

FINANCIAL LIBERALIZATION AND CONSUMPTION SMOOTHING: BRIDGING THEORY AND EMPIRICS

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ABSTRACT

Does financial liberalization increase consumption risk sharing? Yes. This thesis develops a well-defined empirical framework and provides empirical evidence that more financial liberalization improves consumption smoothing, although the relationship is nonlinear and the extent of consumption risk sharing depends on the actual level of impediments to trade in foreign capital. On the other hand, increased cross-country productivity correlations provide fewer incentives for risk sharing and may deteriorate consumption smoothing.

The benefits of sharing risks can go beyond having a smooth consumption. This thesis builds a model of global portfolio diversification which links financial liberalization and industrial specialization. This is an important contribution since standard models of international macro lack mechanisms linking financial openness and industrial specialization. As financial liberalization creates more risk sharing opportunities, agents in an economy are able to shift risks. This insurance permits them to engage in risky activities that they would not otherwise undertake, and will benefit from higher growth opportunities. In return, output volatility will increase and cross-country output correlations will decline. The model also shows that consumption smoothing and portfolio home bias can be affected by both cross-country and cross-sector productivity shock correlations.

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INTRODUCTION

There exists a disconnect between theory and empirics on the question of whether financial liberalization has improved consumption smoothing. This thesis investigates this puzzling situation and offers plausible answers about the relationship between financial liberalization and consumption smoothing. Furthermore, it develops a model of global portfolio diversification that links financial liberalization and production specialization.

The past two decades have witnessed a surge in cross-border capital flows and a sharp decline in capital account restrictions in industrial countries as well as emerging markets and other developing economies. Standard open macroeconomic models predict that this would unambiguously lead to better international consumption risk sharing (Lewis (1996), Obstfeld and Rogoff (1996)). The intuition would be that as countries open their international financial markets, they would be able to *off-load* some of their income risks to the rest of the world. As a result of financial openness one should be able to see domestic consumption *de-linked* from country-specific disturbances. In return, domestic consumption will vary with the common component of international income growth. However, the empirical literature studying the effects of financial liberalization on consumption risk sharing is at best inconclusive, failing to show unambiguously improvements in consumption smoothing, especially for the emerging markets and other developing countries. The first chapter of this study provides some preliminary evidence that the actual degree of financial impediments and cross-country productivity correlations can explain why other studies fail to find improvements in consumption smoothing as countries have become more financially liberalized. Empirical analysis in the second chapter shows that, financial liberalization has indeed improved consumption risk sharing.

The empirical literature on the effects of financial liberalization on international

consumption smoothing has been elusive of theory, without having an explicit equilibrium framework in mind. Its predictions come from a complete markets model, which conjectures that the ability to insure against different states of nature should be reflected in: a) a low correlation between own consumption and own output (own refers to household for micro studies and countries for international studies), b) a high correlation between own consumption and aggregate/rest of the world income or consumption (aggregate refers to total domestic for micro studies within a country, and it is either foreign or global for international studies), and c) a low volatility of consumption. Some studies have been looking at these correlations trying to interpret it as a test of highly integrated markets. Failing to find the predicted patterns in the data, further studies have been more pragmatic and chosen to interpret the magnitudes of these measures as deviations from complete markets outcome, investigating the same measures for different market openness realizations across countries and across time. But, even when market incompleteness has been considered, like for example, controlling for financial impediments, in most cases the analysis has been ad-hoc, probably not testing the implications of an incomplete markets framework.

A careful review of the empirical literature suggest certain features a model investigating the effects of financial liberalization on consumption smoothing should include. First, studies that have carefully distinguished between relatively open and relatively closed periods, or relatively open and relatively closed countries have been more successful in finding evidence of consumption smoothing. This would suggest that the actual level of financial impediments matters for consumption smoothing, and it might be necessary to depart from the complete market framework. Second, the literature suggests that increased productivity shock correlations with the rest of the world might deteriorate measures of consumption smoothing. The intuition

would be that as productivity processes between countries become more similar, there are fewer incentives to diversify risks by investing in a foreign country. Finally, some studies suggest nonlinearities in the relation between financial liberalization and consumption smoothing. The nature of these nonlinearities can be better captured in a well-defined framework that allows for a closed form solution. A general equilibrium framework would capture these nonlinearities and avoid potential problems associated with other *ad-hoc* studies.

Using a simple general equilibrium framework, this study develops a well-defined framework and can test more directly the effects of financial impediments on measures of international consumption smoothing. In this way, it is emphasizing a direct link between theory and empirics. The study will theoretically and empirically show that more financial liberalization leads to more consumption smoothing, but the relationship between the two is nonlinear. The reason why the previous literature failed to find this result is the lack of a well-defined framework that does not allow them to control for the actual level of financial impediments and cross-country productivity similarities.

Financial liberalization can also enhance industrial specialization. The literature on this issue is a little scarce, but an increasing empirical literature suggests an association between financial integration and industrial specialization (Kalemli-Ozcan, Sorensen and Yosha (2003) and Kalemli-Ozcan, Papaioannou and Peydro (2009)). Obstfeld (1994) and Hnatkovska and Evans (2007) show theoretically that as a result of financial liberalization, countries can expand investment in risky sectors, in or out of the country, increasing welfare and output volatility. In general, standard models on international asset trade lack mechanisms linking an economy's financial openness and production specialization. The contribution of the third chapter of this thesis is a simple model of global diversification in which a link between financial liberalization

and specialization emerges very naturally. Within that model, an economy that liberalizes its financial markets is able to share consumption risks, which in turn would allow the country to take extra risks by specializing in its most efficient sector. In return, output volatility will increase and cross-country consumption correlations will decline. One of the nice features of the model is its tractability for every level of financial impediments to trade in foreign capital.

The model has two-sectors with linear technology and stochastic productivity shocks. Production uncertainty in the model ensures incomplete specialization. Under financial autarky, firms will produce in both sectors to ensure against bad productivity shocks. As the country liberalizes, and part of the country's consumption risks are ensured, a higher share of capital is devoted to the sector with the highest productivity. In this model, the economies do not have to reach full specialization, even for fully integrated financial markets. The reason why there is no full specialization is because the role of financial markets is to *share* the risks efficiently, not *eliminate* them.

This model has direct implications on consumption risk sharing. While more liberalization means better consumption smoothing, measures of consumption risk sharing can be affected both by cross-country and cross-sector productivity correlations. As in the second chapter, higher cross-country productivity correlations are associated with lower degrees of consumption risk sharing. On the other hand, as cross-sector productivity correlations increase countries trade more financial assets with the rest of the World and this leads to better consumption smoothing. These two factors work in opposite directions and their effect differs across measure of consumption risk sharing. For example, an increase in both cross-country and cross-sector productivity correlations improves consumption smoothing if measured as the cross-country consumption correlation, but deteriorates it if it is measured as the correlation between

domestic consumption and domestic output. So far, the literature has not distinguished between different measures of consumption smoothing and further research is needed on what each measure represents and what justifies these different responses.

Chapter 1 tries to answer the question of why previous studies have failed to find improvements in consumption smoothing as countries have become more financially liberalized. The second chapter develops an empirical framework and finds that financial liberalization has indeed improved consumption risk sharing as economies have become more financially open. The third chapter develops a model that shows that as countries liberalize and are better able to share consumption risks, they expand production their most efficient sector. This shows a direct link between liberalization and industrial specialization, which is missing in the theoretical literature.

Chapter 1

Why Don't We Observe Improvements in Consumption Smoothing as Countries Get More Financially Integrated

1.1 Introduction

Over the past two decades, official restrictions on cross-border capital flows have decreased while actual capital inflows and outflows among countries have increased substantially. Very influential theoretical studies predict that as countries become more financially liberalized they should be better able to offload some of their income risk onto world markets, smoothing consumption¹. A number of recent papers have empirically examined the relationship between financial liberalization and consumption smoothing²,

¹Lewis (1996)

²Kose et al., 2006

but have not been able to establish causality between the two.

However, there are two problems with the existent work in this literature. First, most studies are ad-hoc. Second, measuring the actual degree of financial openness is a challenging enterprise (Prasad et al (2006)). This study develops and applies a framework for studying the effects of financial liberalization on consumption smoothing, and uses multiple available indicators of financial openness to capture the degree of financial liberalization in different countries.

The main findings are that the effects of financial liberalization on consumption smoothing depend on both the initial extent of financial integration, and on the correlation between the productivity processes of a country and the rest of the world. Failure to account for these factors in past empirical analysis can help explain why we do not observe improvement in consumption smoothing as countries get more financially liberalized. The paper concludes by documenting suggestive evidence that supports the predictions of this theory.

1.2 Theoretical framework

Consider a two-country exchange economy, as in Heathcote and Perri (2002). A tree in each country produces some non-storable fruit. Endowment in each country depends on the realization of the state of nature s . Prior to any trade, the representative domestic agent owns the entire domestic tree, $X(s)$, while the foreign agent owns the foreign one, $Y(s)$. At the start of the period, the domestic household buys claims to a fraction θ_f of the foreign tree (the analysis for the foreign household is analogous), given the budget constraint:

$$\theta P + \theta_f P^* = P \tag{1.1}$$

where, P and P^* are the prices of domestic and foreign trees, respectively, and $(1 - \theta)$ is the fraction of domestic tree sold. Then, the state of nature is revealed, contracts are honored, and agents consume any fruit to which they have claims.

A tax τ on repatriated earnings represents market restrictions. Thus, given a choice for θ , consumption in state s is given by:

$$c(s) = \theta X(s) + \theta_f(1 - \tau)Y(s) = \theta X(s) + \frac{P(1 - \theta)}{P^*(1 - \tau)}Y(s) \tag{1.2}$$

For high values of τ , autarky prevails, while values of τ close to zero imply no impediments to cross-border capital movements and a country that is financially open.

The domestic household solves:

$$\max_{\theta \leq 1} \{E[u(c(s))]\} \tag{1.3}$$

subject to 1.2

I follow Lewis (1996), who argues that as countries get more financially integrated, consumption should vary with the common component of international income growth and should be less dependent on country-specific disturbances, and define the correlation between domestic consumption and domestic output as a measure of consumption smoothing³. As countries integrate with the global economy, increasing their ability to smooth consumption, the correlation between domestic consumption and domestic output should decline. The following equation can be derived for a perfectly symmetric joint distribution between domestic and foreign productivities and an exponential utility function:

$$\text{corr}(c, X) = \left[\left(1 - \frac{\mu}{A\sigma}\right) + \left(\frac{2\mu}{A\sigma} - 1\right) \frac{1}{2 - \tau} + \rho - \frac{\rho}{2 - \tau} \right] \frac{\sigma}{\sigma_c} \tag{1.4}$$

where, μ denotes the mean of output, $E(X)$ and $E(Y)$, at home and abroad⁴, σ is

³Other measures of consumption smoothing used in the literature are $\text{corr}(c, c^*)$ and σ_c . This study does not regard any measure as superior.

⁴Allowing for different country sizes (different means) does not change the analysis.

the standard deviation of output (in this analysis it will be the same for both countries), σ_c is the standard deviation of consumption at home, ρ is the correlation of productivity shocks between home and foreign countries, and τ denotes the impediments to trade in foreign capital. Equation 1.4 shows that the correlation between domestic consumption and domestic output depends on the extent of market restrictions, τ , as well as on the correlation of productivity shocks between the two countries, ρ .

In contrast to early studies in this area, this framework suggests that the degree of consumption smoothing depends not only on the degree of openness, but also on the nature of underlying shocks. Figure 1.1 shows the relation between impediments to trade in capital, τ , and consumption smoothing, as described by equation 1.4⁵. For a given ρ , as the country becomes more liberalized the correlation between consumption and output in the domestic country decreases, albeit in a nonlinear fashion (note that for values of τ close to one there is little or no change in consumption smoothing when τ decreases).

Figure 1.1 also highlights that for fixed values of τ , as ρ increases (this is shown by an upward shift in the curve in the figure) consumption smoothing deteriorates. The intuition would be that as ρ increases, productivity processes between the domestic country and the rest of the world become more similar, making the gains from diversifying con-

⁵In this simple framework, because $c(s) = \theta X(s) + (1 - \theta)Y(s)$, $corr(c, X)$ will be high, even for full integration. For example, for $\tau = 0$ and $\rho = 0$, i.e. full integration and i.i.d. productivities, $corr(c, X) \approx 0.7$.

sumption risk smaller. As the country liberalizes while ρ has increased, the net result may be deterioration in consumption smoothing. In the next section, I show evidence suggesting that ρ may indeed be an important determinant in explaining the patterns of consumption smoothing.

1.3 Empirical analysis

As mentioned above, financial liberalization is difficult to measure. To address this concern, three different indicators of financial openness are used for the subsequent analysis⁶. First, each indicator is standardized on a scale from 2 to 1, with 2 being the most restrictive (high τ) and 1 being the most liberalized (low τ). Then, an index is constructed for each country as the average of all three indicators, for the years and countries available. Next, for each country, I check whether the constructed index suggests periods during which the markets were relatively open. I identify a relatively open period such that it is at least 6 years long and, the value of the constructed index for each year is at least 15% lower than in any other year. Then I calculate consumption smoothing in the identified relatively open periods, if any, and compare it with consumption smoothing in the remaining period, provided that it is at least 6 years long.

Out of 22 countries for which all three indicators were available⁷, I was able to define

⁶Kaminsky & Schmukler, Miniane (<http://www.imf.org/external/pubs/ft/staffp/2004/02/miniane.htm>), and Chinn-Ito (<http://www.ssc.wisc.edu/~mchinn/research.html>).

⁷Canada, Germany, Hong Kong, US and the countries listed in Table 1.1a-b.

8 developing and 10 developed countries that have experienced a relatively open (and a relatively closed) period as defined above. In general, developed countries are more open than the developing ones. For example, for Denmark the openness indicator was 1.53 (2 being the most closed, 1 the most open) during the relatively closed period, and 1.05 during the relatively open period. In contrast, in Brazil the indicator was 1.94 during the closed period and 1.58 during the relatively open period. Thus, according to the model, Brazil would be mapped on the right side of Denmark in Figure 1.1, and consumption smoothing in Brazil and Denmark will respond differently to financial liberalization, provided that ρ has not changed much in these two countries. This can explain why studies like Kose et al 2003 did not find evidence of consumption smoothing for developing countries.

To measure consumption smoothing, I follow Lewis (1996), and calculate the correlation between annual growth of real domestic output per capita demeaned by the aggregate of world output in each period and annual growth of consumption per capita. According to standard theories, one would expect $corr(c, X)$ to be lower for relatively open periods and higher for relatively closed ones.

Next, I investigate whether the theoretical framework explained in Section 2 can help explain these puzzling findings. I construct ρ using annual TFP data from Bosworth and Collins (2003), where TFP is constructed as a residual from growth accounts equations.

I first calculate bilateral correlations of TFP growth between all countries for each of the identified periods. Then, for each country I calculate a weighted coefficient of the productivity shock correlation with the rest of the World, where the weights are the average import shares from each country over the period 1980-2004, as shown in the Direction of Trade Statistics Yearbook.

