997)

I find that in the volatility equation there is some evidence for a differential effect of capital account openness. The interaction term between financial development and capital account liberalization itself has a significant negative coefficient. This suggests that higher financial development helps an economy to handle capital account convertibility better in the sense that convertibility does not lead to excessive fluctuations. I also find that growth spillovers from major trade partners are a significant influence on the mean growth of an economy. These results are robust to alternative measures of financial development and to the removal of the top and bottom 10% countries in terms of per capita Gross Domestic Product of my sample.

Section 2 - Literature Review

This paper relates to empirical and theoretical work in a number of closely related areas. I outline some representative papers below.

In a model of a small open economy Aghion et al. (2000) find that in economies at an intermediate level of financial development, full financial liberalization in the sense of opening the domestic market to foreign capital flows may destabilize the economy. Other theoretical models also yield similar implications. In a three-country model Paasche (2001) shows that if financial frictions are present, a temporary terms of trade shock can be amplified by credit constraints. In Cespedes, Chang and Velasco (2000) the impact of an adverse foreign shock can be strongly magnified by balance sheet effects that arise in the presence of financial constraints. In the context of a closed economy, Bernanke & Gertler (1989) and Kiyotaki & Moore (1987) model the persistence of shocks due to credit constraints.

In this paper I formally test the hypothesis that capital account convertibility leads to higher volatility in less financially developed economies. This implication is derived from the models outlined above, where low levels of financial development lead to high volatility if there are shocks. The reason for this is that if shocks impact net worth and producers are more credit constrained at lower levels of financial development because their borrowing capacity is closely linked to their current net worth, excessive fluctuations in investment and growth could develop. My empirical model allows for simultaneous determination of volatility, economic growth and financial development, since there are important links among these variables.

I now outline the literature that suggests to these linkages. In cross-country data, Ramey and Ramey (AER 1995) find that countries with higher volatility have lower average growth. Thus volatility and growth are closely linked. There is also a literature on the two-way relationship between growth and financial development. King and Levine (QJE 1993) present cross country evidence that financial development is strongly associated with growth. They use four different indicators of financial development.

In this paper I use credit to the private sector as a percentage of gross domestic product as my measure of financial development. This is one of the measures used by King and Levine. I use this measure primarily because it accounts for one of the most important function of the financial sector, channeling savings into the productive sectors of the economy. I test the sensitivity of my results to the use of other measures of financial development. The sensitivity tests are discussed in greater detail in Section 8. My results are quite robust to use of other measures of financial development.

Hugh Patrick (EDCC 1966) discusses the causal relationship between financial development and economic growth. He emphasizes both the "demand-following" phenomenon, in which evolutionary development of the financial system is a continuing consequence of the process of economic development, and the "supply-leading" phenomenon, in which the creation of financial institutions and supply of their financial assets, liabilities and related financial services takes place in advance of demand for them. The latter serves as an opportunity to induce real growth by financial means. Thus financial development and growth are closely linked.

Research on the impact of capital account convertibility on growth has produced conflicting results. Dani Rodrik (1998) finds no empirical association between capital account liberalization and growth in his cross-country study. Using the binary (0-1) indicator constructed by the International Monetary Fund to measure capital account restrictions he regresses average growth of Gross Domestic Product per capita on a number of independent variables including the fraction of years for which the capital account was free of restrictions. Meanwhile Quinn (1997) finds a positive significant correlation between capital account liberalization and economic growth. He constructs a more nuanced measure of capital account openness. For 56 countries over the period 1950 to 1994 and an additional 8 countries starting in 1954, Quinn distinguishes 2 categories of statutory measures that represent capital account restrictions. For both these categories, Quinn codes the intensity of controls on a two point scale(where the values increase at half point increments from 0 to 0.5, 1, 1.5, 2, with 0 denoting most intense and 2 denoting no restrictions). This produces an index of capital account restrictions that ranges from 0 to 4. The differences in the findings of these studies could stem from differences in the countries and the years included in the sample, as well as the manner in which capital account restrictions are measured. Edwards (2001), using the Quinn measure of capital controls, finds that capital account liberalization boosted growth in 1980s in high-income countries but slowed it in low-income countries.

I use the International Monetary Fund measure of capital account openness since the Quinn measure is publicly available for only three years of my sample (one in the mid 70s and two in the 80s).

I study the effect of capital account convertibility not only on growth, but also on volatility. Among existing work on the determinants of volatility, Easterly et al (2000) find that a deeper financial system is significantly associated with less volatility and that the relationship is nonlinear. Denizer et al (2000) find that countries with more developed financial sectors experience less fluctuation in real per capita output, consumption and investment growth. Both these studies regress volatility as measured by (standard deviation of per capita gross domestic product growth rates), against a range of independent variables. The Denizer et al (2000) study also examines the volatility of consumption and investment growth.

With the exception of Mobarak (2001), most previous work has studied growth, financial development and volatility separately. My work takes the logical next step in this literature by allowing for simultaneous determination of growth, volatility and financial development. I provide a framework for testing empirically the idea that capital account convertibility might have differential effects on economies depending on their stage of financial development, and I test for effects of capital account convertibility not only through its direct effect on growth but also through its influence on volatility and financial development.

I also study other sources of influence that the international economy has on the domestic economy via trade openness and spillover effects from growth and volatility of trade partner countries. Kaminsky and Reinhart (2001) explore financial and trade linkages among nations as channels of contagion. In this paper I test for spillovers through the bilateral trade channel. My empirical framework can also be easily used to account for other channels. Easterly and Levine (1994) use a weighting matrix based on total gross domestic product of neighboring countries to account for growth spillover effects in Africa. They instrument for their spillover weights using policy variables. Moreno and Trehan (JEG, 1997) use a weighting matrix of distances to study growth spillovers. They also use trade weighted spillover effects, but they fail to take into account the endogeniety of trade shares and do not instrument for them. In this study I account for spillover effects on the domestic economy's growth and volatility arising from growth and the volatility of the country's top 20 trade partners. The weighting matrix consists of trade shares of the partner countries in the total trade (exports + imports) of the domestic economy. I instrument the weighting matrix of trade shares using lagged trade shares, the populations of the two trading countries normalized by the total world population, their lagged gross domestic product normalized by the total gross domestic product of the world and the physical distance between them normalized by the longest distance in the sample. This is in the spirit of gravity models (Anderson, 1979).

Section 3 - The Derivation of the Empirical Model

The empirical model consists of three equations; one each for economic growth, financial development and volatility.

The volatility equation is derived from intuition built on a number of theoretical models. The main aim here is to test for differential influence of capital account convertibility on the volatility of an economy depending on its level of financial development. The volatility equation controls for the standard variables accounted for in the literature. This study is concerned specifically with the impact of the degree of openness to the international economy. Thus it additionally looks for the influence of capital account convertibility and an interaction term between capital account convertibility and financial development. The aforementioned model of Aghion et al. (2000) suggests that the impact of capital account liberalization will diminish as financial development increases,

$$\frac{\partial^2 \sigma(K,F)}{\partial K \partial F} < 0$$

where

K = Level of capital account openness (higher values represent more openness)

F = Level of financial development (higher values represent higher financial development)

σ = Standard deviation of output

The equation that I estimate for volatility is

$$V_{i,t} = \alpha_0 + \alpha_t + \alpha_1 K_{i,t} + \alpha_2 F_{i,t} + \alpha_3 [(F_{i,t}) * (K_{i,t})] + \alpha_4 G_{i,t} + \alpha_5 W_{i,t} V_{.,t} + X_{1i,t} \underline{\alpha_6} + \varepsilon_{1i,t}$$

Where $V_{i,t}$ is the standard deviation of the growth rate of the gross domestic product per capita of country i in decade t, $K_{i,t}$ is a measure of capital account openness, $F_{i,t}$ is a measure of financial development, $G_{i,t}$ is the growth rate of gross domestic product per capita, and $X_{1i,t}$ contains other determinants of volatility, which are listed in the next section. The term $W_{i,t} V_{.,t} = \sum_{j=1}^{N} w_{ijt} v_{jt}$ is a weighted average of volatilities of the major trading partners of country i in period t, where the weights (w_{ij}) are the trade shares of the major trading partners of the country. This term allows me to test for spillover effects via the trade channel. If the volatility increasing impact of capital market openness is lower at higher levels of financial development, we would expect to find α_3 <0.

To complete the model and account for important interlinks, I also estimate equations for growth and financial development.

The financial development equation is based mostly on the work of Patrick (1966), Greenwood and Jovanovic (1990) and Greenwood and Smith (1997).

Greenwood and Jovanovic (1990) model financial development and economic growth as being endogenously determined. Growth makes costly financial structures affordable, and financial development promotes growth by allowing a higher rate of return to be earned on capital. In Greenwood and Smith (1997), the date when the financial markets start functioning is determined by gains from specialization (which are allowed to be random), the probability distribution of costs of market formation and the initial wealth of the economy. The higher the expected gains from specialization and initial wealth, and the lower the costs of market formation, and lower the uncertainty regarding the costs, the sooner the financial market begins functioning. No other aspects of the distribution of gains from specialization enter into determining financial development in this model. Patrick (1966) analyzes both the demand following and supply leading roles of financial development in the economic growth process. In the former role financial development responds to demand for financial services that results from economic development. According to Patrick, rapid growth induces financial development, as does greater dispersion among growth rates of different sectors :

"…with a given aggregate growth rate, the greater the variance in the growth rates among different sectors or industries, the greater will be the need for financial intermediation to transfer savings to fast growing industries from slow-growing industries and from individuals. The financial system can thus support and sustain the leading sectors in the process of growth… "

The following equation is estimated for financial development,

$$F_{i,t} = \gamma_0 + \gamma_t + \gamma_1 F_{i,t-1} + \gamma_2 K_{i,t} + \gamma_3 G_{i,t} + X_{3i,t}\underline{\gamma_4} + \varepsilon_{3i,t}$$

Where $F_{i,t}$ is a measure of financial development of country i in decade t and $X_{3i,t}$ contains other determinants of financial development gleaned from the theoretical work cited above. Economic growth is included as a proxy for gains from specialization, initial gross domestic product per capita is included as a proxy of the initial wealth of the economy and the (log of) sectoral dispersion of growth rates is included as a measure of the incentive for financial development as per the Patrick (1966) argument quoted above. This equation also includes a lag of financial development, since one could reasonably expect the level of financial development would display persistence. Capital account openness is included as an explanatory variable, since international financial liberalization can provide previously lacking incentives for accelerated reform aiding development of the financial sector (Kaminsky and Schmukler, 2002).