Results are shown in Table 1.1a-b. Brazil, Chile, Philippines (developing), Denmark, Italy and Norway (developed) follow predictions of standard theories. The change in consumption smoothing for the countries in bold in Table 1.1a-b (Korea, Mexico, Finland, Spain and Sweden) can be explained by the increase in the productivity shock correlation with the rest of the world (last two columns). For example, in Sweden, during the relatively closed period (73-83) ρ was 0.21, financial openness was around 1.50, and consumption smoothing ($corr(c, X)$) was 0.23. During the open period (93-04) consumption smoothing deteriorated ($corr(c, X) = 0.41$) at the same time that productivity correlation with rest of the world increased ($\rho = 0.66$). This would correspond to a move from point A to point B in Figure 1.1 and explains why consumption smoothing did not improve in Sweden. Neither the standard theories, nor this model can explain what happened to consumption smoothing in Argentina, Colombia, Malaysia and France, Japan, Portugal, UK.

Whereas standard theories were able to explain only 3 out of 10 developed and only 3 out of 8 developing country experiences, accounting for cross-country productivity corre-

lations helps explain what happened to consumption smoothing in 6 out of 10 developed countries and in 5 out of 8 developing ones.

The constructed correlation of productivity shocks between a country and the rest of the world, ρ , is robust to the choice of the number of years in a period⁸. At the same time, it has been varying a lot between periods (for example for Mexico more than doubled going from 0.17 to 0.36), suggesting that this correlation is empirically relevant⁹. This evidence shows that the actual degree of financial openness and the correlation of productivity shocks with the rest of the world are important factors in explaining the apparent lack of risk sharing as countries get more financially integrated, and calls for more empirical investigation of these facts following the framework derived in Section 2 of this paper.

1.4 Conclusions:

This study highlights a direct link between theory and empirics, which the author feels is absent in the existent empirical studies in this area. Using a very simple model, the author constructs a framework that relates financial liberalization, correlation of productivity processes between two countries and consumption smoothing. Then, using an array of existing indicators, the study identifies countries that have had periods of

⁸Evolution of ρ is similar for 7, 8, 9 and 10-year periods.

⁹This calls for cautious interpretation as TFP derived from growth accounts measures a combination of changes in efficiency in the use of capital and labor inputs, as well as changes in technology.

relative high and relatively low financial openness, and presents empirical evidence that supports the theoretical prediction that correlation between the productivity processes of a country and the rest of the world can explain why we fail to see improvements in consumption smoothing in some of these countries.

Chapter 2

Financial Liberalization and Consumption

Smoothing: Bridging Theory and Empirics

2.1 Introduction

The past two decades have witnessed a surge in cross-border capital flows and a sharp decline in capital account restrictions in industrial countries as well as emerging markets and less developed economies. Standard open macroeconomic models predict that this would unambiguously lead to better international consumption risk sharing¹. The intuition would be that as countries open their international financial markets, they would be able to *off-load* some of their income risks to the rest of the world, *de-linking* domestic consumption from country-specific disturbances. In return, domestic consump-

¹Mace(1991), Lewis(1996), Obstfeld and Rogoff (1996)

tion will vary with the common component of international income growth. However, the empirical literature studying the effects of financial liberalization on consumption smoothing is at best inconclusive, failing to show unambiguously improvements in international consumption risk sharing, especially for the emerging markets and other developing economies. This study investigates this disconnect and offers plausible answers about the relationship between financial liberalization and consumption smoothing.

The empirical literature on the effects of financial liberalization on international consumption smoothing has been elusive of theory, without having an explicit equilibrium framework in mind.² Its predictions come from a complete markets model, which conjectures that the ability to insure against different states of nature should be reflected in: a) a low correlation between own consumption and own output (own refers to households for micro studies and country for international studies), b) a high correlation between own consumption and aggregate/rest of the world income or consumption (aggregate refers to total domestic for micro studies within a country, and is either foreign or global for international studies), and c) a low volatility of consumption. Some studies have been looking at these correlations trying to interpret it as a test of highly integrated markets. Failing to find the predicted patterns in the data, further studies have been more pragmatic and chosen to interpret the *magnitudes* of these measures as deviations from complete markets outcome, investigating the same measures for different market

²a notable exception would be Lewis(1996)

openness realizations across countries and across time. But, even when market incompleteness has been considered, like for example, controlling for financial impediments, in most cases the analyses have been *ad-hoc*, probably not testing the implications of an incomplete markets framework.

Using a simple general equilibrium model, this study develops a well-defined framework and can test more directly the effects of financial impediments on measures of international consumption risk sharing. The results can be summarized as follows. First, the actual level of financial impediments matters for consumption smoothing, and the relationship between the two is nonlinear. While liberalization has little effect on consumption smoothing when financial markets are relatively closed, its impact grows as financial markets become more open. Empirical analysis finds that more liberalization leads to better consumption risk sharing. Second, this study shows both theoretically and empirically that increased productivity correlations with the rest of the world are associated with less international risk sharing (using consumption-based measures). While the net effect of cross-country productivity correlations on consumption risk sharing is small in magnitude, the analysis presented in this paper shows that it interacts with financial impediments and should be considered by the literature.

Why do researchers care about consumption risk sharing? Eliminating consumption risks can have substantial economic effects. There is a large literature about the extent

of the benefits of international risk sharing, which show that these benefits can be large for developing economies. (See Kose, Prasad, Rogoff and Wei (2003) for a review.) For example, Athanoloulis and van Wincoop (2000) estimate that eliminating idiosyncratic consumption uncertainty (relative to world average riskiness) would have the same benefit as a 6.6% permanent increase in the level of per capita consumption of a typical developing country. The empirical analysis in this paper finds that developing countries can further reduce their consumption risks by decreasing financial impediments. Furthermore, this study suggests that the extent of these benefits will depend on cross-country productivity similarities. Investigating these channels can help researchers better understand the benefits of financial globalization.

One of the main benefits of financial globalization is that it provides increased opportunities to protect consumers from the risks associated with idiosyncratic income shocks. Cochrane (1991) and Mace (1991) were among the first studies to argue that consumption should not vary across individuals in response to idiosyncratic shocks; just as borrowing and lending opportunities imply that consumption should not vary over time in response to forecastable shocks.³ These two studies have been the genesis of an extensive literature aimed at understanding the effects of financial integration on international consumption smoothing. Obstfeld (1994) and Lewis (1996) were among the first influential studies to

³They use reported income, which includes after-tax wages and salaries, pension income, interest income, and various lump-sum receipts. Hence, some of the risk sharing has already taken place and is included in the reported income measure. However, at least some risk sharing takes place between receipts of reported income and actual consumption.

investigate consumption risk sharing in an international context. In this case, *own* would refer to country's consumption and output. By the same analogy, in the presence of open financial markets, country's consumption should be more correlated with the common component of the consumption of the foreign countries they trade assets with, and less correlated with domestic output.

Most standard models in open macroeconomics give similar predictions. In the simplest complete markets model, marginal utility growth should be equated across countries so that consumption growth rates should be highly correlated. Dynamic stochastic general equilibrium (DSGE) models, in particular, have been able to generate some quantitative predictions along these lines. These type of models predict that in the absence of trade in goods and financial assets (the case of autarky), the correlations of domestic consumption with world output (or world consumption) would be less than unity provided that output is not perfectly correlated across countries (Backus, Kehoe and Kydland (1995)). In contrast, in a scenario with complete markets that enables perfect risk sharing, it should be possible to decouple fluctuations in consumption from those of output. Cross-country correlations of consumption growth rates would be predicted to be perfect or very high. Moreover, consumption across countries would be more correlated than output. Pakko (1998) also shows that in a two-country endowment economy the correlation between domestic consumption and domestic output should be lower than the correlation between domestic consumption and world output in the presence of inte-

grated financial markets⁴.

Empirical literature investigating the effects of globalization on consumption risk sharing has failed to document a robust relationship between financial integration and consumption smoothing. Kose, Prasad and Terrones (2008) show that emerging markets and other developing economies have not been able to benefit from increased opportunities to smooth consumption, despite the surge in financial flows into and out of these countries. Some other studies have been able to document better consumption risk sharing for more open economies (Lewis (1996), Beakaert, Harvey and Lundblad (2005)), but their estimates are nowhere near the predictions of the theoretical models.

Researchers have also attempted to build models that sometimes reverse these predictions and can be more in line with some of the results presented below. For example, Baxter and Crucini (1995), Heathcote and Perri (2001, 2004), Lewis (1996), show theoretically scenarios that might lead to different outcomes than those presented above. As will be discussed further in the paper, some of these studies require very strong conditions. But, with very few exceptions, these models have not been incorporated in the empirical studies to date.

This study will argue that among the key problems with the existing empirical litera-

⁴This is a direct consequence of the fact that under integrated markets marginal utilities of consumption between the two countries would be perfectly correlated.

ture is the lack of a well-defined framework. In a simple framework, this paper will show a nonlinear relationship between financial liberalization, consumption smoothing and cross-country productivity similarities. Everything else equal, more liberalization means better consumption smoothing, but consumption based measures of risk sharing might deteriorate because of increased productivity correlations with the rest of the world. The paper is organized as follows. The next section develops a theoretically based empirical framework to estimate the effects of financial impediments and cross-country productivity correlation on consumption smoothing. First, it offers a summary of the literature and points out the main messages of the previous studies. These main messages are then incorporated in a simple general equilibrium model, and some testable implications of this model are discussed. In the end, it develops an empirical framework that will serve as the basis for the empirical analysis. Section 2.3 offers a review of the different available indicators as well as a discussion of their strength and weaknesses, before moving into a more formal empirical analysis. Section 2.4 describes the data used and Section 2.5 shows the results of the empirical tests. Some robustness analysis is discussed in Section 2.6 and Section 2.7 summarizes the conclusions and offers some discussion for suggested future work.

2.2 Bridging Theory and Empirics

In theory, one of the main benefits of financial globalization is that it provides increased opportunities to protect consumers from the risks associated with idiosyncratic income shock. In a representative agent framework, integrated world asset markets would imply that the *ex-post* difference between any two countries' intertemporal marginal rates of substitution is uncorrelated with any random variable on which contractual payoffs can be conditioned. Any idiosyncratic consumption risk systematically related to some verifiable random event will be traded, leaving *ex-post* differentials in marginal utility functions of nonverifiable events only. Thus, a country's consumption will not co-vary with its production as any fluctuations in output caused by known *ex-ante* randomness in the production process can be *de-linked* from consumption via capital markets. Under financial integration, growth in individual consumption should be closely correlated to the aggregate consumption pool and less correlated to individual income⁵.

2.2.1 Literature Review

There is an extensive literature aimed at understanding the effects of financial integration on consumption smoothing. Usually, consumption-based measures of risk sharing come from a benchmark model with complete markets. For example, Obstfeld and Rogoff (1996) compare the case of financial autarky and complete markets, where financial markets are modeled as contingency assets. They show that in the later case consump-

⁵ $\log\left(\frac{C_{t+1}^j}{C_t^j}\right) = \beta_1 \log\left(\frac{C_{t+1}^a}{C_t^a}\right) + \beta_2 \log\left(\frac{X_{t+1}^j}{X_t^j}\right) + \varepsilon_{t+1}^j$

tion does not co-move with own output, but with an aggregate measure of income (or consumption). Baxter and Crucini (1995) and Backus, Kehoe and Kydland (1995) also predict that in the case of absence of trade in financial assets domestic consumption should not be correlated with world income (or consumption) provided output is not correlated across countries, whereas under complete markets cross-country consumptions should be highly correlated.

Tables 2.1-2.3 give a summary of studies investigating the effects of financial integration on consumption smoothing⁶. These studies differ in terms of methods they employ, the data sets they use and how they define financial integration. Usually, the literature on consumption risk sharing has asked two main questions. The first is whether there is perfect consumption risk sharing. According to one-good, two-country macro economy models, a high degree of financial liberalization should be reflected in low correlations of domestic consumption and domestic output and high correlations of domestic consumption and world income/consumption. This would mean that cross-country consumption correlations would be higher than cross-country output correlations. If these patterns were observed in the data that would have led researchers to interpret it as evidence of highly integrated financial markets. Out of ten (10) studies that look at international consumption risk sharing in Table 2.1, one (1) finds mixed evidence of perfect consump-

⁶Note that some studies have looked at more than one hypothesis of consumption smoothing and can appear in more than one table. See <http://www12.georgetown.edu/students/ei25/> for a more detailed description.

tion smoothing, whereas nine (9) others reject the hypothesis of perfect risk sharing at very high levels of statistical significance. In addition, one (1) finds that even among US states there are still unexplored opportunities of consumption risk sharing.

One might suspect that the predictions of this line of literature might be unrealistic. Even for a highly integrated economy, output volatility might signal changes in future income resulting in responses to consumption and the expectation of completely independent consumption (growth) and income (growth) might be a little farfetched. Also, agreeing that some consumption risk sharing may take place from borrowing and lending on credit markets and other formal and informal insurance arrangements would suggest that domestic consumption (growth) would be correlated with domestic income (growth) and need not be completely correlated with world income.

This has led researchers to be more pragmatic and interpret the *magnitudes* of the correlations mentioned above as deviations from complete markets outcome. Another group of studies has explored the hypothesis of whether countries have benefitted more from consumption risk sharing opportunities during more open financial liberalization realizations. To answer these questions, they have used two approaches. First, they ask if there are differences in consumption risk sharing across different groups of countries, i.e., financially integrated versus financially non-integrated countries. For example, if correlation between domestic consumption and domestic output is our measure of con-

sumption risk sharing, we should expect to see a lower correlation for countries with more open financial markets. Table 2.2 summarizes these studies. All the 10 (ten) studies in Tables 2.2 show evidence of consumption smoothing for more financially open economies. Among them, 2 (two studies) differentiate countries based on available indicators of financial openness⁷, whereas the rest assume that developed countries are more open than developing economies. In addition, 2 (two) of these studies suggest that business cycle properties matter.

Second, the literature has asked what happens to consumption smoothing across time. Table 2.3 summarizes these results. Out of 11 (eleven) studies looking at the extent of consumption risk sharing across time, 7 (seven) find that there have been improvements in consumption smoothing as countries have become more liberalized. Among them, 2 (two), Bekaert, Harvey and Lundblad (2005) and Islamaj (2008), look at a group of developed and developing economies and distinguish between relatively open and relatively closed periods of financial integration. The rest implicitly assume that countries have tended to become more liberalized across time⁸ and are able to find evidence of consumption smoothing only for the group of developed countries. From the remaining studies, 2 (two) show mixed evidence of consumption smoothing and 2 (two) show that consumption smoothing has deteriorated even for the developed economies.

⁷Lewis (1996) uses capital account restrictions reported from AREAER and Bekaert, Harvey and Lundblad (2005) use equity market openness measures.

⁸Evidence does show that in the last two decades there has been an increase in cross-border capital flows and a decline in financial restrictions between countries.