The growth equation is estimated as

$$G_{i,t} = \beta_0 + \beta_t + \beta_1 K_{i,t} + \beta_2 F_{i,t} + \beta_3 V_{i,t} + \beta_4 W_{i,t} G_{.,t} + X_{2i,t} \underline{\beta_5} + \varepsilon_{2i,t}$$

where $W_{i,t} G_{.,t}$ represents the weighted average of per capita gross domestic product growth rates of the major trading partners of country i, and $X_{2i,t}$ contains other determinants of growth, including initial (beginning of the decade) gross domestic product per capita, initial inflation, initial openness to trade, an index of democracy, the black market premium as a proxy for the extent of government intervention, revolutions and coups per year as a measure of political stability, the mean and standard deviation of terms of trade changes, the log of population, the standard deviation of inflation, initial investment as a percentage of gross domestic product and a measure of human capital. These are the standard explanatory variables from the growth literature.

Section 4 – The Empirical Model

I estimate a simultaneous equations model. The equation that is most important and central to my investigation is the volatility equation. However it is not sufficient to only estimate the volatility equation, since there are other important links that exist. It is widely held that growth and financial development are simultaneously determined and interact with each other in important ways. Also since we are primarily interested in explaining volatility, and the latter is believed to influence and be influenced by growth, it is important to account for this link. Therefore, I estimate three equations simultaneously, one each for growth, volatility and financial development. I allow for spillover effects of growth and volatility of important trade partners on the domestic economy's growth and volatility, respectively.

Thus the model to be estimated is

$$V_{i,t} = \alpha_0 + \alpha_t + \alpha_1 K_{i,t} + \alpha_2 F_{i,t} + \alpha_3 [(F_{i,t})*(K_{i,t})] + \alpha_4 G_{i,t} + \alpha_5 W_{i,t} V_{.,t} + X_{1i,t}\underline{\alpha_6} + \varepsilon_{1i,t} \quad (1)$$

$$G_{i,t} = \beta_0 + \beta_t + \beta_1 K_{i,t} + \beta_2 F_{i,t} + \beta_3 V_{i,t} + \beta_4 W_{i,t} G_{.,t} + X_{2i,t}\underline{\beta_5} + \varepsilon_{2i,t} \quad (2)$$

$$F_{i,t} = \gamma_0 + \gamma_t + \gamma_1 F_{i,t-1} + \gamma_2 K_{i,t} + \gamma_3 G_{i,t} + X_{3i,t}\underline{\gamma_4} + \varepsilon_{3i,t} \quad (3)$$

where

$G_{i,t}$ = mean annual growth rate of real gross domestic product per capita in country i during time period t, where, t = 1 for the decade 1970-79

t = 2 for the decade 1980-89

t = 3 for the decade 1990-99

$V_{i,t}$ = volatility (standard deviation) of the growth rate in country i during the decade t.

$F_{i,t}$ = a measure of average financial development of country i in decade t. $F_{i,t}$ is measured as the average of the ratio of credit to the private sector, over gross domestic product in decade t. Credit to the private sector refers to financial resources provided to the private sector - such as through loans, purchases of non-equity securities, trade credit and other accounts receivables - that establish a claim for repayment.

$K_{i,t}$ = an index of the existence of capital controls for country i, constructed as the average annual International Monetary Fund (IMF) dummy (0-1) over decade t. The index is re-scaled such that zero signifies the most controls and unity the least. The data for this index comes from the IMF's annual reports on exchange arrangements and exchange restrictions. Countries with capital controls are those that the IMF classifies as having "restrictions on payments for capital transactions".

X_1, X_2, X_3 are vectors of independent explanatory variables. All three vectors include initial (start of the decade) gross domestic product per capita, initial inflation, initial trade openness measured as the sum of exports and imports divided by gross domestic product, a democracy index such that zero signifies the least democratic society and one the most, the average black market premium in currency exchange, the average annual number of coups and revolutions, the average gini coefficient of income inequality, the average growth rate of terms of trade, the standard deviation of the growth rate of terms of trade, the standard deviation of inflation and the log of population.

In addition X_1 through X_3 each contain variables excluded from the other regressions, in order to identify the model. X_1 contains a dummy variable for diversified exporters, which equals one if the country is diversified in its export base and zero if it isn't. If no single category of exports accounts for 50 % or more of total exports, the economy is classified as diversified. The categories considered are: nonfuel primary (SITC 0, 1, 2, 4, plus 68), fuels (SITC 3), manufactures (SITC 5 to 9, less 68), and services (factor and nonfactor service receipts plus workers' remittances). The measure of diversification is included only in the volatility equation since while diversification reduces volatility, it does not necessarily have a direct impact on growth except through the channel of volatility itself (Mobarak, 2001). Also the measure of diversification does not appear in the financial development equation, because the more relevant measure - the measure of dispersion of growth rates across sectors - is accounted for in that equation. This is because while diversification per se might not influence financial development, the higher dispersion of growth rates among sectors of the economy would lead to higher demand for financial intermediation (Patrick, 1966).

X_2 contains the initial investment to gross domestic product ratio and enrollment at the secondary education level. The measures of investment and education are included in the growth equation alone since both would directly impact growth, while no such clear relationship can be drawn with respect to volatility. It would be safe to assume that the influence of these two variables would enter into the determination of volatility via growth. The financial development equation is primarily derived from the intuition of the models of Greenwood and Jovanovic (1990) and Greenwood and Smith (1997). In both, financial development is determined by (and in turn determines) economic growth. As long as growth enters the financial development equation, the determinants of growth itself can be assumed to influence financial development primarily through the route of growth itself.

X_3 contains the log of average annual dispersion of growth rates among sectors (agriculture, industry and services). A higher dispersion of growth rates among sectors of the economy indicates higher demand for financial intermediation that would tend to lead to higher financial development (Patrick 1966). It appears therefore only in the financial development equation. In as far as higher dispersion might indicate the level of economic development and thus influence growth rates, the level of initial gross domestic product per capita is already included in the growth equation and is accounting for the stage of economic development. Also the relationship between dispersion of growth rates across sectors and volatility is not clear-cut. While Lilien (1982) concludes that allocative shocks lead to aggregate fluctuations, Abraham and Katz (1986) present evidence to the contrary. The latter's results indicate that aggregate shocks are the main driving force behind aggregate fluctuations. In this paper therefore I assume that dispersion of growth rates across sectors does not have direct links to volatility.

W_t is an N X N weighting matrix that consists of average trade shares, over the decade, of the top 20 trading partners of each country in the sample. The ith row corresponds to trade shares of the ith country with its major trade partners. The ith row will have a zero as its ith element since no country is considered its own trade partner, and also zeroes corresponding to the countries that are not major trade partners of country i. Therefore, W_t serves as a selector matrix.

Table III lists the expected coefficient signs.

<u>Section 5 – Estimation</u>

The model presented in the previous section is estimated by 3 stage least squares. This allows us to use the links between the endogenous variables in the system efficiently. The endogenous variables in the model are growth, its volatility, financial development, the interaction term of financial development and capital account openness. Also the spatial lags of growth W_tG_t and volatility W_tV_t are endogenous (see appendix A for discussion).

In principle the independent explanatory variables (X_1, X_2, X_3 and the index of capital account openness), higher powers of the Xs, i.e., $X^2, X^3, X^4, X^5, X^6, \ldots, X^q$

and WX , W^2X ,W^3X , W^4X , W^5X ,….,W^mX and can potentially be used to instrument for the endogenous variables of the model. One might consider instruments that are nonlinear in the elements of X because of the non-linearities in the model. In addition these non-linearities might also proxy for other exogenous variables for which we do not have data. I set q=1 and m=1 in my estimation. Appendix A discusses the instruments that involve WX and higher powers of W interacted with X.

However in my case an added complication is the fact that the weighting matrix W_t itself is endogenous, since one could reasonably expect a two way relationship between trade and growth. Thus unlike other works in the literature, I cannot use X_t and W_tX_t as instruments for W_tV_t (the spatial lag of volatility) and W_tG_t (the spatial lag of growth). I use the instrumental variables approach suggested by Kelejian and Prucha (2002) to handle the problem of the endogenous weighting matrix. The procedure is as follows. First we get a predicted value of the weighting matrix W_t, say $\hat{W}_t$. Then we use X_t and $\hat{W}_tX_t$ as instruments in the 3 stage least squares procedure. More specifically, we assume a reduced form type model:

$$w_{ij,t} = \alpha + \beta w_{ij,t-1} + \gamma P_{i,t} + \delta P_{j,t} + \varsigma D_{ij} + \phi Y_{i,t-1} + \theta Y_{j,t-1} + \eta_{ij,t} \quad (4)$$

for all $w_{ij,t}$ >0

where $w_{ij,t}$ is the ij th nonzero element of W_t **;** $P_{n,t}$ is the population of country n in period t, normalized by the world population in period t ; D_{ij} is the distance in kilometers between i and j, normalized by the longest distance in my sample; $Y_{n,t-1}$ is the lagged gross domestic product of country n, normalized by the total world gross domestic product; and $\eta_{ij,t}$ is the disturbance term. This equation is in the spirit of the gravity models in the trade literature, where trade between two countries is determined by the size of their respective economies and the distance between them. The model in (4) is estimated by OLS and the fitted value $\hat{w}_{ij,t}$ is obtained, which produces $\hat{W}_t$. Then X_t and $\hat{W}_t X_t$ are used as instruments in the subsequent 3SLS procedure.

Section 6 – Data

My data includes about 60 countries over 4 decades, i.e., 1960 through to 1999. A major source of the data used in this paper is the World Development Indicators database of the World Bank. The Direction of Trade data set of the International Monetary Fund was used to extract trade shares in order to construct the weights used in the spatial lags of growth and its volatility. The Freedom House index of political and civil liberties was used to construct the democracy index used in my analysis. The index is available from the Freedom House website (www.freedomhouse.org/ ratings). The gini coefficient of inequality was obtained from the Deininger and Squire data set, which is available on the World Bank website (http:// www.worldbank.org/ research/ growth/ dddeisqu.htm).

The dummy variables for 'fixed characteristics', such as the dummy for diversified exporters, were extracted from the Network Growth database of the World Bank. This database is available at the World Bank website (http:// www.worldbank.org/

research/ growth/ GDNdata.htm). This is also the source for the black market premium in exchange rate markets and the data on revolutions. The latter data is originally taken from the Arthur S. Banks database.

Table II provides a comprehensive list of all the variables in the study and their sources.

Section 7 – Results

Table IV presents results from estimating equations (1)-(3). I find that capital account liberalization increases volatility significantly, while the interaction between financial development and capital account liberalization dampens it. This suggests the presence of a differential effect of capital account liberalization, where countries with high financial development liberalizing their capital account may not experience the increased volatility that a less financially developed country would.

The magnitude of the coefficients indicates that the volatility increasing impact of capital account liberalization is completely dampened in countries with a ratio of private credit to gross domestic product of roughly 49% or above. To put that result into some perspective, the average private credit to gross domestic product ratio in my sample of countries was approximately 29%, 38% and 44% in the decades of the 1970s, 80s and 90s respectively. Countries that had an average private credit to gross domestic product ratio below 49% during the 70s, but moved above that cutoff by the

90s, include Australia, Belgium, Chile, Finland, Ireland, Israel, Jordan, South Korea, Malaysia, New Zealand, Saudi Arabia, Thailand and the United Kingdom.

A high credit to gross domestic product ratio and a high standard deviation of terms of trade changes increase volatility. The latter finding is in accordance with the Mendoza (1995) model, where terms-of-trade shocks contribute substantially to Gross Domestic Product variability. A more democratic society and higher population dampen volatility. There are a number of reasons to expect democracy to reduce volatility (Mobarak, 2001). Democracy serves as an institution of conflict management, while an autocratic regime is like a risky investment since there is a chance of ending up with a bad dictator instead of a benevolent one, policies too tend to have larger variance in a dictatorship than in a democracy since in a democracy policies are chosen by consensus, while if leaders choose their successors from a small pool, the variance of the quality of leaders tends to be higher. Population is a measure of diversification and thus it has a negative impact on volatility. All other coefficients in the volatility regression have the expected signs.

Financial development varies positively with its lag, initial gross domestic product per capita, capital account openness, economic growth and an equitable distribution of income. Higher dispersion of sectoral growth rates also has a significant positive impact on financial development. These findings correspond closely to the theoretical models of financial development (Patrick 1966, Greenwood and Jovanovic 1990 and

Greenwood and Smith 1997) used to motivate the empirical equation for financial development.

The growth equation yields the standard results of the literature. The coefficient of initial gross domestic product per capita is negative and significant, and so are the coefficients on democracy and the black market premium in currency exchange, which is a composite measure of government policy. The coefficient of initial gross domestic product is consistent with the convergence prediction of neoclassical growth models, which is based on the assumption of diminishing returns to reproducible capital and implies that poor countries tend to grow faster than rich ones. Democratic institutions may have certain inherent inefficiencies that could hinder growth. A higher black market premium is a proxy for greater intervention in the economy by the government. The rate of change of terms of trade has a significant positive coefficient, and so do the log of population and the initial ratio of investment to gross domestic product. Mendoza (1996) predicts that terms of trade variability affects growth.

In terms of spillover effects, I find that the weighted average of growth rates of major trading partners has a positive impact on the growth rate of a given country. There are several alternative ways in which spillover effects may be decomposed. I follow the decomposition used in Kelejian et. al. (2003). Spillovers from a country's neighbors are split into two distinct effects; Emanating and Impacting. The Impacting effect is the average impact that the fundamentals of a neighbor have on the growth of the country in the presence of spillovers. The Emanating effect arises from the fact that in the absence of spillovers, the fundamentals of a country would only have a direct impact on the growth rate in that given country; however, in the presence of spillovers, there is an additional indirect impact since the fundamentals of a given country impact its neighbors' growth which in turn impacts the growth rate of that given country itself. The Emanating effect captures this indirect effect of a county's fundamentals on its growth through the spillover channel. The measure of the spillover effect emanating from each country ranges from 0.1% to about 15% in the 1970s, 0.2% to 18% in the 1980s and 0.2 to 20% in the 1990s. Meanwhile the measure of the extent of the spillover impacting each country ranges from 1.6% to 7% in the 1970s, 1.9% to 7.6% in the 1980s and 2% to 5.4% in the 1990s. Both these measures are relative to the effect that would exist in the absence of spillover effects (Kelejian, et al, 2003). (Refer to Appendix B for a discussion of how these measures are calculated). Table VII presents the impacting and emanating effects of the growth spillovers in a few selected countries.

Section 8 – Sensitivity Tests

Table V presents the results of sensitivity tests. The first three columns present results when alternate measures of financial development are used. The measure I use in the main results - the ratio of credit issued to private firms to gross domestic product - is one of the measures used in the King and Levine (1993) study. There are three other measures used by the King and Levine study. Column 1 presents results when the size of the formal financial intermediary sector relative to gross domestic product, i.e., the ratio of liquid liabilities to Gross Domestic Product, is used to measure financial development. This is the traditional measure of financial depth. Column 2 presents results when the importance of banks relative to the central bank in allocating domestic credit, i.e., the ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets, is used to measure financial development. This measure helps to indicate the relative importance of specific financial institutions. Column 3 presents results when the percentage of credit allocated to private firms, i.e., the ratio of claims on the non-financial private sector to total domestic credit, is used to measure financial development. This indicator is designed to measure domestic asset distribution. The results carry through in two out of the three cases and thus seem to be robust to different ways of measuring financial development. Capital account openness continues to have a positive impact on volatility, i.e., it increases volatility. As before, this effect is ameliorated as the economy is more financially developed.

The last two columns contain results with the richest and poorest countries removed from the sample. Column 4 removes the top 10% of countries in terms of per capita gross domestic product. The differential effect of capital account liberalization carries through in this case, though the coefficient of capital account liberalization itself is only marginally significant. Column 5 contains results when the bottom 10% of countries, in terms of per capita gross domestic product, is removed from the sample. The results carry through and are significant in this case.

Section 9 – Conclusion

This paper studies the impact of capital account liberalization on the volatility of economic growth. I find that there is a significant and robust differential effect of liberalizing the capital account based on the level of financial development. I also account for possible spillovers of the growth and volatility of major trade partners on the domestic economy. I find that there is a significant positive spillover of the growth of an economy's major trading partners on a country's own growth.

The measure of capital account convertibility I use is the International Monetary Fund dummy variable. This may not, however, accurately describe the nuances of the laws and their implementation in each country's case. Thus it may not be possible to make precise policy recommendations in the case of any particular country. All the same, based on the empirical results of this paper, there does seem to be a case for a careful pace of external financial liberalization, especially in emerging markets with a less than well developed financial sector.

Compared to past empirical work (Rodrik 1998, Quinn 1997 and Edwards 2001) that concentrated on the influence of capital account openness on economic growth, this paper's contribution is to explore another route that capital account liberalization could work through, and that is volatility. Rodrik (1998) and Quinn (1997) find contradictory results in their empirical investigation of the influence of capital account liberalization on growth. Rodrik finds the influence insignificant, while Quinn finds a positive significant impact of capital account liberalization. My paper helps to reconcile these results somewhat, since even though the direct impact of capital account liberalization on growth is insignificant in this paper, the impact on volatility depends upon the level of financial development, and in as much as volatility has a negative impact on growth, both the Rodrik and Quinn findings can coexist in this framework.

Past empirical work on volatility has concentrated on domestic determinants of volatility (Denizer, et al (2000), Easterly et al (2000)). Even while considering financial development as a determinant, these papers have overlooked important factors such as capital account liberalization and international spillover effects. Easterly et al find a nonlinear relationship between financial development and volatility, and interpret it to mean that while financial development helps reduce volatility, this is true only up to a certain point. Beyond this point, further financial development might in fact add to volatility.

My results indicate that the impact of financial development on the economy varies with the level of openness of the capital account. As long as the economy is sufficiently financially developed, it is able to handle volatility that results from capital account openness.

Kaminsky and Reinhart (2001) find that both trade and financial linkages are important channels of international spillovers that lead to contagion. In this paper I account for bilateral trade as a channel for spillovers. My framework can be quite easily used to analyze other channels as well. For each channel one would simply construct the relevant weighting matrix and add it to the model.

Kaminsky and Reinhart (2001) conclude that financial links appear to be the most important in the propagation of contagion. In this paper I find significant spillovers of major trade partners' growth on domestic growth, while the spillover effect of trade partners' volatility is insignificant. In this context, considering financial linkages would be an interesting exercise.

Even though the evidence presented here by no means closes the issue under scrutiny, it does support the conjecture that there is a differential influence of capital account convertibility depending on the level of financial development, and this implies that convertibility could well require careful handling by policymakers.

Table I: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Volatility	4.32	3.29	.17	31.73
Growth	2.23	3.08	-10.78	19.38
Capital account openness	.24	.38	0	1
Capital account openness X Financial development	11.35	26.67	0	168.04
Financial development	34.10	28.89	1.13	186.71
Initial GDP per capita	5126.94	7991.10	89.35	45965.61
Initial inflation	47.25	422.81	-12.05	6836.98
Initial trade share of GDP	68.45	48.38	3.68	439.03
WV	2.67	1.02	0	7.41
Democracy index (0-1)	.57	.33	0	1
Black market premium in currency exchange	2.47	1.34	.46	8.76
Revolutions per year	.16	.28	0	2
Gini coefficient of inequality	41.51	9.94	19.9	65.38
Rate of change of Terms of Trade	-.28	3.27	-11.66	25.29
Standard Deviation of rate of change of Terms of Trade	8.05	11.32	0	93.27
Log of total population	15.50	1.96	10.62	20.90
WG	2.79	1.27	0	7.62
Initial gross domestic investment (% of GDP)	22.57	9.29	1.76	82.25
Secondary education	43.13	31.26	1	130.18
Standard deviation of inflation	54.35	469.84	0	8633.69
Diversified exporters	.31	.46	0	1
Dispersion of sectoral growth rates	3.34	1.32	.14	9.64

Table II : Data sources

Variable	Source
Volatility (Standard deviation of growth rate of gross domestic product per capita)	World Development Indicators, World Bank
Growth (Growth rate of gross domestic product per capita)	Direction of Trade Statistics, International Monetary Fund
Capital account openness	IMF annual reports on exchange restrictions
Financial development (ratio of private sector credit to gross domestic product)	World Development Indicators, World Bank
Financial development (the three other measure used in the robustness tests)	International Financial Statistics, International Monetary Fund
Inflation	World Development Indicators, World Bank
Initial trade share of GDP	World Development Indicators, World Bank and Global Development Finance
Trade weights to calculate the spillover matrix	Direction of Trade Statistics, International Monetary Fund
Democracy index (0-1)	Freedom House website www.freedomhouse.org/ratings
Black market premium in currency exchange	Global Development Network Growth Database
Revolutions per year	Arthur S. Banks Cross National Time-Series Data Archive
Gini coefficient of inequality	Lundberg and Squire (2000)
Rate of change of Terms of Trade	Mobarak 2000
Log of total population	World Development Indicators, World Bank
Initial gross domestic investment (% of GDP)	World Development Indicators, World Bank
Secondary education	World Development Indicators, World Bank and Global Development Finance
Dummy for diversified exporters	Global Development Network Growth Database
Dispersion of sectoral growth rates	World Development Indicators, World Bank and OECD\ website

Table III: Expected coefficient signs

	Volatility	Growth	Financial Development
Volatility		-	
Growth	+or-		+
Capital account openness	+	+or-	+
Capital account openness X Financial development	-		
Financial development	-	+	
Initial GDP per capita/1000	-	-	+
Initial inflation	+or-	+or-	+or-
Initial trade share of GDP	+or-	+or-	+or-
WV	+		
Democracy index (0-1)	-	-	+or-
Black market premium in currency exchange	+	-	+or-
Revolutions per year	+	-	-
Gini coefficient of inequality	+	+or-	+or-
Rate of change of Terms of Trade	+	+	+or-
Standard Deviation of rate of change of Terms of Trade	+	-	+or-
Log of total population	-	+or-	+or-
WG		+	
Initial gross domestic investment (% of GDP)		+	
Secondary education		+	
Standard deviation of inflation	+	-	+or-
Diversified exporters	-		
Lagged financial development			+
Dispersion of sectoral growth rates			+