What can explain the findings of the empirical literature on consumption risk sharing. First, studies that have carefully distinguished between relatively open and relatively closed economies, or relatively open and relatively closed periods have been more successful in finding evidence of consumption smoothing. This would suggest that the actual level of financial impediments matters for consumption smoothing, and it might be necessary to depart from the complete markets framework in order to capture the effects of financial openness on consumption risk sharing. Researchers have attempted to build models with incomplete markets that sometimes reverse these predictions and can be more in line with some of the results presented above. For example, Lewis (1996) Heathcote and Perri (2001, 2004), Baxter and Crucini (1995) show theoretical scenarios of market incompleteness that might lead to different outcomes than those presented above. Lewis (1996) and Heathcote and Perri (2004) incorporate impediments to financial markets explicitly in the model and this can allow to study what happens to consumption smoothing as markets change from autarky, to partial integration, to full integration under a unified framework⁹.

Tables 2.2 and 2.3 also show that in some cases studies have been successful in finding improvements in consumption smoothing, once they account for properties of the business

⁹As opposed to Baxter and Crucini (1995), for example, that use a different set of equations to study complete markets and partial integration, or autarky.

cycles¹⁰. Heathcote and Perri (2004) investigates theoretically the effects of productivity shock correlations with the rest of the world on measures of consumption risk sharing. The intuition would be that as productivity processes between countries become more similar, there are fewer incentives to diversify risks by investing in a foreign country. Islamaj (2008) shows that these correlations may, indeed, be empirically relevant. This study will incorporate cross-country productivity similarities in an incomplete markets model and show empirically that they have affected measures of consumption smoothing.

Also, some studies suggest nonlinearities in the relations between financial liberalization and consumption risk sharing¹¹. The nature of these nonlinearities can be better captured in a well-defined framework that allows for a closed form solution. This study uses a general equilibrium framework and avoids potential problems that are associated with other *ad-hoc* studies.

2.2.2 A Simple Model

A simple general equilibrium model that contains some of the features mentioned above, market incompleteness and cross-country productivity shock correlations, can give some good insights about what happens to consumption based measures of international consumption risk sharing as countries get more financially integrated.

¹⁰Artis and Hoffmann (2004, 2006), Islamaj (2008)

¹¹Kose, Prasad and Terrones (2003), Heathcote and Perri (2004), Levchenko (2005).

Consider a two-country exchange economy. Capital in each country is used to produce a perishable output, the quantity of which depends on the realization of the state of nature s . Domestic output is denoted $X(s)$ and foreign output is $Y(s)$. Prior to any trade, the representative domestic agent owns all of domestic capital stock, while the foreign agent owns foreign capital. At the start of each period, the domestic household buys claims to a fraction θ_f of the foreign capital stock, given the budget constraint. Then, the state of nature is revealed, contracts are honored, and agents consume output to which they have claims.

To formalize:

At the start of the period, the domestic household buys a fraction θ_f of the foreign tree subject to the budget constraint:

$$\theta P + \theta_f \frac{P^*}{1 - \tau} = P \implies \theta_f = (1 - \tau) \frac{P}{P^*} (1 - \theta)$$

where P and P^* are the prices of the domestic and foreign stocks respectively, and $(1 - \theta)$ is the proportion of the domestic stock sold.

An important assumption is that endowment from abroad is subject to a proportional tax, τ . This will represent transaction costs in purchasing foreign capital and later will define financial liberalization. The advantage of defining financial liberalization in this

manner is that it allows us to map the degree of liberalization on consumption smoothing for each level of financial impediments. Given a choice for θ , consumption in state s is given by:

$$c(s) = \theta X(s) + \theta_f(Y(s) = \theta X(s) + \frac{P}{P^*}(1 - \theta)(1 - \tau)Y(s) \quad (2.1)$$

where θ represents fraction of domestic output held, $X(s)$ and $Y(s)$ represent domestic and foreign outputs, respectively, and τ represents impediments to trade in foreign capital¹².

The domestic household solves:

$$\max_{\theta} \{E[u(c_t(s))]\}$$

such that (2.1) and $\theta \leq 1$.

First Order Conditions can be written as:

$$FOC_{\theta} : E[u'(c_t(s))X_t(s)] = \frac{P}{P^*}(1 - \tau)E[u'(c_t(s))Y_t(s)]$$

¹²Market clearing for stocks implies: $\theta + \lambda_f = 1$ and $\theta_f + \lambda = 1$, where λ and λ_f represent the holdings of domestic and foreign capital share of the foreign consumer. Market clearing for consumption good requires: $c(s) + c^* + (\theta_f Y(s) + \lambda_f X(s))\tau = X(s) + Y(s)$.

(provided $\theta < 1$)

Consider the case in which the utility is exponential

$$u(c) = -\frac{1}{A} \exp\{-Ac\}$$

where A is the coefficient of risk aversion.

Assume that X and Y are jointly normally distributed with means μ_x and μ_y , respectively, equal variance σ^2 and correlation coefficient ρ ¹³.

It can be shown that, θ , the amount of domestic endowment that a consumer chooses to keep, can be determined endogenously, and is a function of τ , ρ and μ . This is an interesting observation since it relates the actual amount of financial flows to the financial restrictions imposed on the international markets. This would suggest that studies that use financial flows as a measure of financial integration may suffer from an endogeneity problem¹⁴.

¹³Initially assume $\mu_x = \mu_y = \mu$. Because, the joint distribution over foreign and domestic endowments is perfectly symmetric $P = P^*$ as a result.

¹⁴More exactly, $\theta = \min\{1, \frac{(1-\rho-\tau)+\tau\frac{\mu}{A\sigma^2}}{(2-\tau)(1-\rho)}\}$. If $\tau \rightarrow 0, \theta \rightarrow \frac{1}{2}$, if $\tau \rightarrow 1, \theta \rightarrow 1$

The assumption of normal distribution of productivity shocks might be a little problematic, since normally distributed shocks would produce negative values for output with positive probability. In practice, when studying the predictions of this model, it is assumed that the mean of output is a large positive number and the standard deviation is small, so as to minimize the probability of consumers facing negative output realizations. These assumptions are in line with the data.

Given an expression for θ , we can derive expressions for all the measures of consumption smoothing used in the literature that depend only on τ , ρ and μ . ρ is the cross-country correlation of productivity shocks and μ can be interpreted as the mean of output in each country. τ represents financial impediments in capital markets and can be thought as exogenously determined by a government authority. Thus, we have expressions for measures of consumption smoothing that depend on exogenous variables only. In contrast to earlier studies, this framework suggests that: first, consumption smoothing depends on financial liberalization in a non-linear fashion¹⁵, and second, that consumption smoothing depends not only on the degree of financial openness, but also on the nature of the underlying shocks.

¹⁵Kose, Prasad and Terrones (2003) suggest a non-linear relationship between volatility of consumption growth to income growth and the volume of financial flows.

2.2.3 Testable Implications

The fraction of domestic and foreign assets held (portfolio choice) will depend on τ , the actual level of impediments to foreign capital. So will the consumption based measures of consumption risk sharing. The exact relationship between these variables can be seen best in graphs. Figures 2.1 and 2.2 show these measures of consumption smoothing (vertical axis) and the level of financial impediments (horizontal axis), for different levels of cross-country productivity shock correlations. Low impediments means more liberalized markets. In Figures 2.1 and 2.2 $\mu = 2$, $\sigma = 0.1$ and $\theta = 1$. At a consumption level μ , these values translate to a coefficient of relative risk aversion (corresponding to $\theta\mu$) of 2 (See Heathcote and Perri (2004)). Figure 2.1 shows what happens to the correlation between domestic consumption and domestic output as transactions costs decrease¹⁶ and Figure 2.2 shows the relationship between impediments to foreign capital and cross-country correlation of consumptions. The next sub-section points out some testable implications that this model might have.

Correlation between domestic consumption and output:

Figure 2.1 shows what happens to the correlation between domestic consumption and domestic output as impediments to trading foreign capital, τ , decrease. A low correlation between consumption and output means that countries are better able to share consumption risks. For a given ρ , as the country becomes more liberalized the correlation between

¹⁶Figures 1-2 assume $\mu = 2$, $A = 1$ and $\sigma = 0.1$

consumption and output in the domestic country decreases, albeit in a nonlinear fashion (note that for high values of τ there is little or no change in consumption smoothing when τ decreases). Figure 2.1 also highlights that for fixed values of τ , as ρ increases (this is shown by an upward shift in the curve in Figure 2.1 consumption smoothing deteriorates (the correlation between consumption and output increases). The intuition would be that as ρ increases, productivity processes between the domestic country and the rest of the world become more similar, making the gains from diversifying consumption risk smaller. As the country liberalizes while ρ has increased, the net result may be deterioration in consumption smoothing. This might be shown by moving from point A to point B in Figure 2.1.

Thus, lower financial restrictions will improve, whereas more similar productivity processes will deteriorate consumption smoothing. For these parameter values, even small impediments to trading foreign capital will shut down international financial markets, as the gains of sharing risks for this parameterization are small. This is in line with the findings of the literature for developed countries (Cole and Obstfeld (1991)). Theoretically, τ would correspond to an array of policy and institutional arrangements, which would be hard to measure. In practice, financial openness measures, which are also imperfect (see section 3), are used to estimate these implications. They may represent only a subset of τ in the model, but can be thought of as being effective only after other institutional arrangements, like the existence of financial institutions, are set in place.

Cross-Country Consumption Correlations:

Figure 2.2 shows the relationship between financial restrictions and cross-country consumption correlations for different ρ . In this case, a higher correlation means better risk sharing. Again, everything else equal, fewer impediments to trade in foreign capital, correspond to better consumption smoothing. For very high frictions, as τ decreases, there is no change in cross-country correlations of consumption. Only for low enough impediments to foreign capital would fewer restrictions correspond to better consumption smoothing.

Again, for a fixed τ , consumption smoothing may change if productivity correlations with the rest of the world change. For high (restrictive) costs to trading foreign capital, cross-country consumption correlations are determined by productivity correlations, ρ , by definition. For low levels of financial restrictions, a higher ρ corresponds to deterioration in consumption smoothing. This might seem a little counter-intuitive as an increase in ρ will increase output correlations by definition, and in return will increase consumption correlations. But, on the other hand, an increase in ρ has a huge negative effect on the portfolio share of domestic assets, which in turn decreases cross-country correlations for plausible parameter values. The second effect dominates and a higher ρ corresponds to a deterioration in consumption smoothing. See Heathcote and Perri (2004) for more details.

To summarize, first, everything else equal, there exists a nonlinear relationship be-

tween financial liberalization and consumption smoothing. The nonlinearity feature makes clear distinctions between different measures of consumption smoothing as to how they respond to financial liberalization. Loosely speaking, for a fixed ρ (assuming that the tax is non-restrictive) more liberalization would mean more consumption smoothing, but an incremental change in financial integration would have a different quantitative effect on consumption smoothing across the different measures. For example, for low impediments, an incremental decrease in τ would show more improvement in risk sharing if one calculates risk sharing using $corr(c, X)$ than if one uses cross-country correlations of consumption (note that for low impediments the graph for $corr(c, X)$ is steeper than the graphs for $corr(c, c^*)$). The opposite is true for high (but non-restrictive) impediments to foreign capital. When using $corr(c, X)$ to measure consumption risk sharing, financial liberalization improves consumption smoothing with increasing returns, whereas, when using $corr(c, c^*)$ as a measure of consumption risk sharing, liberalization improves consumption smoothing with decreasing returns. Also, the effect of productivity shock correlation on measures of consumption risk sharing appears to be different, depending on the actual level of financial restrictions. These nonlinearities are not merely a mathematical fact, but have important implications for the effect of financial liberalization and cross-country productivity correlations on consumption smoothing. An empirical framework shown in the next section will test these implications.

The literature so far has treated different measures of consumption smoothing simi-

larly and has not differentiated between the two. These measures can respond differently to financial liberalization. The difference is not only qualitative, as discussed in the previous paragraph, but also quantitative. Using cross-country consumption correlations, consumption smoothing will change from 0 to 1 as the country moves from financial autarky to complete liberalization. On the other hand, the same liberalization implies a change from 1 to 0.6 when using correlation between domestic consumption and income as a measure of consumption smoothing¹⁷. Chapter 3 will also show that in a two-country, two-sector framework, an increase in cross-country productivity shock correlation may have different effects on different measures of consumption smoothing. More research on the different measures of consumption risk sharing may be needed.

Also, productivity shock correlation with the rest of the world matters for consumption smoothing. Recently, some research accounting for business cycle properties has shown success in relating consumption smoothing and financial integration and this simple model gives a clear idea of how productivity shocks correlations affect consumption based measures of risk sharing.

2.2.4 Empirical Framework

In this section, I present the empirical framework that is used in the empirical analysis. The framework is derived from the theoretical model shown above, and in that sense,

¹⁷This is the reported value for $corr(c, X)$ when $\tau = 0$ and $\rho = 0$. The y-intercept will change for different values of ρ .

I am making a direct link between theory and empirics.

Remember equation (2.1) that says: $c(s) = \theta X(s) + \theta_f Y(s)$

i.e., at the end of each period the domestic consumer gets his portion of the domestic output stock and what he owns of the foreign output stock.

One can estimate:

$$c_t = \beta_{1t} X_t + \beta_{2t} Y_t \quad (2.2)$$

where X_t is the domestic output, Y_t is the foreign output. Note that the coefficients in front of domestic output and world output are changing over time, and not fixed as assumed by some of the previous literature.

It can be shown that one can estimate¹⁸:

$$\beta_{1t} = \gamma_1 \tau'_t + \gamma_2 \rho'_t + \gamma_3 \rho'_t \tau'_t \quad (2.3)$$

$$\beta_{2t} = \delta_0 + \delta_1 \tau'_t + \delta_2 \rho'_t + \delta_3 \rho'_t \tau'_t \quad (2.4)$$

¹⁸See the Appendix (2.8) for more detail. Note that β_{1t} is positively related to τ .

where¹⁹

$$\tau'_t = \frac{1}{(2 - \tau_t)}$$

and

$$\rho'_t = \frac{1}{(1 - \rho_t)}$$

According to our model, one should expect τ to be positively related to β_{1t} and negatively related to β_{2t} . Based on the discussion on the previous subsection, the relationship between financial liberalization and consumption smoothing is nonlinear and also dependent on ρ . Note that ρ is not merely a control but enters interactively in the regression. For plausible parameters for the mean and volatility of output, the net effect of a change in τ and ρ on β_{1t} will be positive and statistically significant, and on β_{2t} negative and statistically different from zero.