Table IV : Results

	Volatility	Growth	Financial Development
Volatility		-.04(-0.32)	
Growth	.01(0.07)		**4.01(3.94)***
Capital account openness	**2.44(1.97)***	-.19(-0.50)	**6.61(2.14)***
Capital account openness X Financial development	**-.05(-2.18)***		
Financial development	**.03(2.59)***	.01(0.78)	
Initial GDP per capita/1000	.007(0.19)	**-.07(-2.11)***	**.71(3.05)***
Initial inflation	-.001(-1.64)	.0002(0.50)	.0005(0.13)
Initial trade share of GDP	-.004(-0.62)	-0.00003(-0.00)	.05(1.15)
WV	-.28(-1.22)		
Democracy index (0-1)	**-1.36 (-2.20)***	**-1.17(-1.97)***	-3.20(-0.72)
Black market premium in currency exchange	0.18(1.12)	**-.29(-2.29)***	-.21(-0.19)
Revolutions per year	.84(1.52)	-.53(-1.07)	-.01(-0.00)
Gini coefficient of inequality	.03(1.69)	.03(-1.55)	**.39(2.80)***
Rate of change of Terms of Trade	.05(0.74)	**.20(3.90)***	-.49(-1.03)
Standard Deviation of rate of change of Terms of Trade	**.04(2.45)***	-.002(-0.14)	-.14(-1.07)
Log of total population	**-.41(-2.46)***	**.31(2.11)***	2.22(1.87)
WG		**.62(2.56)***	
Initial gross domestic investment (% of GDP)		**.07(2.90)***	
Secondary education		.01(1.55)	
Standard deviation of inflation	.002(1.78)	-.001(-0.83)	.002(0.22)
Diversified exporters	-.47(-1.56)		
Lagged financial development			**.90(13.85)***
Dispersion of sectoral growth rates			**2.53(2.27)***
Observations		178	

Note *= significant at 5% confidence.
The t-ratios are in parentheses.

Table V : Robustness Tests

	Volatility	Volatility	Volatility	Volatility	Volatility
	Different measure fin dev1	Different measure fin dev2	Different measure fin dev3	Less top 10% richest countries	Less bottom 10%poorest countries
Growth	-.20(-1.27)	-.23(-1.39)	-.04(-0.29)	.12(0.65)	-.13(-0.72)
Capital account openness	**12.99(2.72)***	**4.97(2.45)***	4.56(1.17)	4.37(1.89)	**3.02(2.51)***
Capital account openness X Financial development	**-.17(-2.80)***	**-.13(-2.93)***	-.06(-1.28)	**-.12(-2.14)***	**-.06(-2.76)***
Financial development	**.04(1.83)***	**.05(2.80)***	.02(1.51)	**.04(2.14)***	**.05(3.44)***
Diversified exporters	**-.73(-2.14)**	-.71(-1.78)	-.49(-1.71)	-.51(-1.32)	-.43(-1.31)
Observations	167	136	170	147	164

Note *= significant at 5% confidence. ^= significant at 10% confidence.

Different measure fin dev1 is the ratio of deposit money bank domestic assets to the sum of deposit money bank domestic assets and central bank domestic assets. This is the measure of financial development labeled BANK, in the King and Levine (1993) analysis.

Different measure fin dev2 is the ratio of M2 to GDP. This is the measure of financial development labeled LLY, in the King and Levine (1993) analysis.

Different measure fin dev3 is the ratio of non financial private sector claims to total domestic credit. This is the measure of financial development labeled PRIVATE, in the King and Levine (1993) analysis.

Table VI : Countries with No Restrictions on the Capital Account Transaction as per IMF Classification (1966-1999)

Country	Period without Restriction
Argentina	1968-70, 1994-96
Australia	1984-95
Bolivia	1967-81, 1987-99
Botswana	1966-67, 1998-99
Canada	1966-95, 1997-99
Costa Rica	1966-70, 1973-74, 1981-82, 1995-96, 1998-99
Denmark	1988-95, 1997-99
Ecuador	1967-70, 1972-93, 1995
Fiji	1966-70
The Gambia	1968, 1992-96
Guatemala	1974-80, 1990-99
Honduras	1967-80
Hong Kong	1967-99
Indonesia	1970-96
Islamic Republic of Iran	1975-78
Liberia	1967-84
Malaysia	1974-99
Mexico	1967-82
Nicaragua	1967-78, 1997-99
Niger	1996
Panama	1967-1996, 1998-1999
Paraguay	1983-84, 1997-99
Peru	1966-69, 1979-84, 1994-99
Seychelles	1966-96, 1998-99
Singapore	1979-96
Switzerland	1966-99
Togo	1967, 1995
United Kingdom	1979-99
United States	1966-99
Uruguay	1966-67, 1979-93, 1997-99
Republic of Yemen	1973-1990

Table VII : Estimates of Spillover Effects of Trade Partners' Growth for a few Selected Countries : Emanating Effects

	1970	1980	1990
Countries	Spillover Effects Emanating from each country (EM) (% age points)	Spillover Effects Emanating from each country (EM) (% age points)	Spillover Effects Emanating from each country (EM) (% age points)
Argentina	0.8	0.5	1.7
Australia	1.9	1.8	1.9
Brazil	1.2	1.2	2.1
China	1.1	3.4	5.3
Democratic Republic of Congo	0.1	0.5	0.2
Denmark	1.5	1.0	1.0
India	0.5	0.6	0.6
Turkey	0.2	0.4	0.5
United Kingdom	5.5	6.1	4.6
United States	15.5	17.7	19.6

Table VIII : Estimates of Spillover Effects of Trade Partners' Growth for a few Selected Countries : Impacting Effects

	1970	1980	1990
Countries	Spillover Effects Impacting each country (EM) (% age points)	Spillover Effects Impacting each country (EM) (% age points)	Spillover Effects Impacting each country (EM) (% age points)
Argentina	3.1	2.8	3.1
Australia	3.2	3.3	3.1
Brazil	3.1	3.0	3.0
China	3.0	3.1	3.2
Democratic Republic of Congo	7.0	7.6	4.5
Denmark	3.5	3.5	3.1
India	2.9	2.9	2.7
Turkey	3.0	2.9	2.9
United Kingdom	3.0	3.2	2.8
United States	2.6	2.7	2.5

Chapter 2: Trade Liberalization and the Extensive Margin

Section 1 - Introduction

Tariffs, quotas and other instruments of protection restrict free trade. Trade liberalization refers to the process of removal of these barriers. This usually leads to considerable increase in the trade of the liberalizing country. Studies of episodes of trade liberalization have yielded evidence of a relatively larger expansion of trade at the extensive margin. Thus while there is also an increase in the existing trade of the country, goods not traded before ('new' goods) often account for the largest share of the increase in trade. Kehoe and Ruhl (2002) is one such study that documents this pattern in liberalizing countries. They examine the bilateral trade patterns of countries in North America and Europe that were involved in significant trade liberalization. They find considerable overall increase in trade after liberalization. Further they distinguish between two categories of trade growth between countries, the extensive and the intensive margin. Growth in the intensive margin refers to growth in trade in goods that were already being traded before liberalization was undertaken, while growth in the extensive margin is growth in trade in goods that had not previously been traded. The comparison of the two rates of growth yields interesting results. They find evidence of significantly larger growth in the extensive margin following the lowering of trade barriers compared to the growth in the intensive margin. When they divide goods into categories based on the size of trade conducted in them before liberalization, they find that the goods that were traded the least (or not at all) before liberalization accounted for a disproportionately large share in trade following the reduction of trade barriers.

These findings have important implications for calculations of the loss from tariffs. It appears that the true cost of not liberalizing trade may actually be considerably larger than just the deadweight loss of tariffs in existing markets. If the latter constituted the full extent of the loss then we would have to assume that all goods that could have potentially existed in the market with free trade actually do exist. However it would be unrealistic to make such an assumption since the data seem to indicate that trade liberalization increases not just existing trade but also leads to trade in goods not traded at all before. The true cost would therefore also include the large negative welfare effects that result from the disappearance of goods due to trade restrictions. These losses would tend to be larger since entire markets disappear, making society lose the entire amount of welfare that could be generated in them. Romer (1994) makes this point using a partial equilibrium model. He models a developing economy where differentiated inputs are available from abroad. Each foreign exporter of a differentiated input has a different fixed cost of entering the developing economy's market. Trade restrictions, such as tariffs, prevent some of these exporters from entering if they have a higher cost of entry. He estimates welfare losses resulting from such trade restrictions that cause a wedge between the range of productive inputs that are available in a developing country and the range of productive inputs that could be put to use there. In the literature, this aspect of the cost of trade restrictions has been largely ignored, i.e., the change in the number of entrants is not taken into account and therefore the set of goods available in the economy is assumed to be constant before and after trade liberalization. In his paper Romer shows that in a typical economic model that implicitly assumes that the set of goods in an economy never changes, the predicted efficiency loss from a tariff is small, on the order of the square of the tariff rate. However once he allows for the possibility that international trade can bring new goods into an economy, this loss can be as much as two times the tariff rate.

The particular model that Romer uses is highly simplified (Panagariya, 2002) and one of the contributions of this paper is to extend Romer's analysis to a more conventional general equilibrium model and study the impact in the market for consumer goods.

The Indian trade liberalization of the 1990s is an instructive case in this context. While some trade liberalization was undertaken in India since as far back as the 1970s and early 1980s, there was acceleration in the pace of this process only in the late 1980s. Even then the basic policy mindset, that tended to regard trade liberalization with considerable suspicion, underwent a true change only in the 1990s (Panagariya, 2001). Thus while trade liberalization had been undertaken only on an ad-hoc basis before, it was undertaken systematically in the 1990s. A perusal of data from the Indian trade liberalization of the early 1990s lends support to Romer's hypothesis. A comparison of the rates of growth in the intensive and extensive margins of trade leads to a familiar conclusion. New goods growth appears to be very strong after liberalization of trade policy. In fact the strongest growth of trade occurred in new goods, outpacing outpaced the growth in goods that were traded before the liberalization. It is also instructive to note the categories (for example by SITC classification) to which the new goods belong. Romer's model is set up in a way that only allows for inputs to be new goods. Analysis of the categories into which the new goods fell in the Indian case reveals that the new goods were well dispersed as far as the SITC classification goes. Thus it would seem that while inputs did constitute a part of the extensive margin of growth of trade in India, some of the new goods belonged to other categories – such as consumer goods – as well.