The net effects of a change in τ and ρ can be written as:

¹⁹ $\gamma_1 = 1, \gamma_2 = 1 - \frac{\mu}{A\sigma^2}, \gamma_3 = 2(\frac{\mu}{A\sigma^2} - 1), \delta_0 = 1, \delta_1 = 1, \delta_2 = \frac{\mu}{A\sigma^2} - 1, \delta_3 = 2(1 - \frac{\mu}{A\sigma^2})$ Note that τ is positively related to τ'_t

$$\frac{\partial \beta_{1t}}{\partial \tau} = \gamma_1 + \gamma_3 \rho'_t \geq 0 \quad (2.5)$$

$$\frac{\partial \beta_{1t}}{\partial \rho} = \gamma_2 + \gamma_3 \tau'_t \geq 0 \quad (2.6)$$

$$\frac{\partial \beta_{2t}}{\partial \tau} = \delta_1 + \delta_3 \rho'_t \leq 0 \quad (2.7)$$

$$\frac{\partial \beta_{2t}}{\partial \rho} = \delta_1 + \delta_3 \tau'_t \leq 0 \quad (2.8)$$

The hypotheses above can be tested for different values of τ and ρ . To perform the test, I substitute (2.3) and (2.4) into (2.2) and estimate:

$$\Delta c_t = \Delta(\beta_{1t} X_t) + \Delta(\beta_{2t} Y_t) + \varepsilon_t \quad (2.9)$$

$$\frac{c_t}{Y_t} = \beta_{1t} \frac{X_t}{Y_t} + \beta_{2t} + \xi_t \quad (2.10)$$

$$c_t = \beta_{1t}X_t + \beta_{2t}Y_t + \nu_t \quad (2.11)$$

where ε_t , ξ_t and ν_t represent measurement error. The null hypotheses test whether the net effects of a change in τ or ρ are statistically significant and if they have the predicted sign. Equation (2.9) comes from first-differencing equation (2.2). Differencing the variables has the advantage that it makes the series stationary. However, the model presented earlier suggested that knowing only the change in liberalization may not be enough to capture the effects of liberalization on consumption smoothing²⁰. Although this equation can capture some of the effects of openness on consumption risk sharing, one should look at the regression in levels for a more complete picture.

Equation (2.10) looks at the same relationship for level output and consumption per capita, hoping to capture some of the long term effects of financial liberalization on consumption smoothing. Stationarity is imposed by dividing with world output. The drawback is that world output volatility can be influenced by countries that do not necessarily trade with the country under consideration, or fluctuations in world output may not necessarily affect domestic output and domestic consumption. The appearance of

²⁰In the short run, consumption might also be affected from expected future changes in income, as suggested by PIH, and the effects of financial liberalization can be blurred. Some of the long effects of financial liberalization can be captured only with level regressions (See Artis and Hoffmann (2007) for a more detailed analysis).

world output on both the RHS and LHS of equation (2.10) may bias the results. Another way is to test like in equation (2.11) where levels of consumption and output are considered. This relationship can, in principle, be estimated consistently by OLS. However, consumption and output series can be co-integrated and OLS may suffer potential simultaneity and serial correlation of the errors. The panel dynamic OLS (PDOLS) estimator suggested by Mark and Sul (2003) accounts for serial correlation and potential simultaneity by including leads and lags of the differences of the right hand side variables. Different numbers of leads and lags give similar results, which suggest that the estimations are consistent across specifications. The next section describes the data and other details about the tests.

2.3 Rule Based Measures of Financial Liberalization

A natural starting point for any data-based discussion of the effects of financial integration on consumption smoothing is a review of different available indicators of financial liberalization. In particular, any such study would be interested to know how each indicator matches with the tax τ on foreign capital, especially since different degrees of financial openness have different implications for the effects of more liberalization on consumption based measures of risk sharing. Unfortunately, measuring financial integration is a challenging enterprise (Edison et. al. (2002)).

It is important to understand how to interpret financial liberalization. In our model

financial liberalization is represented by a tax, τ , in trading foreign capital. For $\tau = 0$ the markets are fully open and consumers can ensure against idiosyncratic country risk ex-ante. For $\tau = 1$ the country is said to be in financial autarky. The model also tells us that τ should be interpreted as a rule-based measure of financial openness. It is a decision which can be thought of as exogenous (of course in the real world it can be correlated with the government's perception of the economic situation and other factors²¹), and the actual flows of foreign capital in and out of a country can be represented by θ , which is also a function of τ .

More specifically, if any of the existing measures tells us that the country is fully open, is this situation correctly represented by a $\tau = 0$ in the model? Also, as a country goes from being fully closed to fully open, does this correspond to a decrease in τ from 1 (one) to 0 (zero)? As researchers have attempted to develop finer measures of financial integration, do these measures give us extra information in terms of the actual degree of financial openness? For example, one such widely available measure is the IMF AREAER measure of capital restrictions. It is constructed as an on/off indicator of the existence of rules/restrictions that inhibit cross-border flows for each country in each year. If no restrictions are present the indicator will be 1 (one), and if any restriction is present it will be 0 (zero). To make it compatible with our model, we can calculate (1 - IMF Measure) and so zero would correspond to no restrictions and one would represent

²¹See Eichengreen (2001) for a review.

the case of any restrictions on the capital account. As discussed, τ in the model would correspond to an array of policy and institutional arrangements that would allow for the *ex-ante* diversification of any income risks. The question becomes, does a change from zero to one in the IMF measure of financial restrictions correspond to a movement from C to zero in our model, or a move from point B to point A as shown in the Figure 2.3, for example? It is hard to tell from just one measure and in a previous study Islamaj (2008) makes use of an array of available indicators to rectify the problem.

Table 2.4 shows different indicators of financial liberalization. The IMF indicator has been available for a large set of countries since 1966. But the indicator has certain disadvantages. First, it is a yes/no measure, providing no information about the intensity of the capital controls. Second, it does not distinguish between restrictions on capital inflows and outflows. Starting in 1996, the IMF replaced the single indicator of capital account restrictions with a set of indicators for the existence of particular restrictions on capital inflows and outflows. This is a better measure of the array of restrictions on financial markets, but a drawback is that the new data are not directly compatible with the old data.

Quinn (1997, 2003) constructs an index that attempts to capture the intensity of enforcement of controls through a careful reading of the descriptions in the AREAER. Unfortunately, its coverage for developing countries is limited and only for selected years.

Brune et. al. (2001) have developed an index with more extensive coverage that also picks up information from 5 different categories of AREAER (which are an aggregation of the 13 categories in the new AREAER). The main drawback is that these data are not publicly available.

Bekaert, Harvey and Lundblad construct an index based in the dates of equity market liberalization. Still, this is a 0/1 indicator and equity market liberalization may be only a part of the liberalization process countries have been going through in the past two decades.

Miniane constructs an index for 34 countries for the period 1983-2004 using information from the AREAER accounts and based on the 13 categories of the new classification of the AREAER. The main drawback is that there is limited country coverage. Chinn and Ito calculate the first standardized principal components of the four major categories of AREAER; presence of multiple exchange rates, current account restrictions, capital account restrictions and requirement of the surrender of export proceeds. For controls on capital transactions, they use the share of five-year window that the capital controls were not in effect. This indicator is available for 163 countries from 1970-2006. Edwards (2005) also constructs an index for 1970-2000 that combines three data sources: a) Quinn (2003), b) Mody and Murshid (2002), which is the simple average of four AREAER categories, and c) country specific sources. Some missing data are also imputed.

Kaminsky and Schmukler (2003) develop an index for 28 countries by looking at domestic financial sector liberalization as well as openness of the equity markets to foreign investment, besides capital account restrictions. Further along these lines, Abiad and Mody (2005) construct a similar index for 35 countries for the period 1973-1996. They put more weight on reforms on domestic sector and look at restrictions on capital accounts, privatization in the financial sector, operational restrictions, barriers of foreign participation in the banking system, interest rates controls and credit controls. These studies add new dimensions to the liberalization indicators, which can represent an array of institutional arrangements that would enhance financial integration, and are still based on rule-based measures. A disadvantage is that they are of limited availability, and also they involve new sources of measurement error and potential simultaneity with the income growth.

As seen from the discussion above, the measurement of the extent of financial openness is a difficult enterprise. These studies have tried to capture the complexity of real world capital controls with varying degrees of success. Although, it is hard to say anything decisive about the actual degree of financial openness for most countries, these indicators do share some common features. First, all of them show a decreasing trend in financial restrictions over the years, consistent with the belief of increased globalization seen in the surge in cross-border financial flows. They also suggest that more developed countries

have been more financially open, consistent with the belief that industrial countries have interacted more with the rest of the world.

For countries like Belgium, Canada, Germany, Netherlands, Panama, UK and US, all the indicators show a very open economy for the period 1970-2003 (Netherlands and UK have liberalized around mid 70's). Another group of countries, among them Austria, Denmark, Finland, New Zealand, Singapore and Sweden, seem to have gone through a major liberalization in their financial markets in the 80's and have been very open since then. A few other countries, like France, Greece, Ireland, Italy, Japan, Peru, Portugal and Spain, have opened their markets a little later, in the 90's. These countries may have still not reaped the benefits of globalization. Of the remaining countries, mostly developing economies, a few have liberalized late in the 90's, whereas a significant number of these economies have had substantial restrictions in their financial markets during the period 1970-2003, according to the available indicators of financial openness.

Instead of regarding one indicator as better than the others, this paper will use multiple indicators as each of them gives us some extra information about the actual degree of financial liberalization. The results are similar for different indicators of financial liberalization.

2.4 Data

All the tests are carried out with widely available data and the STATA files are available from the author upon request. The dataset ranges from 1970-2003²². Output and consumption per capita data come from PWT 6.2.

Financial liberalization data come from the sources in Table 2.4 which are publicly available. All data are turned into yearly format and are normalized between zero (0) and one (1), where 0 means no restrictions, and 1 means closed markets. Then τ'_t and ρ'_t are constructed as described in the previous section.

Cross-country productivity is constructed using productivity data from Bosworth and Collins (2003). First, bilateral correlations are calculated for each country. Then, for each country, the author constructs productivity correlations with rest of the world by taking the weighted average of the bilateral correlations, where the weights are import shares as reported by Direction of Trade Statistics Yearbook database provided by the IMF. Rolling windows of different length are constructed for the bilateral correlations and the results do not depend on the window length.

²²Check Bosworth and Collins (2003) for a list of countries.

2.5 Results

Test results for equation number (2.9) are shown in Table 2.5. The first difference of consumption per capita is regressed on the first difference of GDP per capita and various measures of financial liberalization as described by the equation. All the financial indicators used are described in Table 2.4. The results presented are for 10-year rolling windows of productivity correlations, but the results are robust to different window lengths.

Table 2.5 shows the net effects of financial liberalization and changes in cross-country productivity correlations on β_{1t} and β_{2t} . *p-values* are shown in parenthesis. The effects of liberalization are estimated for the average values of ρ , whereas the effects of a change in ρ are estimated for low values of τ (25th percentile), as for high τ the effects can be ambiguous as discussed previously in the paper. The net effect is as predicted and statistically significant in most cases. The results are stronger for the effects of τ , whereas the effects of a change in productivity shock correlations with the rest of the world are smaller, although in some cases statistically different from zero. Our main hypothesis would be that financial impediments affect the measures of consumption smoothing. As it can be seen, overall we fail to reject H_0 for all the available indicators of financial liberalization. For example, for the Miniane indicator (column 1), a one unit decrease in our constructed financial liberalization measure (lower τ'_t) has decreased β_{1t} , the coefficient of regressing domestic consumption on domestic output (in differences), by 0.16 units. This would suggest an increase in consumption risk sharing. On the other hand,

an increase in productivity correlations with the rest of the world that increases ρ'_t by one unit would decrease β_{2t} by 0.11 units, showing a deterioration on consumption smoothing. In general, the effects of a change in cross-country productivity correlations are low in magnitude and sometimes not statistically different from zero.

These results are even stronger for the regressions in levels, which potentially capture some of the longer term effects. Table 2.6 shows results for equation (2.10). Again, the results suggest strong effects of financial liberalization and cross-country productivity correlations on consumption smoothing²³. A one unit decrease in financial restrictions affects β_{1t} by 0.26 units and β_{2t} by -0.45 units. A higher estimate compared to the results in Table 2.5 can be interpreted as this regression capturing some long term effects of financial integration on consumption smoothing. As expected, the effects of financial liberalization on consumption risk sharing may be blurred in the short run. According to PIH, consumers may adjust their consumption in anticipation of future expected changes of their permanent income and this may be one reason why they can change their consumption even though there is no change in financial openness.

On the other hand, the results of equation (2.10) may be influenced by the world output. Fluctuations in aggregate world income that may not have necessarily been reflected

²³more information about the coefficients can be found in Tables 9-11. As a caveat, note that R^2 are really high (as reported). This can be expected because yearly data are used for consumption and output. First, these series can be serially correlated, and, second, a substantial part of output constitutes of consumption.

in country's consumption and output may be erroneously captured by equation (2.10)²⁴. One can also estimate equation (2.11) which uses data on domestic consumption and income per capita and can potentially capture some long term effects. The problem in this case would be that consumption and income are non-stationary and they can commove together. To account for co-integration, panel dynamic OLS are used. By adding first differenced leads and lags of the non-stationary variables on the RHS, PDOLS accounts for bias that may come from simultaneity and serial correlation. Different number of leads and lags show similar results and Table 2.7 presents the results for one lead and one lag. As shown in Table 2.7, the effects of financial liberalization on β_{1t} are stronger in this case, compared to Table 2.5. A decrease in impediments to trading foreign capital that decreases τ' by one unit would decrease β_{1t} by 0.26 units, suggesting a strong effect of financial liberalization on consumption smoothing. For example, if a country has liberalized completely, like Denmark, Finland, etc, the decrease in financial impediments would have decreased β_{1t} by approximately 0.13 units (Table 2.7).

Another point that this study makes is that the effects of liberalization on consumption smoothing is different for different levels of impediments to foreign capital. It would be interesting to perform the same tests for different levels of financial liberalization and compare the results. But, a simple high-low differentiation might not be a good idea. We are ignoring the Capital Account and Current Account measures since they are 0/1

²⁴Note that Y appears in the denominator of both the LHS and RHS of the equation.

indicators. Figure 2.4 shows the distribution for 4 of the constructed measures of financial liberalization used in the regressions above. As it can be seen from the figures, the distribution is pretty scarce and a further segregation of these distributions might spoil the results since in some cases quite a few observations are clustered around the same values. Thus, one should be careful when trying to differentiate among levels of liberalization. We want to differentiate among different degrees of impediments to trade in foreign capital and at the same time, we want our variables to have a distribution.

Table 2.8 shows the results for equation (2.11) when we perform the same tests on the most open 75 percent of the sample (High) and the least open 75 percent (Low). The idea would be that for high degrees of openness, the effects of financial liberalization on consumption smoothing should be stronger. Looking back at Figure 2.1, this can be interpreted as being at the left side of Figure 2.1. The results suggest that the effects are indeed stronger for the most open part of the sample²⁵. For example, for the Miniane indicator, the effect of a unit change in liberalization is 0.22 units for the least open part of the sample, whereas it increases to 0.35 for the most open realizations²⁶. The same tests for the equation in differences suggest similar results (not reported here).

To summarize, this section shows statistically significant evidence that more financial liberalization improves consumption smoothing, whereas increased productivity correla-

²⁵t-tests comparing that one coefficient is statistically greater than the other confirm these results.

²⁶coefficient estimates can be found in Table 12

tions with the rest of the world deteriorate consumption based measures of international consumption risk sharing. It also provides supportive evidence that the effects of liberalization on consumption smoothing are stronger for lower levels of financial impediments.

2.6 Robustness Analysis

Table 2.13 shows pair-wise correlations between the different measures. As it can be seen the measures are correlated with each other, but at the same time the coefficients imply that there are differences between the measures (correlations are not close to 1) and that we are gaining new information from each indicator. The Kaminsky & Schmukler and Abiad & Mody indicators are in general less correlated with the other indicators and this reflects the inclusion of measures for sectors other than capital and current account in these indicators. The other indicators, which are more closely related to the IMF AREAER's are more similar to each other, although there are still differences which suggest each indicator is different from the other. As argued, we don't regard any of them better than the others, but make use of all the information they provide.

The results presented in Table 2.5-2.8 used cross-country productivity correlations for 10-year rolling windows. The same tests were carried out for different time length. 9-year, 8-year and 7-year rolling windows were also considered and the results were very similar, suggesting that the length of the rolling window does not make a difference.

As mentioned in the data section, cross-country productivity correlations were weighted using data from Direction of Trade Statistics Yearbook. The results presented here were done using the weight for each year as reported in DOTS and for the years in which data is not available the most recent available share is used. Other weighting schemes were used, like fixing the shares of a given year as weights, or using an average over all the years, but the results were very similar. Thus, the results are robust to different ways of generating the productivity correlations with the rest of the world, ρ .

Estimates of ρ suggest that the correlations of productivity processes in the developed countries are higher than those of the developing countries²⁷. For example, the average ρ for the industrialized economies is around 0.2, whereas for the developing economies is around 0.07. The same coefficient is very high for Canada, around 0.53, and also high for US and other European countries²⁸. This might explain why some of the studies could not document evidence of consumption smoothing. For example, Heathcote and Perri find that international consumption risk sharing between US, Europe, Canada and Japan has deteriorated. The exceptionally high productivity correlations with the rest of the world for the developed economies may explain these results. When it comes to developing economies, probably the reason why studies do not find improvements in consumption risk sharing is the relatively high level of financial impediments.

²⁷The quantitative considerations in Heathcote and Perri (2004) suggest that the nature of international shocks has changed since the beginning of the 1980's. Imbs (2006) also finds that financial integration increases business cycle correlations.

²⁸ ρ is 0.2 for US, 0.17 for UK, 0.3 for Denmark, and relatively high for Europe. Contact the author for more detailed statistics.

Tables 2.14-2.16 replicate Tables 2.9-2.11 when the sample is standardized to include only countries that have available data for both the Miniane and Kaminsky and Schmukler indicators. Thus, the sample size is the intersection of the Kaminsky & Schmukler and Miniane samples for the years 1983-2002. Again, the results presented in Tables 2.5-2.6 hold, suggesting that these results are robust to the sample size²⁹. For the regression in levels, Table 2.16, the results were robust to using different leads and lags in the PDOLS methodology. The same results hold for the net effects.

The regressions in this study were not constrained, but the estimates suggest that for all actual values of τ and ρ the shares of domestic output will be lower than 1, which was the upper bound on θ imposed by the model. The model also suggests some other constraints on the estimates, which might be subject to further research.

Overall, the results presented in this paper are robust to different specifications and different ways of constructing some of the underlying variables. More importantly, the results are not driven by the set of developed countries, but hold for developed as well as developing countries.

²⁹The results still hold when the sample is dictated by the Miniane indicator only and by Kaminsky and Schmukler indicator only.

2.7 Conclusions and Suggestions for Future Work

Standard open macroeconomic models predict that under financially open markets consumers would be able to benefit from increased risk sharing opportunities. The empirical evidence shows only mixed evidence. This paper investigates the effects of financial liberalization on international consumption risk sharing and tries to answer the question of why do empirical studies fail to observe improvements in consumption smoothing as countries have become more liberalized. First it constructs an empirical framework based on a firmly grounded theoretical model, emphasizing a direct link between theory and empirics that the author thinks has been missing in the previous literature. Then, empirical evidence shows that financial liberalization improves consumption risk sharing. The net effects of cross-country productivity similarities on consumption risk sharing appear to be low, but the analysis show that they should be considered in the literature as they interact with financial impediments and can deteriorate measures of consumption smoothing.

This study adds to the literature of the effects of globalization on consumption smoothing in three different ways. First, it provides an extensive survey of the current literature and discusses in detail the strength and weaknesses of each study. This paper divides studies according to the question they ask. Some studies have been looking at the hypothesis of perfect consumption risk sharing and concluded that there is no perfect risk sharing. Others have been more pragmatic and looked at risk sharing across

groups of countries and through time. Whereas most studies reject the hypothesis of perfect risk sharing, there is some evidence that more open countries have shared more consumption risks or that some countries have benefited more from risk sharing benefits during more financially open periods. This suggests that the actual level of financial impediments to trading foreign capital matters for consumption smoothing and should be explicitly modeled. Another factor that can affect measures of consumption smoothing is the productivity correlations with the rest of the world. The more similar the productivity processes between countries, the fewer incentives are there for consumers to share risks by purchasing foreign assets.

Second, this study develops an empirical framework based on a theoretical model that may shed light on why we fail to see more consumption risk sharing as financial integration has increased. Consumers trade output claims in a two country endowment economy, where output stems from a stochastic process. First trade occurs, then shocks are realized and consumers consume their claims. The purchase of foreign output is subject to a tax. The model shows how consumption based measures of consumption risk sharing depend on the degree of impediments to foreign capital and on the similarity of productivity processes. This model has some nice testable implications. An empirical framework is constructed showing a way to directly measure the effects of financial liberalization and productivity correlations with the rest of the world on measures of consumption smoothing.

Third, this paper provides empirical evidence that more financial liberalization improves consumption smoothing. The effect of financial openness on consumption smoothing is not only statistically significant, but also economically important. The results hold for developed and developing countries.

This study assumed that cross-country productivity correlations are exogenous and not related to financial liberalization. Future work can be focused on investigating whether productivity similarities with the rest of the world have been influenced by financial liberalization. That would determine a potential endogeneity problem that might exist in this paper and help capture better the relation between financial liberalization and consumption smoothing.

Also, more work can be done in defining open and closed periods of financial openness and comparing the extent of consumption smoothing. So far, it has been hard to distinguish between open and closed periods of financial openness because of imperfections with measures of financial liberalization. Different indicators can say different things about the extent of openness of a given country on a given year. For those countries for which different indicators suggest similar degree of openness, preliminary results show that the effects of financial liberalization on consumption smoothing are stronger (not reported in this study) than the results presented in this paper. Future research should

focus on identifying more objective criteria of openness and study the effects of financial liberalization on different economic indicators. Focusing on countries for which there is no disagreement among indicators about the degree of openness can help researchers better understand the benefits of financial globalization.

2.8 Appendix

At the start of the period, the domestic household buys a fraction θ_f of the foreign tree subject to the budget constraint(2.8):

$$\theta P + \theta_f \frac{P^*}{1 - \tau} = P \implies \theta_f = (1 - \tau) \frac{P}{P^*} (1 - \theta)$$

where P and P^* are the prices of the domestic and foreign stocks respectively, and $(1 - \theta)$ is the proportion of the domestic stock sold.

Given a choice for θ , consumption in state s is given by:

$$c(s) = \theta X(s) + \theta_f Y(s) = \theta X(s) + \frac{P}{P^*} (1 - \theta) (1 - \tau) Y(s) \quad (2.12)$$

where θ represents fraction of domestic output held, $X(s)$ and $Y(s)$ represent domestic and foreign outputs, respectively, and τ represents impediments to trade in foreign cap-

ital.

The domestic household solves:

$$\max_{\theta} \{E[u(c_t(s))]\}$$

such that (2.12) and $\theta \leq 1$.

First Order Conditions can be written as:

$$FOC_{\theta} : E[u'(c_t(s))X_t(s)] = \frac{P}{P^*}(1 - \tau)E[u'(c_t(s))Y_t(s)]$$

(provided $\theta < 1$)

Consider the case in which the utility is exponential

$$u(c) = -\frac{1}{A} \exp\{-Ac\}$$

where A is the coefficient of risk aversion.

Assume that X and Y are jointly normally distributed with means μ_x and μ_y , respectively, equal variance σ^2 and correlation coefficient ρ ³⁰.

³⁰Initially assume $\mu_x = \mu_y$. This assumption will be dropped later. Because, the joint distribution over foreign and domestic endowments is perfectly symmetric $P = P^*$ as a result.

Then:

$$FOC_\theta : E[u'(c_t(s))X_t(s)] = (1 - \tau)E[u'(c_t(s))Y_t(s)]$$

$$cov(u'(c_t(s)), X_t(s)) + E[u'(c_t(s))]E[X_t(s)] = (1 - \tau)\{cov(u'(c_t(s)), Y_t(s)) + E[u'(c_t(s))]E[Y_t(s)]\}$$

Applying Stein's Lemma, it can be calculated that:

$$\theta = \frac{(1 - \rho - \tau) + \tau \frac{\mu}{A\sigma^2}}{(2 - \tau)(1 - \rho)}$$

provided $\theta < 1$

for the symmetric case: $c(s) = \theta X(s) + (1 - \theta)Y(s)$

$$\begin{aligned} \theta &= \frac{1}{(2 - \tau)} - \frac{\tau}{(1 - \rho)(2 - \tau)} + \frac{\tau \frac{\mu}{A\sigma^2}}{(1 - \rho)(2 - \tau)} = \frac{1}{(2 - \tau)} + \left(\frac{\mu}{A\sigma^2} - 1\right) \frac{\tau}{(1 - \rho)(1 - \tau)} \\ &= \frac{1}{(2 - \tau)} + \left(\frac{\mu}{A\sigma^2} - 1\right) \frac{1}{(1 - \rho)} \left(-1 + \frac{2}{2 - \tau}\right) = \frac{1}{(2 - \tau)} - \left(\frac{\mu}{A\sigma^2} - 1\right) \frac{1}{(1 - \rho)} + 2\left(\frac{\mu}{A\sigma^2} - 1\right) \frac{1}{(1 - \rho)} \frac{1}{2 - \tau} \end{aligned}$$

and

$$\begin{aligned}
(1 - \theta) &= 1 - \frac{1}{(2 - \tau)} - \frac{\tau}{(1 - \rho)(2 - \tau)} + \frac{\tau \frac{\mu}{A\sigma^2}}{(1 - \rho)(2 - \tau)} \\
&= \frac{2 - \tau - 2\rho + \tau\rho - 1 + \rho + \tau - \tau \frac{\mu}{A\sigma^2}}{(1 - \rho)(2 - \tau)} = \frac{1 - \rho + \tau\rho - \tau \frac{\mu}{A\sigma^2}}{(1 - \rho)(2 - \tau)} \\
&= \frac{1}{2 - \tau} + 1 - \frac{2}{2 - \tau} - \frac{1}{1 - \rho} + 2\frac{1}{2 - \tau} \frac{1}{1 - \rho} + \frac{\mu}{A\sigma^2} \frac{1}{1 - \rho} - \frac{2\mu}{A\sigma^2} \frac{1}{2 - \tau} \frac{1}{1 - \rho} \\
&= 1 - \frac{1}{2 - \tau} + \left(\frac{\mu}{A\sigma^2} - 1\right) \frac{1}{1 - \rho} + 2\left(1 - \frac{\mu}{A\sigma^2}\right) \frac{1}{1 - \rho} \frac{1}{2 - \tau}
\end{aligned}$$

Chapter 3

Financial Liberalization, Industrial Specialization and International Consumption Risk Sharing

3.1 Introduction

Standard models of international asset trade lack mechanisms linking an economy's financial openness and industrial specialization. The contribution of this paper is a simple model of global portfolio diversification in which a link between financial liberalization and specialization emerges very naturally. Within that model, an economy that liberalizes its financial markets is able to share consumption risks, which in turn would allow the country to take extra risks by specializing in its most efficient sector. Output volatility will increase and cross-country output correlations will decline.

The basic theme of this paper goes back to Arrow's (1971 p.137) observation that *"the mere trading of risks, taken as given, is only part of the story and in many respects the less interesting part. The possibility of shifting risks, of insurance in the broadest sense, permits individuals to engage in risky activities that they would not otherwise undertake."* Obstfeld (1994) and Hnatkovska and Evans (2007) show theoretically that the insurance provided by international markets allows countries to expand production in risky sectors, thereby increasing welfare and also output volatility. The much simpler framework this paper chooses emphasizes a link between financial liberalization and specialization, which to the best of my knowledge is missing in the theoretical literature up to date. Kalemli-Ozcan, Sorensen and Yosha (2003) show that risk sharing enhances specialization in production and Kalemli-Ozcan, Papaioannou and Peydro (2009) provides empirical evidence that a higher degree of financial integration is associated with less synchronized output cycles. This paper rationalizes on these findings and shows how financial integration can enhance specialization and trade.

The model is a two-country, two-sector model with linear technology and stochastic productivity shocks. Production uncertainty in the model ensures incomplete specialization. When financial autarky exists, firms will allocate capital to both sectors to ensure against uncertainty in production, even though one of the sectors is more productive. As consumers engage in financial transactions and they ensure part of their consumption,

countries can devote a larger share of their capital to the sector they have a comparative advantage in. As the country moves towards more liberalization this pattern of specialization increases, but it does not have to reach full specialization. The reason why there is no full specialization is because the role of international financial markets is to *share* the risks efficiently, not *eliminate* them. Even in the case of perfect risk sharing, there still exist some risks in production, which will make the consumer not fully specialize, so it can ensure internally against any remaining shocks.

A related study is Koren (2003) that tries to explain the low level of international trade (compared to the predictions of the gravity model) in a multi-sector framework with productivity shocks. In this paper, financial markets are modeled differently. Our specification allows us to observe non full specialization even if the markets are complete. While Koren (2003) requires very strict assumptions, like no country-specific shocks, this study can distinguish between country-specific and sector-specific shock correlations and can track what happens to portfolio choice and different measures of consumption smoothing for different levels of shock correlations. Also, modelling financial markets as in this study, allows us to map financial openness on portfolio choice and production specialization.

A direct consequence of the model is the effect of financial liberalization on consumption smoothing. In this model substantial liberalization may not mean an improvement

in consumption smoothing, consistent with the empirical literature in this area. The actual impediments of trading foreign capital and cross-country productivity correlations can explain why empirical studies fail to find improvements in consumption smoothing as countries have become more financially liberalized. Kose, Otrok and Whiteman (2003) provide evidence of a world business cycle, which suggests a high correlation of business cycles between countries. Heathcote and Perri (2004) argue that as business cycles become more correlated, the gains from diversifying risk become smaller, and this in return decreases the holding of foreign shares from consumers, causing a deterioration in consumption smoothing. Islamaj(2008, 2009) extends this idea for different measures of risk sharing and shows supportive evidence that the increase in productivity shock correlations between a country and the rest of the world may have indeed been a reason why we fail to observe improvements in consumption smoothing as countries get more financially liberalized. The model presented here extends this idea by facilitating the study of the effects of financial liberalization on portfolio choice and consumption smoothing accounting for changes in productivity shock correlations not only between countries, but also between sectors. The relationships between liberalization and risk sharing, and productivity correlations and risk sharing are nonlinear. This nonlinearity is not merely a mathematical fact, but has important implications about consumption smoothing. This paper presents a general equilibrium framework that solves for a closed form solution and can capture the nature of these nonlinearities.