This paper extends the Romer (1994) partial model framework to a general equilibrium framework. Also, given that the data indicate that the growth in the extensive margin seems to be well dispersed among different categories of goods, this paper considers the impact of entry of new consumer goods. The aim is to calculate the total cost of trade protection, both from the deadweight loss of the tariff in existing markets and from the disappearance of consumer goods due to tariffs. My model is a symmetric two-country model. I start with free trade and then consider imposing equal tariffs in both countries. Thus terms of trade remain unchanged. In this model the two countries trade in differentiated goods; there is thus monopolistic competition. I assume that the firms that produce these differentiated goods are heterogeneous in the level of the fixed cost they face to enter an export market. Without tariffs there are firms on the margin that are able to just break even when they enter a foreign market. Once the tariff is imposed, these marginal exporters could be eliminated from the foreign market even if the tariff imposed is very small. The heterogeneity of firms based on fixed cost differences plays an important role in determining the cost of protection in terms of loss of welfare from the disappearance of goods due to trade restrictions. This is because it is the fixed cost differences that determines who gets to enter the foreign market and who does not. Thus it divides firms into those that supply only to the domestic market and those that also sell abroad. An important result of my model is that the exporting firms are characterized by higher productivity than those that supply their output exclusively in the domestic market. This is similar to the implication of the models by Melitz (2003) and Helpman, Melitz and Yeaple (2002), although my model generates this characteristic using different assumptions.

I now compare my model and assumptions to those of Melitz (2003) and Helpman, Melitz and Yeaple (2002). In these papers the authors assume that each firm's productivity is drawn from a distribution, and based on this productivity the firm either exits or decides to produce. If it decides to produce, it can either supply only to the domestic market or to both the domestic and the foreign market. These models conclude that only the most productive firms choose to participate in the international market. Thus the assumption of heterogeneous marginal cost drives the results in these models. My model is based on a different assumption and one that is quite plausible in the context of the real world. I make the assumption that different firms have different fixed costs of entry into a foreign market. Since the products that they produce are dissimilar, it is very likely that the investment that would be required in order to set up shop in a foreign market would be different. For instance, the costs of gaining knowledge of the local market or of setting up a supply chain, etc, would be different depending on the logistics of the market for that product. It is thus the heterogeneity in the fixed cost of entry that drives the results in my model. I arrive at the same structure of the industry as the aforementioned papers, where the most productive firms get to participate internationally, though I use a different and arguably more plausible basis of firm heterogeneity. This form of firm heterogeneity is also assumed in Romer (1994).

The final step of the analysis is to calculate the cost of trade protection. In order to present a clear contrast to the results that would be obtained if only the deadweight loss in existing markets was considered, I calculate the cost of trade protection under two different sets of assumptions. First I assume, as is the common practice in such studies, that there is no change in the set of goods available in the economy after trade liberalization. Thus the number of entrants into the foreign market is held constant at the free trade level and the cost of protection arises solely from the deadweight loss of tariffs. The second set of calculations allows the number of entrants, and therefore the set of available goods in the economy, to vary with the level of protection. The welfare costs are consistently higher under the latter scenario. This is true especially at lower levels of tariff. This illustrates the Romer effect outlined before.

Section 2 - The Case of the Indian Trade Liberalization

The hypothesis that tariff reductions can lead to an increase in the extensive margin of trade can be put to test if one can find a case of trade liberalization that occurred using tariff reduction as the sole instrument of liberalization. Usually, however, a whole gamut of trade policy instruments is changed together in the process of liberalization. So, for instance, in the case of the Indian trade liberalization of the 1990s, the liberalization process involved both significant tariff reduction (the highest rate fell from 355 to 40 percent) and substantial breaking down of non-tariff barriers such as a reduction in the proportion of imports subject to licensing. All the same a closer and more detailed look at the data of Indian trade is useful, since it demonstrates at least that most of the growth in trade that resulted from the liberalization process was on the extensive margin. Before this period of reform and liberalization India was an extremely protected economy; during 1985-90, the average annual trade to GDP ratio was only 5% (Panagariya, 1998). The program of economic reform that was initiated in 1991 was of significant proportions, and as part of this program a considerable amount of trade reform took place within a span of a few years. This provides a good study of the impact of trade liberalization on the growth of trade on the extensive and the intensive margin in the context of a developing country. It is also useful in pinning down parameter values for the model developed in this paper.

In order to analyze the trade data to determine the growth in trade at the extensive margin and the intensive margin, I divide the traded goods into categories that reflect these margins. The methodology of creating these categories is borrowed from Kehoe and Ruhl (2002). Goods that were not traded at all or traded in very small quantities are lumped together in the first category. The rest of the goods are arranged into categories based on the value of trade. The growth of trade in these categories is then tracked as the trade liberalization process continues.

This methodology tracks the evolution of trade (imports and exports) in India starting from 1988 and going to up to 1999. Thus the analysis starts approximately three years before the launching of the major economic reforms program in 1991 and continues for eight years afterwards.

I now describe the procedure that I use to analyze the growth in the extensive and intensive margin of trade in India. The goods are defined by their SITC classification (Revision 3). The goods are arranged in ascending order of the magnitude of trade. They are then divided into 10 groups, each constituting approximately 10% of trade in the first year of the sample, i.e., 1988. The groups are constructed such that the first group includes those goods that were not traded at all in 1988, as well as goods with a small amount of trade. I keep adding to this group till the trade share of this category reaches 10% of total trade. The last group, therefore, consists of the most heavily traded goods in the year 1988. Therefore, while the first group had the largest number of SITC categories in it, the successive groups had a smaller and smaller number of SITC categories, and the last group had the fewest number of SITC categories adding up to a 10% share of total trade, since the quantity of trade in each of these SITC categories is very large. This exercise was undertaken in the exact same way for exports and imports separately.

Table IX presents this analysis for imports of India starting in 1988 and going through to 1999. The first group that constituted 10% of imports in 1988 consisted of 2312 SITC categories of goods. This group contained all of the new goods, i.e. the extensive margin of India's import trade, and those goods that were traded in the smallest amounts in 1988. The extensive margin consists of those goods that were imported for the first time after this initial year of the sample. It is interesting to note that it is this group of imports that showed the maximum growth among all of the import groups. Also there is a definite spurt in this growth in the post 1991 trade liberalization period. By the end of the sample period, the share of this group in trade had grown from 10% in 1988 to 35% in 1999. While some of the increase in trade probably occurred in the natural process of economic development of India, the timing and composition of the growth in trade is suggestive. Specifically the timing of the growth coincides quite neatly with the major push in trade liberalization that occurred in the early 1990s, suggesting that liberalization policy measures had an important role in the growth in trade. The composition of the growth is skewed towards goods that were either not traded before (the extensive margin) or goods that were traded very little, supporting Romer's hypothesis that trade restrictions can lead to complete disappearance of certain goods. As is evident in the Indian case, liberalization led to the 'appearance' of completely new goods from the outside world. The share of all the other groups was either stable or declined during the same time period.

Table X presents this analysis for exports of India during the same time period. The first group of goods, including the entire extensive margin of exports, includes 2533 SITC categories of goods. The share of this group grows from 10% in 1988 to 27% in 1999. Again the Romer (1994) hypothesis and the findings of Kehoe and Ruhl (2002) are supported in these results.

It is interesting to look deeper into exactly what the extensive margin of imports consisted of. I analyze the goods that were part of the extensive margin in detail. Table XI lists the total number under each broad division of the Standard International Trade Classification, and also the number of goods in each category that were newly imported into India after 1988 and thus constituted the extensive margin. It appears that new goods are widely distributed among the SITC categories and are not concentrated in any particular group of goods.

Section 3 - The Model

The aim of this model is to evaluate the impact of tariffs on the number of foreign entrants into the domestic economy. Once this impact is established, the next step is to compare the costs of protection in terms of lost utility, in the case where the number of foreign entrants is held constant versus the case where this number is allowed to vary with tariffs.

I assume a very simplified world economy consisting of two symmetric countries. There are $M^i + 1$ sectors of production in each country where i=1,2 for country 1 and country 2. One sector in each country produces a homogeneous product while the rest of the sectors produce differentiated products. The homogenous product is assumed to be identical in both countries. This assumption helps us to get equal wages in both countries with trade.

The utility function of consumers in each country is identical, and is given, for country 1 by,

$$U = H^{1-\alpha}[(\sum_{i=1}^{N^1} x_i^{\beta})^{\frac{1}{\beta}}]^{\alpha} \qquad (1)$$

where x_i is consumption of the differentiated good produced by sector i; H is the consumption of the homogeneous good; $N^1 + 1$ is the total number varieties of goods available in Country 1, and N^1 is the sum of the number of varieties of the differentiated good that are produced domestically and those that are imported from abroad, i.e., $N^1 = M^1 + M_E^2$ where M^1 is the number of domestically produced varieties in Country 1 and M_E^2 is the number of varieties that are exported into country 1 by producers from country 2. As will become evident, not all producers are able to supply to the foreign market.

The utility function of consumers, as given by equation (1), is such that each consumer spends a fraction α of income on differentiated products and a fraction (1-α) on the homogeneous good. Let the homogeneous good be the numeraire. The utility function yields preferences over varieties of product x that have the standard CES form. The elasticity of substitution between the different varieties of product x is given by $\sigma = \frac{1}{1-\beta} > 1$.

The particular form of the utility function assumed in this model implies that people prefer more variety to less. For a given level of spending on differentiated products, and a given price for the available varieties, consumer welfare increases as the number of varieties becomes larger (Helpman and Krugman, 1985).

We solve the consumers' problem next. We maximize the utility function of the consumer subject to the budget constraint. Assume that E is the aggregate spending in the country. Let E include government tariff revenues as well, since we assume that all government revenues are refunded to the public in lump-sum. The Lagrangian function of this maximization problem can be written as,

$$L = H^{1-\alpha}[(\sum_{n=1}^{N} x_n^{\beta})^{\frac{1}{\beta}}]^{\alpha} + \lambda[E - \sum_{n=1}^{N} p_n x_n - p_H H]$$

where λ is the lagrangian multiplier, p_n is the price of the nth variety of x and p_H is the price of the homogeneous good, is assumed to equal 1 since H is the numeraire.

After simplification, the first order condition with respect to x_n yields the following:

$$x_n = (\frac{\lambda}{\alpha U})^{-\sigma} p_n^{-\sigma} \qquad (2)$$

Since a fraction α of income is spent on the differentiated goods,

$$\alpha E = \sum_{n=1}^{N} x_n p_n \qquad (3)$$

Substituting for x_n from the first order condition (2) into the budget constraint (3), we get

$$\left(\frac{\lambda}{\alpha U}\right)^{-\sigma} = \frac{\alpha E}{\sum_{n=1}^{N} p_n^{1-\sigma}} \qquad (4)$$

Substituting from (4) back into (2), we get the following demand function,

$$x_i = \frac{\alpha E p_i^{-\sigma}}{\sum_{q=1}^{N} p_q^{1-\sigma}} = A p_i^{-\sigma} \qquad (5)$$

where

$$A = \frac{\alpha E}{\sum_{q=1}^{N} P_q^{1-\sigma}} \qquad (6)$$

is taken as given by each firm.

From (5), the inverse demand function is,

$$p_i = \left(\frac{x_i \sum_{q=1}^{N} p_q^{1-\sigma}}{\alpha E}\right)^{-\frac{1}{\sigma}} \qquad (7)$$

Country 1 is endowed with L^1 units of labor. The homogeneous product is produced in both countries and wages are equalized. The homogeneous product is produced with one unit of labor per unit of its output. Thus the common wage rate equals one. By symmetry, the total number of differentiated products sold in both countries is equal and so are the number of domestic suppliers and exporters. Thus $N^1 = N^2$, $M^1 = M^2$ and $M_E^1 = M_E^2$.

Each firm bears a fixed cost of entry into the domestic market. This cost is measured in labor units and is denoted by F. The marginal cost of production is θ. As in Romer (1994), we choose the units for measuring quantities of all the differentiated goods so that θ, the marginal cost of one additional unit of each good, is the same for all goods. Given this structure of the cost of production, each firm produces a unique differentiated product. All firms supply in their respective domestic market. If a firm also chooses to enter the foreign market, it bears an additional fixed cost. This fixed cost of entering the foreign market is denoted by $\mu(k)$. Here the index k is defined as k= 1, 2, …, M^1. The goods are arranged so that μ is increasing in k. For simplicity, we assume that this dependence is linear: $\mu(k) = \mu k$. Thus the domestic producers in each of the two countries are arranged in increasing order of their fixed cost of entering the foreign market. Firms are therefore heterogeneous based on the differences in their fixed cost of exporting.

Each firm chooses to export if the ex-post monopoly revenue it can extract is greater than $\mu(k)$. As we have specified before M_E^2 is the total number of varieties of the differentiated product that are exported from country 2 into country 1. Each of these exported varieties is produced by one particular firm in country 2. These firms differ in their fixed cost of exporting to country 1. Assuming that they are arranged in ascending order of this fixed cost, the last good that is able to afford to enter the market of country 1 is good M_E^2. For this marginal good entry costs just equal ex-post monopoly revenue and thus, this firm earns exactly zero profit. For all firms that choose to export, the profits that are made in export market are positive and only the marginal entrant earns exactly zero profit.

Thus the firms in each of the two symmetric countries can be divided into two categories. One category of producers choose to supply both in their domestic market as well as in the foreign market as exporters. This category of producers is able to make profits in their export market by extracting a monopoly revenue that is greater than their fixed cost of entering the export market, $\mu(k)$. The second category consists of those producers that choose to supply their output only in their domestic market. These producers' fixed cost of exporting is so high that they are unable to break even in the export market.

Thus those domestic firms that earn negative profits from entering the foreign market, choose to supply only in the domestic market. The profit maximizing problem of each of the domestic suppliers is of the following form,

$$\max_{x^D} \; p^D(x^D)x^D - \theta x^D \qquad (8)$$

where p^D is the price and x^D is the quantity of a variety that's produced and sold domestically. Recall that we have assumed preferences of the form that yield constant elasticity of demand and a cost structure that consists of constant marginal cost of production. These two assumptions together ensure that all varieties that are produced and sold domestically have the same price. Solving the above maximization, the price of all domestically produced varieties is, $p^D = \frac{\theta}{\beta}$. As a result of free entry of firms, all domestic firms that supply only in the domestic market earn exactly zero profits.

Those firms in each country that earn non-negative profits in the export market supply both in the domestic as well as the foreign market. In order to study the maximization problem that these firms solve let us first suppose that the government in both countries imposes an ad-valorem tax or tariff, τ on all purchases of goods imported from abroad.

Firms that operate both in their domestic market and in the foreign market face a profit maximization problem of the form,

$$\max_x p^D(x^D)x^D - \theta x^D + p^F(x^F)x^F(1-\tau) - \theta x^F \tag{9}$$

The solution of this problem gives us the price at which all imported goods will be sold. The price of imported goods is $p^F = \frac{\theta}{\beta(1-\tau)}$. The constant proportional mark up in this case is $\frac{1}{\beta(1-\tau)}$. Imported goods therefore are more expensive than domestically produced goods because of the tariffs.

As mentioned above, the operating profit from serving the domestic market is driven to zero for all firms that produce and supply in the domestic economy. Thus,

$$x^D p^D(x^D) - \theta x^D = F \qquad (10)$$

We substitute in equation (10) the expression for p^D that we obtained earlier from the profit maximization problem of domestic producers. Solving the above for x^D we get,

$$x^D = \frac{F\beta}{\theta(1-\beta)} \qquad (11)$$

Next we solve for x^F, the equilibrium quantity imported of each variety. We do this by equating the marginal rate of substitution between foreign and domestic goods to the ratio of their prices:

$$\frac{(x^D)^{\beta-1}}{(x^F)^{\beta-1}} = \frac{p^D}{p^F} \qquad (12)$$

We substitute the expression for p^D and p^F that we obtained earlier from the solution of the profit maximization problem of the suppliers of the differentiated goods. Also we substitute the expression for x^D that we obtained in (11) above. Solving (12) for x^F yields

$$x^F = \frac{F\beta(1-\tau)^{\frac{1}{1-\beta}}}{\theta(1-\beta)} \qquad (13)$$

As mentioned before all exporters will earn non-negative profits in the export market. While constant elasticity of substitution in preferences and constant marginal cost of production imply that the price charged for each variety of exports is exactly the same, the fixed cost of entering the export market is different for each firm. As a result all exporters that choose to enter the foreign market except for the marginal exporter who earns exactly zero profits.

The marginal exporter from country 2 supplies the good denoted by M_E^2, and we can write its zero profit condition as

$$\mu M_E^2 = (1-\tau)p(x^F)x^F - \theta x^F \qquad (14)$$

where the left hand side denotes the fixed cost of entering the foreign market for the exporter of good M_E^2. Substituting the expressions for the price of imports and their equilibrium quantity from (13) above, we can solve for the total number of country 2 exporters that choose to supply their goods to country 1:

$$M_E^2 = \frac{F(1-\tau)^{\frac{1}{1-\beta}}}{\mu} \qquad (15)$$

The number of firms in each country that choose to supply to the foreign market is a function of F, the fixed cost of domestic production; τ, the advalorem tariff rate; μ, which affects the fixed cost of entering the foreign market; and β. Equation (15) allows us to study the impact of imposing tariffs on the number of foreign entrants into a market. Since $\frac{1}{1-\beta} > 1$ the number of entrants is greater when $\tau = 0$ compared to when $\tau > 0$. Thus even a tiny tariff has the impact of making some goods disappear from the domestic market, as it reduces the number of foreign firms that are able to enter the domestic market profitably.

The usual assumption in calculating the loss from government intervention in the form of taxes and tariffs is that the number of varieties of goods remains unaffected by such policy. The deadweight loss of tariffs in existing markets is thus considered the only loss. However, it is quite plausible that in the context of the international economy, imposition of tariffs may lead to some producers being thrown out of foreign markets. In the context of the current model, if tariffs are raised, the number of foreign producers that can profitably export is reduced. This, according to Romer (1994), can have an especially adverse impact in developing countries, where imports are often a source of technological advancement. So if some goods are not allowed to enter a developing country, it is possible that those markets will not exist at all in that country, especially if it does not have the technological know-how to produce such goods. It is therefore important to account for loss that arises not only from the deadweight loss of tariffs in the conventional sense of shrinkage of existing markets, but also losses due to nonexistence of markets would otherwise exist.

As in Romer (1994), I compare the welfare loss from the tariff under two situations. In the first case the number of foreign entrants into the domestic market is held constant. Under this scenario, the tariff is imposed after the fixed cost of entry has been incurred by the foreign producers, so in this case the number of entrants is not impacted by the tariff since entry costs are sunk. This mimics the usual economic analysis of the cost of trade restrictions, where only the deadweight loss due to shrinkage of market size is taken into account.

In the second case, the number of foreign entrants is allowed to depend on the tariffs. Under this scenario the tariff is imposed before the entry cost is incurred by the foreign firms. Therefore in this case since the fixed entry costs are not yet incurred, the tariffs impact the entry decision of firms. Therefore, the number of entrants is reduced as a result of the tariff. In this case the cost of protection is higher, since it includs not only the conventional deadweight loss, but also the loss of welfare due to the disappearance of some imported goods.

We measure the cost in terms of loss of consumer welfare (utility). We use the utility function and calculate the percentage change in utility when tariffs are imposed. Essentially we compare the situation where tariffs are nonexistent ($\tau = 0$) to a situation where there are positive tariffs ($\tau > 0$). The loss of utility will be exactly the same in both countries, given their symmetry.

Consider first the case where the number of foreign entrants is held constant irrespective of the tariffs. The percentage loss of utility due to the presence of tariff in each country will be -

$$1 - \left.\frac{U(\tau)}{U(0)}\right|_{M_E = M_E(0)} = C_1 \qquad (16)$$

In the case where the tariffs are fully anticipated and therefore the number of foreign firms that enter a country is allowed to vary with the tariff, the percentage loss of utility in each country is,

$$1-\frac{U(\tau)}{U(0)}=C_2\,. \qquad (17)$$

Section 4 - The Welfare Consequences of Tariffs in this Setup

To calculate the consequences for the welfare of a representative consumer in the domestic economy we compare utility levels achieved on the one hand with free trade and on the other with a tariff. This comparison is made under two scenarios, one where the number of foreign participants in the domestic economy remains the same after a tariff is imposed and the other where the number of foreign participants that enter the domestic economy is allowed to fall to a lower level as compared to the free trade scenario.

The costs are in percentage terms, i.e., I calculate the percentage change in the level of utility of the representative consumer after the tariff is imposed compared to the level of utility achieved without the tariff.

Assuming a tariff τ , equation (15) gives the number of foreign entrants in the domestic economy when the tariff is positive as

$$M_E^2(\tau)=\frac{F(1-\tau)^{\frac{1}{1-\beta}}}{\mu}$$

Now in order to calculate the number of foreign entrants under free trade we set the tariff equal to zero, i.e. $\tau = 0$, in equation (15) and get the number of foreign entrants in the domestic economy as,

$$M_E^2(0) = \frac{F}{\mu}$$

Recall that equation (11) yields the expression for the equilibrium output sold by each domestic firm in the domestic market,

$$x^D = \frac{F\beta}{\theta(1-\beta)}$$

Equation (13) gives the equilibrium output sold by each foreign producer in the domestic market,

$$x^F(\tau) = \frac{F\beta(1-\tau)^{\frac{1}{1-\beta}}}{\theta(1-\beta)}$$

Again under free trade we set $\tau = 0$ in equation (13) and obtain the equilibrium output sold by each foreign producer in the domestic market as,

$$x^F(0) = \frac{F\beta}{\theta(1-\beta)}$$

All costs of production are expressed in terms of labor units. The total labor force in each country accounts for the total cost of production incurred by domestic producers in producing output that is sold in the domestic market as well as output that is exported.