Next section explains the model. First, it explain the basic intuition for the firms' problem. In this economy, firms choose capital, whereas consumers make portfolio choice decisions. I show the solutions for capital allocations for three different cases; first, cross-country and cross-sectoral shock correlations are zero, second, cross-sectoral shock correlations are different from zero, and third, cross-country shock correlations are positive. The results are shown in Section 3.4 and can be summarized as follows. First, more liberalization increases specialization. Second, higher cross-sectoral productivity correlations increase financial diversification and industrial specialization. Finally, higher cross-country productivity correlations, decrease portfolio diversification. For low values of impediments to trading foreign capital, firms try to increase expected profits by increasing specialization, whereas for higher values of impediments firms increase expected profits by diversifying production more. Section 3.4 also shows some implications of the model and further sensitivity analysis. Some concluding remarks and suggestions about future work are written down in the last section.

3.2 The Model

3.2.1 Domestic Firms' Problem

Consumers own k units of capital and sell it to firms with production technology:

$$\begin{aligned}y_a &= z_a A_a k_a \\ y_b &= z_b A_b k_b\end{aligned}\tag{3.1}$$

Consumers sell capital at price p to domestic firms and the firms decide how to allocate the capital between sector a and sector b . The sector specific z_a and z_b represent stochastic productivity shocks and A_a and A_b represent productivity coefficients. In the case of similar productivity shocks, $A_a > A_b$ will mean that in the domestic country sector a is more productive than sector b . Firms sell one share per sector and consumers buy shares at prices q_a , q_b and q_a^* , q_b^* for domestic and foreign shares respectively. Then, shock are realized and consumers consume their claims.

Firms maximize the value of their firm minus costs. The costs in this case are just the capital they purchase and the problem of the domestic firm can be written as below.

Domestic firms' problem:

$$\max_{k_a, k_b \geq 0} \{q_a + q_b - p(k_a + k_b)\}\tag{3.2}$$

where

$$\begin{aligned} q_a &= \sum_s \pi(s)Q(s)z_a(s)A_a k_a \\ q_b &= \sum_s \pi(s)Q(s)z_b(s)A_b k_b \end{aligned} \tag{3.3}$$

and $Q(s)$ is the price of a unit of output in state s , whereas $\pi(s)$ is the probability that state s will occur.

Note that an interior solution requires that $q_a = pk_a, q_b = pk_b$

In equilibrium

$$k_a + k_b = k \quad (\text{assume } k = 1)$$

First Order conditions with respect to k_a and k_b , respectively (assuming interior solution):

$$\begin{aligned} p &= \sum_s \pi(s)Q(s)z_a(s)A_a \\ p &= \sum_s \pi(s)Q(s)z_b(s)A_b \end{aligned} \tag{3.4}$$

which implies:

$$\sum_s \pi(s)Q(s)z_a(s)A_a = \sum_s \pi(s)Q(s)z_b(s)A_b \tag{3.5}$$

and if $Q(s) = u'(c(s))$ then

$$\sum_s \pi(s) u'(c(s)) z_a(s) A_a = \sum_s \pi(s) u'(c(s)) z_b(s) A_b \quad (3.6)$$

This equation will dictate the allocation of capital between sectors. Consumers will buy shares of each sector in the domestic and foreign country. The purchase of foreign shares will be subject to a tax τ that will denote impediments to purchasing foreign capital. λ_a and λ_b (λ_a^* and λ_b^*) will denote holdings of domestic (foreign) share holdings of the domestic consumer in sectors a and b , respectively. The holdings of the foreign consumer will be denoted as η_a^* , η_b^* (η_a , η_b) for the holdings of the foreign (domestic) shares in sectors a and b , respectively. The share of capital that can be pinned down from equation 3.6 will depend on the degree of financial openness, τ . This may not be immediately obvious since consumers do not care where capital is allocated as long as they get paid p for each unit of it, and firms profit do not directly depend on the transaction costs τ . But, firms make their capital allocation decision taking as given the portfolio share choices of the consumers for each sector.

i.e., domestic firm's problem:

$$\max_{k_a, k_b \geq 0} \{q_a + q_b - p(k_a + k_b)\}$$

given, $\lambda_a, \lambda_b, \lambda_a^*, \lambda_b^*$

the same equation is still true:

$$\sum_s \pi(s) u'(c(s)) z_a(s) A_a = \sum_s \pi(s) u'(c(s)) z_b(s) A_b$$

Assuming the utility is exponential $u(c(s)) = -\frac{1}{\theta} e^{-\theta c(s)}$, where $c(s)$ is consumption at state s , and goods a and b are perfect substitutes, and that productivity shocks $z(s)$ come from a multivariate normal distribution, the equation above becomes:

$$(-\theta \text{cov}(c, z_a) + \mu_a) A_a = (-\theta \text{cov}(c, z_b) + \mu_b) A_b \quad (3.7)$$

where μ_a and μ_b are the means of the productivity shock in each sector. The standard deviations of these shocks will be assumed all equal to σ . Because the four shocks come from a multivariate normal distribution, there exist 6 correlations between them that will affect the correlations of output produced across sectors and across countries. Let's denote the correlation between productivity shock in domestic (foreign) sectors a and b as $\rho_{ab}(\rho_{a^*b^*})$, the correlation of productivity shocks across countries for sectors a and b as ρ_{aa^*} and ρ_{bb^*} , respectively, and the correlation across different sectors in different countries as ρ_{ab^*} (for sector a in the domestic country and sector b in the foreign country) and ρ_{a^*b} (for the correlation between domestic sector b and foreign sector a). For the rest of the paper we'll assume that $\rho_{ab^*} = \rho_{a^*b} = 0$, and will focus only on what happens when the productivity correlations across sectors and across countries change.

Case 1: Assuming all $\rho_{ab} = \rho_{a^*b^*} = \rho_{aa^*} = \rho_{bb^*} = \rho = 0$:

The covariances in equation 3.7 will be defined as:

$$\text{cov}(c, z_a) = \lambda_a k_a A_a \sigma^2 \quad (3.8)$$

$$\text{cov}(c, z_b) = \lambda_b k_b A_b \sigma^2 = \lambda_b (1 - k_a) A_b \sigma^2$$

and 3.7 can be re-written as:

$$A_a(-\theta \lambda_a k_a A_a \sigma^2 + \mu_a) = A_b(-\theta \lambda_b (1 - k_a) A_b \sigma^2 + \mu_b) \quad (3.9)$$

This equation implies that:

$$k_a = \frac{\lambda_b A_b^2}{\lambda_a A_a^2 + \lambda_b A_b^2} + \frac{\mu_a A_a - \mu_b A_b}{\theta \sigma^2 (\lambda_a A_a^2 + \lambda_b A_b^2)} \quad (3.10)$$

Thus, the firm chooses the capital taking portfolio holdings λ_a and λ_b as given. (analogous for k_a^*)

Note that for $A_a = A_b$ and same mean of the shocks, $k_a = \frac{1}{2}$

Case 2: assuming $\rho_{ab} = \rho_{a^*b^*} = \rho \neq 0$ and $\rho_{aa^*} = \rho_{bb^*} = 0$: i.e., cross-sectoral productivity correlations are different from zero.

In this case, the covariances in equation 3.7 will be defined as:

$$\text{cov}(c, z_a) = \lambda_a k_a A_a \sigma^2 + \lambda_b A_b (1 - k_a) \rho \sigma^2 \quad (3.11)$$

$$\text{cov}(c, z_b) = \lambda_a k_a A_a \rho \sigma^2 + \lambda_b (1 - k_a) A_b \sigma^2$$

and,

$$(-\theta \text{cov}(c, z_a) + \mu_a)A_a = (-\theta \text{cov}(c, z_b) + \mu_b)A_b \quad (3.12)$$

This equation implies that:

$$k_a = \frac{\lambda_b A_b (A_b - A_a \rho) + \frac{1}{\theta \sigma^2} (\mu_a A_a - \mu_b A_b)}{\lambda_a A_a^2 - (\lambda_a + \lambda_b) A_a A_b \rho + \lambda_b A_b^2} \quad (3.13)$$

Note that for $\rho = 0$, equation 3.13 turns into equation 3.10.

3.2.2 Foreign Firm's Problem

The firm in the foreign country solves an analogous problem. Denoting the value of sectors a and b in the foreign country as q_a^* and q_b^* , and the capital allocation as k_a^* and k_b^* , respectively the foreign firms' problem becomes:

$$\max_{k_a^*, k_b^* \geq 0} \{q_a^* + q_b^* - p^*(k_a^* + k_b^*)\} \quad (3.14)$$

which implies:

$$\sum_s \pi(s) Q^*(s) z_a^*(s) A_a^* = \sum_s \pi(s) Q^*(s) z_b^*(s) A_b^*$$

and if $Q^*(s) = u'(c^*(s))$ then

$$\sum_s \pi(s) u'(c^*(s)) z_a^*(s) A_a^* = \sum_s \pi(s) u'(c^*(s)) z_b^*(s) A_b^*$$

Making the same assumptions as for the domestic country, this equation can be re-written as:

$$(-\theta \text{cov}(c^*, z_a^*) + \mu_a^*) A_a^* = (-\theta \text{cov}(c^*, z_b^*) + \mu_b^*) A_b^* \quad (3.15)$$

where μ_a^* and μ_b^* are the means of the productivity shock in each sector.

Case 3: assuming $\rho_{aa^*} = \rho_{bb^*} = \rho \neq 0$ and $\rho_{ab} = \rho_{a^*b^*} = 0$: i.e., cross-country productivity correlations are different from zero.

In this case, capital allocations for each sector in the domestic and foreign countries can be pinned down by the following set of equations which are derived from the first order condition of the domestic and foreign firm's problem

$$(-\theta \text{cov}(c, z_a) + \mu_a) A_a = (-\theta \text{cov}(c, z_b) + \mu_b) A_b \quad (3.16)$$

$$(-\theta \text{cov}(c^*, z_a^*) + \mu_a^*) A_a^* = (-\theta \text{cov}(c^*, z_b^*) + \mu_b^*) A_b^* \quad (3.17)$$

where,

$$\text{cov}(c, z_a) = \lambda_a k_a A_a \sigma^2 + \lambda_a^* A_a^* k_a^* \rho \sigma^2 \quad (3.18)$$

$$\text{cov}(c, z_b) = \lambda_b (1 - k_a) A_b \sigma^2 + \lambda_b^* (1 - k_a^*) A_b^* \rho \sigma^2$$

$$\text{cov}(c^*, z_a^*) = \eta_a^* k_a^* A_a^* \sigma^2 + \eta_a A_a k_a \rho \sigma^2$$

$$\text{cov}(c^*, z_b^*) = \eta_b^* (1 - k_a^*) A_b^* \sigma^2 + \eta_b (1 - k_a) A_b \rho \sigma^2$$

From these equations one can find that:

$$k_a = \frac{\alpha_1 \alpha_4 - \alpha_2 \alpha_5}{\alpha_3 \alpha_4 - \alpha_5 \alpha_6} \quad (3.19)$$

and

$$k_a^* = \frac{\alpha_2 \alpha_3 - \alpha_1 \alpha_6}{\alpha_3 \alpha_4 - \alpha_5 \alpha_6} \quad (3.20)$$

where,

$$\begin{aligned}
\alpha_1 &= \frac{\mu}{\theta\sigma^2}(A_a - A_b) + \lambda_b A_b^2 + \lambda_b^* A_b A_b^* \rho \\
\alpha_2 &= \frac{\mu}{\theta\sigma^2}(A_a^* - A_b^*) + \eta_b^* A_b^{*2} + \eta_b A_b A_b^* \rho \\
\alpha_3 &= \lambda_a A_a^2 + \lambda_b A_b^2 \\
\alpha_4 &= \eta_a^* A_a^{*2} + \eta_b^* A_b^{*2} \\
\alpha_5 &= (\lambda_a^* A_a A_a^* + \lambda_b^* A_b A_b^*) \rho \\
\alpha_6 &= (\eta_a A_a A_a^* + \eta_b A_b A_b^*) \rho
\end{aligned}$$

and $\lambda_a, \lambda_b, \lambda_a^*, \lambda_b^* (\eta_a^*, \eta_b^*, \eta_a, \eta_b)$ are the holdings of the domestic and foreign portfolios of the domestic (foreign) consumer on sectors a and b , respectively.

3.2.3 Consumer's Problem

Consumers will choose portfolio shares for each sector that will maximize their expected utility, taking the capital allocation as given from the firm's problem. Consumer's problem becomes:

$$\max_{\lambda_a, \lambda_b, \lambda_a^*, \lambda_b^* \in [0,1]} \sum_s \pi(s) u(c(s)) \quad (3.21)$$

given k_a (and k_a^*)

s.t.

$$q_a \lambda_a + q_b \lambda_b + \frac{1}{(1-\tau)} (q_a^* \lambda_a^* + q_b^* \lambda_b^*) = pk \quad (3.22)$$

$$c(s) = \lambda_a y_a(s) + \lambda_b y_b(s) + \lambda_a^* y_a^*(s) + \lambda_b^* y_b^*(s) \quad (3.23)$$

Purchasing foreign capital will be subject to a tax τ . For $\tau = 0$, financial markets will be fully liberalized. As τ increases, it will be costlier for the consumer to buy shares of the foreign sectors and the consumers will bias his/her portfolio towards domestic portfolio holdings. For high enough τ , the consumers will not purchase any more shares of the foreign sectors. In this case, it can be said that financial markets are in autarky and no trade in financial assets takes place.

First order conditions for the domestic consumer (assuming all stock purchases interior):

$$\begin{aligned} -q_a \psi + \sum_s \pi(s) u'(c(s)) \frac{\partial}{\partial \lambda_a} c(s) &= 0 \\ -q_b \psi + \sum_s \pi(s) u'(c(s)) \frac{\partial}{\partial \lambda_b} c(s) &= 0 \\ -q_a^* \psi + (1 - \tau) \sum_s \pi(s) u'(c(s)) \frac{\partial}{\partial \lambda_a^*} c(s) &= 0 \\ -q_b^* \psi + (1 - \tau) \sum_s \pi(s) u'(c(s)) \frac{\partial}{\partial \lambda_b^*} c(s) &= 0 \end{aligned} \quad (3.24)$$

and

$$c(s) = \lambda_a z_a(s) A_a k_a + \lambda_b z_b(s) A_b (1 - k_a) + \lambda_a^* z_a^*(s) A_a^* k_a^* + \lambda_b^* z_b^*(s) A_b^* (1 - k_a^*)$$

(analogous for the foreign consumer)

Three independent equations come out of these FOC's. Analogously, three more equations are derived from the foreign consumer and 4 more equations represent the stock market clearance conditions as below:

$$\begin{aligned}
 \lambda_a + \eta_a &= 1 \\
 \lambda_b + \eta_b &= 1 \\
 \lambda_a^* + \eta_a^* &= 1 \\
 \lambda_b^* + \eta_b^* &= 1
 \end{aligned}
 \tag{3.25}$$

From these 10 equations, one can pin down 8 portfolio choices (for the domestic and foreign consumers) and prices p and p^* that consumers sell their capital to firms for each value of impediments to foreign capital τ .