Hence we can write the following equality for country 1, keeping in mind that a symmetric equality will apply in country 2 :

$$L^1 = M^1 * (F + \theta x^D) + \sum_{k=1}^{M_E^1} \mu k + M_E^1 \theta x^F + H \qquad (18)$$

In the above equation, the total labor force is equated to the total cost of production in the economy. Thus, the total labor force of country 1 is equated to the total cost of domestic production for the domestic market, $M^1 * (F + \theta x_i)$, plus the total fixed cost of exporting for those firms that choose to export, $\sum_{k=1}^{M_E^1} \mu k$, plus the variable cost of production for export, $M_E^1 \theta x^F$, plus the total production cost of the numeraire homogenous good H.

We can use equation (18) to solve for the total number of producers from each country, i.e., M^i where i=1, 2 for country 1 and country 2 respectively. This solution for country 1 is,

$$M^1 = \frac{L^1 - \sum_{k=1}^{M_E^1(\tau)} \mu k - M_E^1 \theta x^F - H}{F + \theta x^D} \qquad (19)$$

where M^1 is the total number of producers from country 1.

With free trade $\tau = 0$ in both countries, and the number of total firms in country 1 is,

$$M^1(0) = \frac{L - \sum_{k=1}^{M_2^E(0)} \mu k - M_E^1(0)\theta x^F(0) - H}{F + \theta x^D} \qquad (20)$$

In the absence of free trade when tariff is non-zero, i.e., $\tau > 0$ in both countries, there arise 2 separate cases. In one case the tariffs are not allowed to impact the number of firms that choose to export, the total number of domestic firms in country 1 (and symmetrically country 2) works out to be,

$$M^1(\tau)\Big|_{M_E^1 = M_E^1(0)} = \frac{L - \sum_{k=1}^{M_E^1(0)} \mu k - M_E^1(0)\theta x^F(\tau) - H}{F + \theta x^D} \qquad (21)$$

Here the number of domestic firms is calculated assuming that the number of firms that choose to export is not impacted by the tariffs. However, note that the optimal output of the traded products x^F changes, since that depends on the level of tariffs τ.

In the second case, when tariffs are non-zero, $\tau > 0$ in both countries and these tariffs are allowed to impact the number of firms that choose to export, the total number of domestic firms, in country 1 (and symmetrically country 2) is,

$$M^1(\tau) = \frac{L - \sum_{i=1}^{M_E^1(\tau)} \mu k - M_E^1(\tau)\theta x^F(\tau) - H}{F + \theta x^D} \qquad (22)$$

Here both the number of firms that choose to export and the optimal output of each export are impacted by the tariff.

Now from (1), the utility function of the consumers is,

$$U = H^{1-\alpha}[(\sum_{i=1}^{N} x_i^{\beta})^{\frac{1}{\beta}}]^{\alpha}$$

Note that N is the total number of varieties available to the consumers in each country. Thus N is the sum of the total number of firms and therefore varieties that are produced in the domestic economy plus the number of varieties that are imported from abroad. Therefore, for instance, in the case of country 1, $N^1 = M^1 + M_E^1$. Recall also that due to symmetry, $N^1 = N^2$ and $M^1 = M^2$ and $M_E^1 = M_E^2$.

Now we are ready to write down the expression for utility under different trade policy regimes and different assumptions regarding the impact of imposing tariffs. There are 3 broad cases. First is the case where there exists free trade, i.e., $\tau = 0$, in both countries. Utility in this case is,

$$U(0) = H^{1-\alpha}[\{M^1(0)(x^D)^{\beta} + M_E^2(0)(x^F(0))^{\beta}\}^{\frac{1}{\beta}}]^{\alpha} \qquad (23)$$

Second is the case where $\tau > 0$ in both countries, and the number of entrants is held constant at the level under free trade,

$$U(\tau)\Big|_{M_E^2=M_E^2(0)} = H^{1-\alpha}[\{M^1(\tau)\Big|_{M_E^1=M_E^1(0)}(x^D)^{\beta} + M_E^2(0)(x^F(\tau))^{\beta}\}^{\frac{1}{\beta}}]^{\alpha} \qquad (24)$$

Third is the case where $\tau > 0$ in both countries, and the number of entrants is allowed to vary with the tariff,

$$U(\tau) = H^{1-\alpha}[\{M^1(\tau)(x^D)^\beta + M_E^2(\tau)(x^F(\tau))^\beta\}^{\frac{1}{\beta}}]^\alpha \qquad (25)$$

Thus, for each country the welfare cost of imposing tariffs, assuming tariffs do not impact the number of entrants is,

$$C_1 = 1 - \left.\frac{U(\tau)}{U(0)}\right|_{M_E = M_E(0)}$$

Substituting the expressions for utility obtained in equation (23) and (24) in the case of country 1 (and thus symmetrically country 2),

$$C_1 = 1 - \frac{H^{1-\alpha}[\{M^1(\tau)\big|_{M_E^1 = M_E^1(0)}(x^D)^\beta + M_E^2(0)(x^F(\tau))^\beta\}^{\frac{1}{\beta}}]^\alpha}{H^{1-\alpha}[\{M^1(0)(x^D)^\beta + M_E^2(0)(x^F(0))^\beta\}^{\frac{1}{\beta}}]^\alpha}$$

Finally, the welfare cost of imposing tariffs assuming that the tariffs do influence the number of entrants is,

$$C_2 = 1 - \frac{U(\tau)}{U(0)}$$

Substituting the expressions for utility obtained in equation (23) and equation (25), in the case of country 1 (and thus symmetrically country 2)

$$C_2 = 1 - \frac{H^{1-\alpha}[\{M^1(\tau)(x^D)^\beta + M_E^2(\tau)(x^F(\tau))^\beta\}^{\frac{1}{\beta}}]^\alpha}{H^{1-\alpha}[\{M^1(0)(x^D)^\beta + M_E^2(0)(x^F(0))^\beta\}^{\frac{1}{\beta}}]^\alpha}$$

Let us first calculate the percentage change in the level of utility in the case where the number of foreign firms that choose to enter the domestic market remain the same even after the tariff is imposed. The expression for it is given by equation for the cost denoted by C_1 above.

A comparison of C_1 and C_2 will reveal the relative magnitude of the costs under the assumption of fixed and flexible number of entrants into the domestic market.

Table XII shows the welfare loss, i.e. the cost of protection under the two cases for different values of the parameters. In row 'A' the base case is presented. Here the ratio of imports to GDP is about 10% with no tarrifs and 5% with the tariffs. This is close to the ratios in India after and before the trade liberalization respectively. The tariffs are set at 20%, which is approximately the average rate of protection on consumer goods in India. In this case, $C_2 > C_1$.

Rows B and C show the impact of changing the fixed cost F of setting up production in the home country. This is the cost that all firms bear in order to produce and sell in the domestic market. As this fixed cost rises (falls), the number of firms in each economy falls (rises) and the optimal output supplied by each firm rises (falls). This is because a larger output is required in order to break even in the domestic market. Since the number of foreign entrants and their optimal output are both directly proportional to the domestic fixed cost both increase with the increase in F. Here again $C_2 > C_1$.

In rows D and E, we examine the impact of changing μ. This parameter affects the fixed cost of exporting to a foreign market. An increase (decrease) in μ leads to fewer firms being able to enter the foreign market as the fixed cost of entry becomes too high. Therefore here the number of foreign participants in each market decreases (increases) and the total number of domestic firms that participate in each market increases (decreases). Yet again we find that, $C_2 > C_1$.

Section 5 - Conclusion

In the traditional analysis of the welfare cost that results from putting barriers to trade, the deadweight loss that results from the shrinkage in market size due to tariffs is usually the only component included in the calculation. While this analysis is entirely valid for markets that continue to exist even after the tariff is imposed, it overlooks those markets that may cease to exist due to the trade restrictions. In fact, if trade restrictions lead to certain goods not being imported at all, then the cost resulting from trade restrictions could potentially be much larger than if one only considers the deadweight loss of the tariff in existing markets. Romer (1994) argues that the costs of lost markets might be quite significant especially for developing countries. In these countries, imports might be desirable both for their own sake and also as an important source of technological progress. His analysis concentrates on the number of varieties of intermediate goods that were available in an economy, before and after trade restrictions were imposed. He finds that the estimates of cost of protection were a lot larger when he accounted for downward adjustment in the number of foreign entrants into the market.

In this paper I begin with the basic intuition of the Romer model, i.e. the possibility of higher costs of protection resulting from disappearance of goods. I analyze trade data from the Indian trade liberalization episode of the early 1990s. A significant fraction of the 'new' goods that entered the Indian market after the liberalization was comprised of consumer goods. I extend the Romer partial equilibrium model that accounted for the intermediate goods market to a general equilibrium model that is concerned with the market for consumer goods. I analyze the impact of trade liberalization on the utility of the representative consumer under two scenarios. The first scenario replicates the usual analysis that holds the number of foreign participants in the domestic economy constant. The second scenario allows for an adjustment of this number. In my model firms are heterogeneous based on the fixed cost that they pay to export to a foreign market. When I allow the number of foreign participants to change in response to trade restrictions, the marginal foreign firms that were barely making non-negative profits in the domestic market are forced to exit. I find that in almost all cases the cost of protection calculations that allow for adjustment in the number of foreign participants produce higher estimates of this cost than calculations that assume that the number of foreign entrants is constant.

The implications of the model also echo the real life example of India's 'natural experiment' of considerable trade liberalization in a developing country in a relatively short span of time. New goods were an important source of the resulting growth in trade. This trend of a significant change in the number of foreign participants in the domestic economy appears to be an important one and the analysis in this paper supports the view that it deserves to be explicitly accounted for.

Table IX : Evolution of Imports

The tables below present the evolution of the share of imports in total imports, by groups that constitute approximately 10% share each in 1988.

The groups are constructed such that the first category contains the least traded SITC classifications and the last category contains the most traded ones.

Share of total imports (% of total imports)*:

# of SITC categories included	88	89	90	91	92	93	94	95	96	97	98	99
2312	10	13	15	15	17	20	28	26	28	32	38	35
211	10	10	11	9	9	11	11	11	11	11	9	10
97	10	10	11	10	11	13	13	14	12	11	10	8
49	10	9	9	8	8	7	7	7	6	5	5	4
29	10	8	9	9	8	8	9	9	8	7	6	6
19	10	9	9	8	7	6	5	5	4	5	3	2
13	10	8	7	6	5	5	7	8	8	7	8	8
8	10	12	11	10	9	6	6	6	5	5	3	6
3	20	21	18	25	26	24	14	14	18	17	18	21

*SITC (Revision 3) categories 66721 and 66722 have been clubbed together into one category for the above analysis, since there appears to have been a reclassification away from category 66721 towards category 66722 without any connection to real trade changes.

Table X : Evolution of Exports

The table below presents the evolution of the share of exports in total exports, by groups that constitute approximately 10% share each in the first year of my sample, 1988.

The groups are constructed such that the first category contains the least traded SITC classifications and the last category contains the most traded ones.

Share of total exports (% of total exports):

# of SITC categories included	88	89	90	91	92	93	94	95	96	97	98	99
2533	10	13	14	18	20	22	23	24	26	27	25	27
132	10	10	11	10	10	11	11	12	12	12	12	11
52	10	11	10	11	11	8	9	7	8	8	7	8
23	10	10	11	10	8	7	7	7	7	7	7	7
11	10	10	10	11	10	11	11	11	12	12	11	10
7	10	11	11	10	11	10	9	8	9	8	8	7
5	11	9	10	11	10	10	11	12	10	10	11	8
1	3	3	3	2	2	1	1	1	1	1	1	1
1	26	23	20	17	18	20	18	18	15	15	18	21

Table XI : The New Goods

The table below presents the Standard International Trade Classification (SITC Revision-3) categories of the 'new goods' that started being imported by India after its trade liberalization.

SITC : Revision 3 Description of section	Division Code	Total number of categories in the division.	Number of new imports that fall into this division.
0. Food and Live Animals			
Live animals other than animals of division 03	00	11	6
Meat and meat preparations	01	38	12
Dairy products and birds' eggs	02	22	6
Fish (not marine mammals), crustaceans, mollusks and aquatic invertebrates and preparations thereof	03	47	21
Cereals and cereal preparations	04	34	7
Vegetables and fruit.	05	96	49
Sugars, sugar preparations and honey	06	17	5
Coffee, tea, cocoa, spices and manufactures thereof	07	35	13
Feeding stuff for animals (not included unmilled cereals)	08	26	13
Miscellaneous edible products and preparations	09	18	5
1. Beverages and Tobacco			
Beverages	11	14	2
Tobacco and tobacco manufactures	12	8	1
2. Crude Materials, Inedible, Except Fuels			
Hides, skins, and furskins, raw	21	18	2
Oil seeds and oleaginous fruits	22	15	2
Crude rubber (including synthetic and reclaimed)	23	16	0
Cork and wood	24	18	3
Pulp and waste paper	25	14	0
Textile fibres (other than wool tops and other combed wool) and their wastes (not manufactured into yarn or fabric)	26	57	7

SITC : Revision 3 Description of section	Division Code	Total number of categories in the division.	Number of new imports that fall into this division.
Crude fertilizers, other than those of division 56, and crude minerals (excluding coal, petroleum and precious stones)	27	48	3
Metalliferous ores and metal scrap	28	44	3
Crude animal and vegetable materials, n.e.s.	29	37	8
3. Mineral Fuels, Lubricants and Related Materials			
Coal, coke and briquettes	32	7	0
Petroleum, petroleum products and related materials	33	21	3
Gas, natural and manufactured	34	8	0
Electric current	35	1	0
4. Animal and Vegetable Oils, Fats and Waxes			
Animal oils and fats	41	10	4
Fixed vegetables fats and oils, crude, refined or fractionated	42	27	5
Animal or vegetable fats and oils, processed; waxes of animal or vegetable fats and oils, n.e.s.	43	7	0
5. Chemicals and Related Products			
Organic chemicals	51	125	1
Inorganic chemicals	52	84	1
Dyeing, tanning and coloring materials	53	33	0
Medical and pharmaceutical products	54	45	1
Essential oils and resinoids and perfume materials; toilet, polishing and cleaning preparations	55	26	2
Fertilizers (other than those of group 272)	56	21	5
Plastics in primary forms	57	54	0
Plastics in non-primary forms	58	23	0
Chemical materials and products, n.e.s.	59	63	5
6. Manufactured Goods classified chiefly by materials			
Leather, leather manufactures, n.e.s and dressed furskins	61	22	1
Rubber manufactures, n.e.s.	62	31	2
Cork and wood manufactures (excluding furniture)	63	31	5

SITC : Revision 3 Description of section	Division Code	Total number of categories in the division.	Number of new imports that fall into this division.
Paper, paperboard and articles of paper pulp, of paper or of paperboard	64	72	2
Textile yarn, fabrics, made-up articles, n.e.s., and related products	65	222	33
Non-metallic mineral manufactures, n.e.s.	66	95	11
Iron and steel	67	166	0
Non-ferrous metals	68	71	1
Manufactures of metals, n.e.s.	69	119	5
7. Machinery and Transport Equipment			
Power generating machinery and equipment	71	44	2
Machinery specialized for particular industries	72	116	4
Metal working machinery	73	70	0
General industrial machinery and equipment, n.e.s. and machine parts, n.e.s.	74	151	1
Office machines and automatic data processing machines	75	30	1
Telecommunications and sound recording and reproducing apparatus and equipment	76	36	1

SITC : Revision 3 Description of section	Division Code	Total number of categories in the division.	Number of new imports that fall into this division.
Electrical machinery, apparatus and appliances, n.e.s. and electrical parts thereof (including non-electrical counterparts n.e.s.	77	126	3
Road vehicles (including air-cushion vehicles)	78	41	8
Other transport equipment	79	39	4
8. Miscellaneous Manufactured Articles			
Prefabricated buildings; sanitary plumbing, heating and lighting fixtures and fittings, n.e.s.	81	17	0
Furniture and parts thereof; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings	82	23	13
Travel goods, handbags and similar containers	83	9	8
Articles of apparel and clothing accessories	84	96	70
Footwear	85	19	4
Professional, scientific and controlling instruments and apparatus, n.e.s.	87	66	0

SITC : Revision 3 Description of section	Division Code	Total number of categories in the division.	Number of new imports that fall into this division.
Photographic apparatus, equipment and supplies and optical goods, n.e.s.; watches and clocks	88	60	11
Miscellaneous manufactured articles, n.e.s.	89	152	34
9. Commodities and Transactions not classified elsewhere in SITC			
Postal packages not classified according to kind	91	1	0
Special transactions and commodities not classified according to kind	93	1	0
Coin (other than gold coin) not being legal tender	96	1	0
Gold, non-monetary (excluding gold, ores and concentrates)	97	3	2

Table XII : Comparison of Costs.

Row	**Parameters***	**Costs****
A.	F=1000, α=0.5, μ=0.05, L=1 billion, θ=0.01, τ=0.2, β=0.5	C_1 = 0.0016 C_2 = 0.0035
B.	F=100, α=0.5, μ=0.05, L=1 billion, θ=0.01, τ=0.2, β=0.5	C_1 = 0.000016 C_2 = 0.000036
C.	F=2000, α=0.5, μ=0.05, L=1 billion, θ=0.01, τ=0.2, β=0.5	C_1 = 0.006 C_2 = 0.013
D.	F=1000, α=0.5, μ=0.005, L=1 billion, θ=0.01, τ=0.2, β=0.5	C_1 = 0.013 C_2 = 0.030
E.	F=1000, α=0.5, μ=5, L=1 billion, θ=0.01, τ=0.2, β=0.5	C_1 = 0.000016 C_2 = 0.000036

*

F - fixed cost of setting up production in the domestic market

α - the share of income spent on differentiated goods.

μ - μk is the fixed cost of exporting to the foreign market, k=1,2,…N

L - size of the labor force

θ - marginal Cost of producing one unit of the differentiated good

τ - advalorem rate of tariff

β - the elasticity of substitution among the differentiated products is $\sigma = \frac{1}{1-\beta}$

**

C_1 - cost of protection when number of exporters is held constant.

C_2 - cost of protection when number of exporters is allowed to change.

Appendices

<u>*Chapter 1: Ready for Capital Account Convertibility?*</u>

Appendix A - Instruments for $W_t V_t$ and $W_t G_t$

The single equation example, outlined below helps to illustrate why $W_t V_t$ and $W_t G_t$ are endogenous and what the appropriate instruments for them are.

Start with the following model,

$$Y = X\beta + \lambda WY + \varepsilon$$
$$|\lambda| < 1$$

assume that the roots of λW are all less than 1 in absolute value. WY measures the spatial lag term that measures the spillover effect. W is the weighting matrix. In my model, the sum of the rows of the weighting matrix are less than or equal to 1 since the weights are trade shares of major trading partners of an economy.

Now,

$$Y = X\beta + \lambda WY + \varepsilon$$
$$\Rightarrow Y = [I - \lambda WY)^{-1}[X\beta + \varepsilon]$$

WY is endogenous because

$$E[(WY)\varepsilon'] = W(I - \lambda W)^{-1}\Omega_{\varepsilon} \neq 0$$

Now for the instruments

$$E(WY) = W(I - \lambda W)^{-1} X\beta$$
$$\Rightarrow E(WY) = W(I + \lambda W + \lambda^2 W^2 + ...)X\beta$$
$$\Rightarrow E(WY) = WX\beta + W^2 X(\lambda\beta) + W^3 X(\lambda^2\beta) + ...$$

Therefore the potential instruments for WY are $X, WX, W^2X, W^3X,..., W^mX$. I take m=1 in my estimation. Thus, the set of instruments that I can potentially use for the endogenous variables in the system are the vectors, X and WX.

Appendix B - Emanating and Impacting Spillover Effects

Consider the model

$$Y = X\beta + \lambda WY + \varepsilon$$

where WY measures the spatial lag term that measures the spillover effect. W is the weighting matrix.

Now,

$$Y = (I - \lambda W)^{-1}[X\beta + \varepsilon]$$
$$\Rightarrow EY = (I - \lambda W)^{-1} X\beta$$

Let g_{ij} be the i,j-th element of $(I - \lambda W)^{-1}$. Then,

$$\frac{\partial E(Y_{it})}{\partial X_{jt}} = g_{ij}\beta$$
$$and$$
$$\frac{\partial E(Y_{it})}{\partial X_{it}} = g_{ii}\beta$$

Following Kelejian et al., 2003, there are two interesting impacts that can be measured with respect to the spillover effect :

1. The impact that feeds back into country i due to the fact that its influence on other countries, through the spillover term, in turn influences it. Thus g_{ii} will typically be greater than 1 for any country i. The measure of this feedback effect (emanating effect, EM) for country i is in percentage terms and is calculated as,

$$EM_i = 100(g_{ii} - 1)$$

This measure gives an estimate of the impact of a unit change in X_i (any of the exogenous explanatory variables in country i) on the expected value of Y_i relative to the impact that would've existed in the absence of spillovers.

2. The average spillover impact of a country's neighbours is called the impacting effect (IM). For country i it is measured in percentage terms as,

$$IM_i = 100 \frac{\Sigma_{j=1}^{N} g_{ij}}{N}$$

where the N is the number of neighbours whose average impact is being measured. This measure gives an estimate of the impact of a unit change in X_j (any of the exogenous explanatory variables in country j) on the expected value of Y_i relative to the impact that would've existed in the absence of spillovers.

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