3.2.4 Definition of Equilibrium

Denote $s \equiv (s_a, s_b, s_a^*, s_b^*)$

An equilibrium is a set of quantities $\lambda_a(s), \lambda_b(s), \lambda_a^*(s), \lambda_b^*(s), \eta_a^*(s), \eta_b^*(s), \eta_a(s), \eta_b(s)$, prices p, p^* , and productivity shocks $z_a(s_a), z_b(s_b), z_a^*(s_a^*), z_b^*(s_b^*)$ which satisfy the following conditions:

1. Market clearing condition for goods:

$$c_a + c_a^* = y_a + y_a^* = k_a A_a z_a + k_a^* A_a^* z_a^*,$$

$$c_b + c_b^* = y_b + y_b^* = k_b A_b z_b + k_b^* A_b^* z_b^*$$

2. Market clearing condition for stocks:

$$\lambda_a + \eta_a = 1 \quad \lambda_a^* + \eta_a^* = 1$$

$$\lambda_b + \eta_b = 1 \quad \lambda_b^* + \eta_b^* = 1$$

3.3 Symetric case

Consider the case when both countries are symmetric:

$$A_a = A_b^* = A \tag{3.26}$$

$$A_b = A_a^* = B$$

$$p = p^*$$

which implies:

$$k_a = 1 - k_b = k_b^* = 1 - k_a^* \tag{3.27}$$

$$\lambda_a = 1 - \eta_a = \eta_b^* = 1 - \lambda_b^*$$

$$\lambda_b = 1 - \eta_b = \eta_a^* = 1 - \lambda_a^*$$

In this case, the equilibrium λ_a and λ_b can be pinned down by the first two independent equations coming out of the FOC's. The next section will show the portfolio holdings, capital allocations and consumption smoothing for each value of τ . More sensitivity analysis will show what happens when cross-country and cross-sectoral productivity correlations change.

3.4 Results

3.4.1 Implications of the Model

This section discusses some theoretical implications of this model. First, it studies the holdings of shares for each sector and capital allocation across sectors as the country gets more financially liberalized. As liberalization increases, the consumer holds less shares of the domestic sectors and starts buying more shares of the foreign sectors. Also, with liberalization more capital is allocated to the most productive sector. Next, it discusses the implications of this model about the relationship between financial liberalization and consumption smoothing. Then, it looks at what happens to portfolio shares for each sector as the productivity correlations change. Given the complexity of this model, it is easy to distinguish between the effects of a change in cross-country and cross-sector productivity correlations. It can be shown that the more similar the productivity processes between countries, the lower the amount of asset trade among countries. The intuition

would be that gains from sharing risks would be smaller. On the other hand, the higher the correlation between productivity processes between sectors in each country, the lower the portfolio shares of the domestic sectors and the higher the incentives of individuals to share income risks abroad. This section also discusses the effects of a change in cross-country and cross-sector productivity correlations on capital allocation across sectors.

Financial Liberalization, Portfolio Holdings and Industrial Specialization

This model provides a framework to relate financial liberalization, portfolio shares and specialization. Most importantly, in this framework countries do not necessarily fully specialize in one good, even if they can produce it more efficiently. Incomplete specialization is achieved because of uncertainty in technology. As explained above, individuals in each country face uncertainty in both sectors. If they specialize in only one sector, then there exists a possibility that they will be faced with a bad shock and not be able to meet their consumption needs. If there was financial autarky, countries would share this risk internally by allocating capital in both sectors. When financial markets are open, the consumer engages in trading claims to production with the other country. In this case, the consumer are provided with an extra insurance and this "insured wealth" allows the countries to expand production in their most productive sector without jeopardizing their consumption. But, financial markets serve only to *share* risks efficiently, not to *eliminate* them (even when markets are complete). Thus, production risk is still

present, and as a result we do not see full specialization in production.

Figure 3.1 shows what happens to portfolio holdings as impediments to trade in foreign capital decrease. The parameters of the model are similar to those in Chapter 2; $\mu = 2, \sigma^2 = 0.01, \theta = 1$ and $A_a = 1.001, A_b = 1$ (See Chapter 2 for more details on how to interpret these values). Note that $A_a > A_b$, meaning that sector a is more productive than sector b . Moving left on the horizontal axis represents less frictions in buying foreign assets and can be represented as financial liberalization. As countries become more open, the consumer holds less shares of the domestic sectors. Purchases of foreign sectors also increase as financial openness increases (not shown in the figure). Full liberalization corresponds to a portfolio share of $1/2$ for each sector as in Heathcote and Perri (2004). The results are similar for holdings in sector b and foreign holdings are 0 for restrictive impediments, whereas go up to $1/2$ for fully liberalized markets.

Figure 3.2 shows what happens to the capital share in sector a as financial restrictions decrease. As discussed, for high values of τ , which correspond to closed financial markets, individuals in each country engage in the production of both goods in order to avoid the risks stemming from volatility in each sector. As impediments to trade in foreign capital decrease and consumers start buying shares of the foreign sectors (as shown in Figure 3.1), consumers in each country enjoy some extra insurance. Firms, which care about their shareholders, respond by expanding production in the most efficient sector. The

figure shows what happens to capital allocation in sector "a" in the domestic country (capital allocation in sector "b" is just one minus capital in sector "a"). As expected, although there is some specialization, the countries do not fully specialize because there still exists some production risk that is not fully insured. The results are analogous for the foreign country (note that in the foreign country sector b is more efficient).

This framework allows us to track changes in portfolio choice, capital supply and other variables as countries liberalize their accounts. Everything else equal, there exists a non-increasing relationship between liberalization and portfolio shares, as well as a monotonic relationship between openness and capital allocation in each sector. Note that this relationship is nonlinear and the more liberalized the country the larger the effect of financial liberalization on capital allocation. Later the model will study the effects of changes in cross-country and cross-sector productivity correlations on portfolio shares and capital allocation.

Financial Liberalization, Productivity Shock Correlation and Consumption Risk Sharing

The literature on consumption risk sharing falls into three broad categories. The first strand emphasizes that in complete financial markets, marginal utility growth should be

equated across countries so that consumption growth rates should be highly correlated. This correlation-based approach predicts that, absent financial market frictions, not only should consumption be highly correlated across countries, but it also should be more correlated than output (Backus, Kehoe and Kydland (1995)). A second strand of the empirical consumption risk sharing literature has focused on regression-based measures. These studies emphasize an alternative prediction of the complete markets model: fluctuation in relative marginal utility growth should be independent of idiosyncratic risk (as measured by relative output growth rates). Therefore, the coefficient of a regression of relative consumption growth on relative output growth should be low under high degrees of financial liberalization (Mace (1991), Cochrane (1991), Lewis (1996)). The acknowledgement that real financial markets are likely to be incomplete has led researchers to adopt a more pragmatic approach in applied work, and argue that the coefficient of this regression can be of interest in itself and that it should be interpreted as a measure of the deviation from the complete markets outcome (Asdrubali, Sorensen and Yosha (1996), Crucini (1999)). Another prediction in the theoretical literature of consumption risk sharing is that volatility of consumption should be low in financially open settings (some recent studies have been looking at the ratio of consumption volatility and output volatility to better control for output crises) (Obstfeld and Rogoff (1996), Kose, Prasad and Terrones (2003)).

Figure 3.3 shows what happens to the measures of consumption smoothing as re-

restrictions to trade in capital shares decrease (Consumption volatility also decreases as the country becomes more liberalized (not shown in the Figure)). The dotted thick blue line shows $corr(c, c^*)$. Standard theories predict that in financially open environments consumption should be highly correlated across countries. The solid red line shows $corr(c, y)$, the correlation between domestic consumption and domestic output. A lower correlation would correspond to better consumption risk sharing. For all these measures of consumption smoothing, more liberalization means better smoothing, everything else equal. It should be noted that this relationship is highly nonlinear and the actual level of impediments to capital matters. For example, for high levels of τ in Figure 3.3 as impediments to trade in foreign capital decline, there is little change in $corr(c, y)$ (dotted line). Only for low τ do we observe an increase in consumption smoothing as restrictions to trading capital shares decrease.

All these available measures of consumption risk sharing are associated with potential advantages and disadvantages (see Artis and Hoffmann (2004) for a more complete discussion). So far, the literature has not considered any one measure better than the others, but it has been using them interchangeably. This framework can highlight some of the differences across these measures. First, as openness increases consumption smoothing improves with an increasing rate for the $corr(c, y)$ measure (lower $corr(c, y)$ means better consumption smoothing), whereas improves at a decreasing rate when $corr(c, c^*)$ is used as a measure of consumption risk sharing. Second, whereas $corr(c, c^*)$ can increase from 0

to 1 as openness increases, $corr(c, y)$ declines only from 1 to approximately 0.7 ($\rho = 0$). Thus, although both measures suggest better consumption smoothing as liberalization increases, the effects of an incremental change in liberalization differ both qualitatively and quantitatively across measures.

3.4.2 The Role of Productivity Shock Correlations and Further Sensitivity Analysis

What happens if productivity shock correlations between countries and/or sectors are greater than zero? Figure 3.4 shows a scenario where productivity correlations across sectors, for each country, are different from zero, but cross country productivity shock correlations are zero, i.e., $\rho_{ab} = \rho_{a^*b^*} = \rho = 0.2$, but $\rho_{aa^*} = \rho_{bb^*} = 0$ ¹. Again, the solid line shows the case when all productivity correlations are zero and the dotted line shows the case when productivity correlations across sectors for each country are positive. As can be seen from the figure, the more similar the productivity processes across sectors the lower the shares of the domestic sector a held (the curve shifts down). The intuition would be because the gains to diversifying risk across sectors are lower, so the consumers choose to diversify risks across countries.

¹Chapter 2 calculates the average productivity correlations with the rest of the world to be approximately 0.07 for developing countries and around 0.2 for developed ones. See Chapter 2 for more details.

Figure 3.5 shows what happens to capital allocation for a low and high correlation of productivities between sectors within a country as impediments to capital decrease. In this case sector a is more productive in the home country and sector b is more productive in the foreign country. Again, we see some specialization as the countries liberalize their capital accounts, but not full specialization. For each τ , the green dashed line (which corresponds to higher shock correlations) shows a higher level of specialization than the blue solid line (low level of productivity correlations). The intuition would be that the more similar the productivity processes, the higher the probability of experiencing the same loss however you diversify, so the individuals have a higher incentive to focus their production in the sector that will give them more output. Again, not all risks are eliminated, so full specialization will not occur.

Figure 3.6 shows what happens for every level of τ when all productivity correlations are zero (solid line) and when cross-country productivity correlations for each sector are positive, i.e., $\rho_{aa^*} = \rho_{bb^*} = \rho = 0.2$. As expected, the consumer holds a higher share of the domestic sectors in this case because gains from risk sharing are smaller. Higher cross-country productivity correlations provide fewer incentives to buy shares of the foreign country.

Figure 3.7 maps measures of consumption smoothing on impediments to trade in for-

eign capital. It also shows what happens to these relationships as cross-country productivity correlations increase (ρ_{aa^*} and ρ_{bb^*}). As expected, higher productivity correlations deteriorates consumption smoothing. $Corr(c, y)$ jumps up and this will correspond to a decline in consumption risk sharing, whereas $corr(c, c^*)$ shifts down and this will mean a deterioration in consumption smoothing as well. For higher cross-sector productivity correlation, the story is exactly the opposite and consumption risk sharing improves as countries purchase more foreign assets.

Figure 3.8 shows what happens for every level of τ when all productivity correlations are zero (solid line) and when both cross-country and cross-sectoral productivity correlations are positive, i.e., $\rho_{aa^*} = \rho_{bb^*} = \rho_{ab} = \rho_{a^*b^*} = \rho = 0.2$. In all cases the curves jump upwards. But we read these measures differently. We say that a country is better able to smooth consumption if it experiences a higher $corr(cc^*)$ and/or a lower $corr(c, y)$. In Figure 3.8 we can see that an increase in productivity correlation with the rest of the world deteriorates consumption risk sharing if the measure of consumption smoothing is $corr(c, y)$, but it improves consumption risk sharing if one uses $corr(cc^*)$. Thus, the effect of a change in cross-sector and/or cross-country productivity correlation is different across measures of consumption smoothing. As discussed, so far the literature has treated all these measures as equivalent, but as seen in Figure 3.8 they can respond differently to different changes in productivity shock correlations. More research on differences across measures of consumption risk sharing is necessary.

Figure 3.9 shows what happens to capital allocations as cross-country productivity correlations increase. In this case, there are two opposing effects at work. First, as countries become more similar, there are fewer incentives to diversify abroad and this will lead to more diversification of production at home. On the other hand, as cross-country correlations increase, aggregate volatility increases, which in turn will make portfolio diversification less profitable. Firms at home will prefer to switch capital to the more productive sector a as the consumer buys less shares of sector a abroad. Figure 3.9 shows that for high enough impediments to purchasing foreign assets, the former effect dominates and firms diversify production at home. For low restrictions, as cross-country productivity shock correlations increase, firms put more capital to the more productive sector a .

Figure 3.10 shows what happens to output correlations as the country liberalizes its financial markets. Because more liberalization provides extra consumption insurance and allows countries to specialize in their most productive sector, output across countries will become less correlated as countries open their financial markets. This is in line with the empirical findings of Kalemli-Ozcan, Papaioannou and Peydro (2009). Figure 3.11 shows that output volatility also increases as impediments to purchasing foreign capital decrease, which is the result of Obstfeld (1994) and Evans and Hnatkovska (2007). For the parameter values used in this paper, Output volatility has increased by more than 3%.

This study develops a framework that allows us to map financial liberalization and portfolio choice in a two dimensional framework. It shows a link between financial openness and output volatility. As countries become more financially open and engage in asset trade, they will use the extra consumption insurance provided by the international asset markets to take more risks and will expand production in their most productive sector. In return output volatility will increase and cross-country output correlations will decline. This model also allows us to map changes in specialization and consumption risk sharing as financial markets become more open. *Ceteris parabus*, there exists a decreasing relationship between liberalization and portfolio shares in each sector, as well as between openness and consumption risk sharing. This is what standard theories suggest, but there are a few caveats to these results. First, higher cross-country (cross-sector) productivity correlations imply higher (lower) portfolio shares in the domestic sectors. Second, if a country has liberalized, but at the same time its productivity correlations with the rest of the world has increased, we may see an increase in portfolio shares, as opposed to a decrease as standard theories suggest.

Another caveat goes to the measures of consumption smoothing. I have picked two measures of consumption risk sharing interchangeably used in the literature. The model shows that these measures respond differently to changes in productivity shock correlation between countries and between sectors. This calls for a more careful consideration

of the measures of consumption risk sharing in the literature.

Further sensitivity analysis tries several things. First, a higher θ , the risk sharing coefficient corresponds to higher share holdings of the domestic firms and less specialization for each τ (except for $\tau = 0$ where we see full diversification of assets). A higher mean of the productivity shock z in sector a in domestic country, corresponds to more specialization in home country than abroad and more shares of the domestic firms. A higher mean in both sectors in home country corresponds to more shares in both domestic sectors.

This paper presents a simple model of international asset trade that shows that more financial liberalization will provide countries with more consumption insurance. This extra insurance, in return, will enable countries to take extra risks and expand production in their most productive sector. Output volatility will increase and output across countries will be less correlated. These results are supported by recent empirical work.

3.5 Conclusions and Future Work

International financial markets have become increasingly integrated in the past two decades. Recent empirical studies (Kalemli-Ozcan, Sorensen and Yosha (2003) and Kalemli-Ozcan, Papaioannou and Peydro (2009)) show that a higher degree of financial integration is associated with more specialization and lower output correlations across

countries. This paper presents a simple model of international financial trade that relates financial openness with industrial specialization and output volatility. As countries open their financial markets and engage in asset trade with foreign countries, they increase their consumption insurance. This extra insurance would allow the countries to take more risks, and, as a result, they will expand the production on their most efficient sectors. In return, they will experience a higher output volatility. Also, lower cross-country output correlations will be observed.

This framework has important implications for the consumption smoothing literature. Theoretical studies predict that country portfolios should be heavily biased towards foreign assets, leading to highly correlated consumption growth rates between countries and low correlations between growth of domestic consumption and domestic output. However, empirical studies investigating the effects of financial integration on consumption smoothing are at best inconclusive, failing to find support to the theoretical predictions of this literature. This paper develops a two-country, two-sector framework with uncertainty in production to reconcile theory and data. In particular, this paper analytically solves for the equilibrium consumption based measures of risk sharing. The two countries receive stochastic productivity shocks which are then combined with capital to produce final consumption goods. Consumers own domestic capital and can buy shares of foreign capital subject to a tax which represents market restrictions in this model.

In this setup, consistent with the data, consumption based measures of risk sharing may deteriorate even when the countries liberalize their financial markets substantially. The model suggests that financial market frictions, and increases in productivity shock correlations between two countries, may help explain why we fail to see improvements in consumption risk sharing as countries have become more financially integrated. There exists a monotonic relationship between financial liberalization and consumption smoothing, i.e., more liberalization means that countries are able to better smooth their consumption risks, but this relationship is nonlinear and the actual level of impediments to buying foreign capital matters for the extent of risk sharing. Further, an increase in productivity shock correlations between two countries as financial markets liberalize may reduce the gains of diversifying consumption and cause the measures of consumption risk sharing to deteriorate. The paper shows how the relationship between financial integration and consumption smoothing is qualitatively consistent with facts documented in the empirical literature in this area.

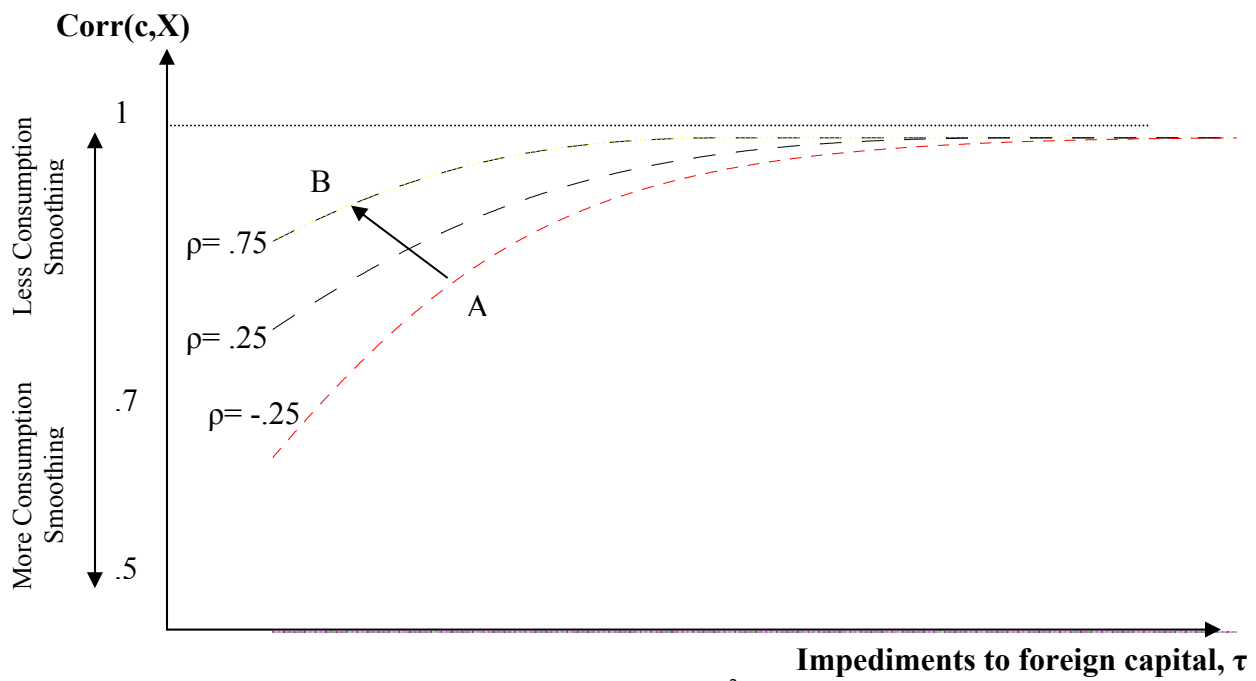
This paper also highlights some differences across different measures of consumption smoothing. So far, the literature has not differentiated between these measures and has been using them interchangeably. This study suggest that there are both qualitative and quantitative differences across the relationships between financial liberalization and these measures and consumption smoothing. For example, focusing on cross-country consumption correlations consumption smoothing would improve at a decreasing rate as

liberalization increases and it can improve from 0 (low consumption smoothing) to 1 (high consumption smoothing). On the other hand, using correlations between domestic consumption and output as the measure of consumption risk sharing, consumption smoothing will improve with an increasing rate as the country becomes more open. Also, consumption smoothing will only improve from 1 (low consumption smoothing) to approximately 0.7 (low consumption smoothing). Furthermore, cross-country and cross-sector productivity correlations affect these measures differently. An increase in both cross-country and cross-sector productivity correlations will deteriorate consumption smoothing according to the response of the correlation between domestic consumption and domestic output, but will improve consumption smoothing according to the response of the cross-country consumption correlations. Further research studying the differences across these measures can be done in the future.

Also, future work should consist in analyzing further the effects of productivity shock correlations between countries and between sectors on consumption smoothing. It is interesting and more realistic to investigate these relationships adding investment to the analysis. Also, dynamic considerations, abstracted in this study are important directions in which this literature should be further developed. In the end, assuming that the goods are not perfect substitutes and solving this model can help one analyze the relationship between liberalization and trade and test this theory empirically.

Appendix A: Figures and Tables

Figure 1.1: Financial Openness and Consumption Smoothing



Note: The choice of parameters in Figure 1 is: $\mu = 2$, $A = 1$ and $\sigma^2 = 0.2$

Figure 2.1: Financial Liberalization and Correlation between Own Consumption and Income:

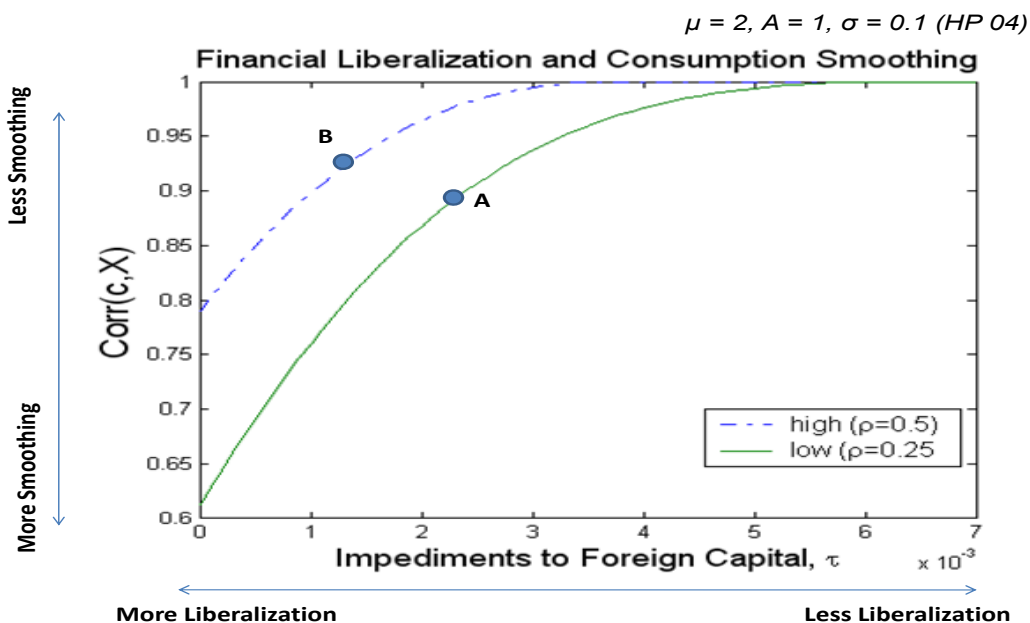
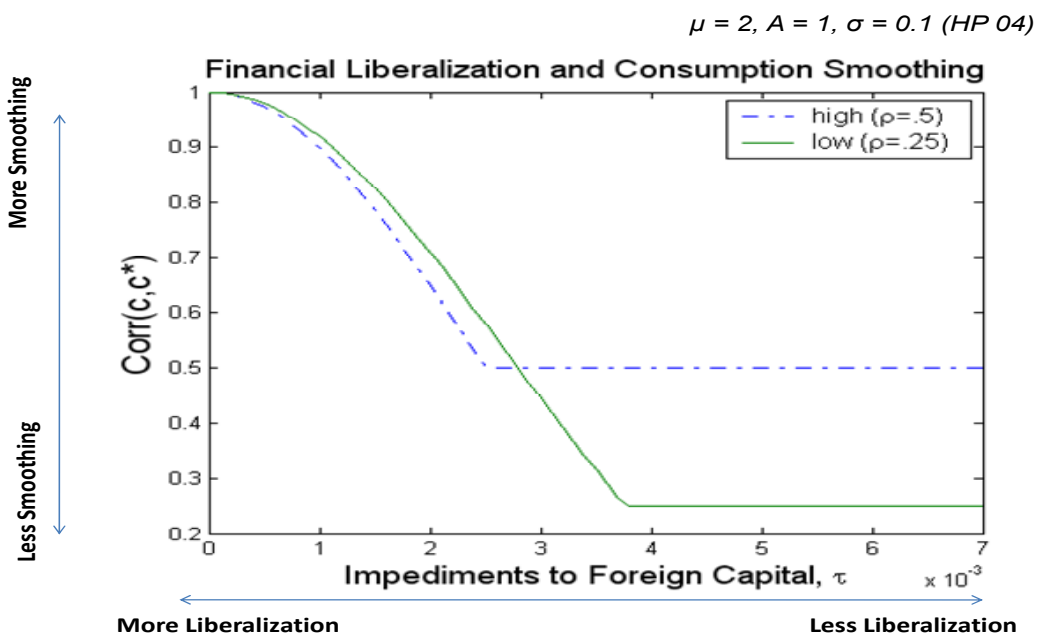
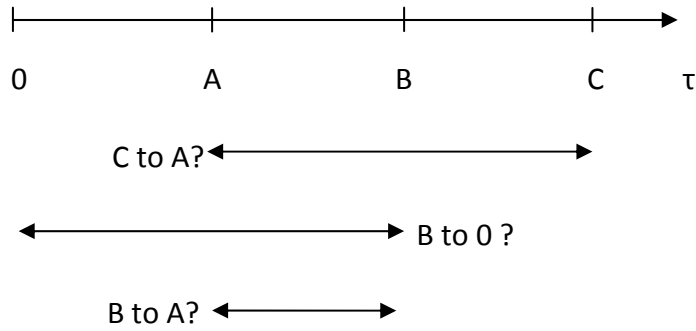


Figure 2.2: Financial Liberalization Correlation between Own and ROW Consumption



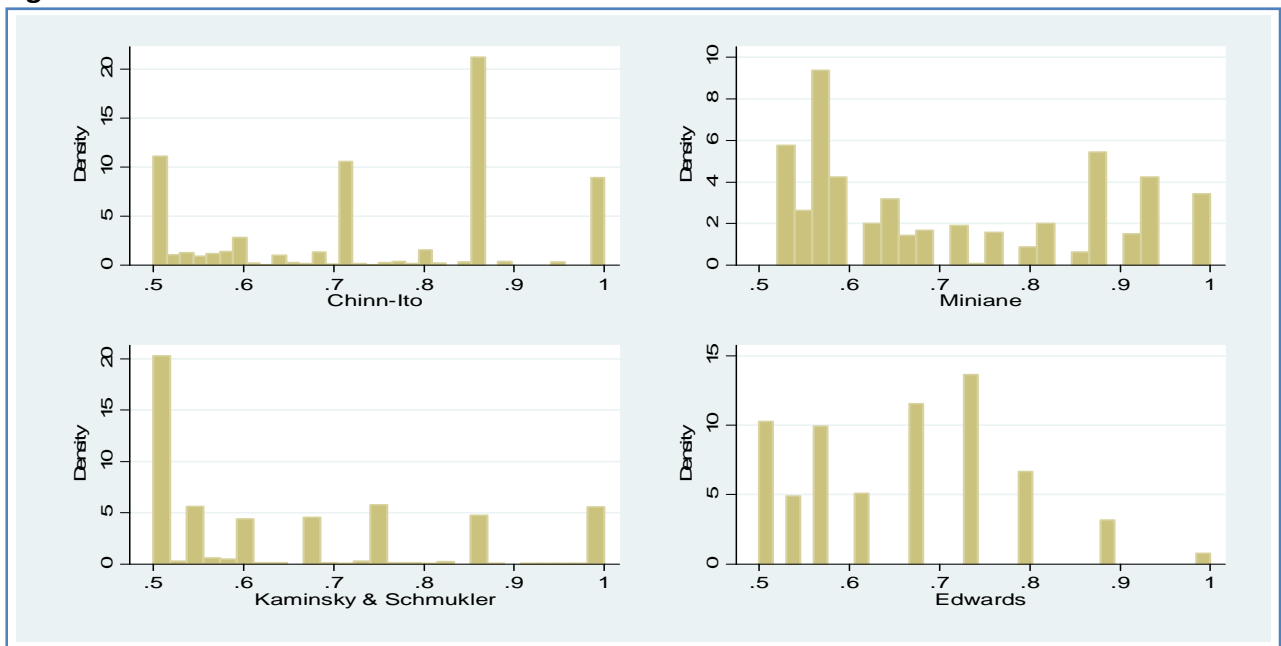
Notes: Figure 1-2 shows a mapping of impediments to trade in purchasing foreign capital and different measures of consumption smoothing as described in the model above for the symmetric case. The parameters used are $\mu=2$, $A=1$ and $\sigma=0.1$. The scale of τ (horizontal axis) is consistent with the story that even small impediments may shut down financial markets (Cole and Obstfeld (1991)).

Figure 2.3: Mapping Financial Liberalization Indicators into the Model



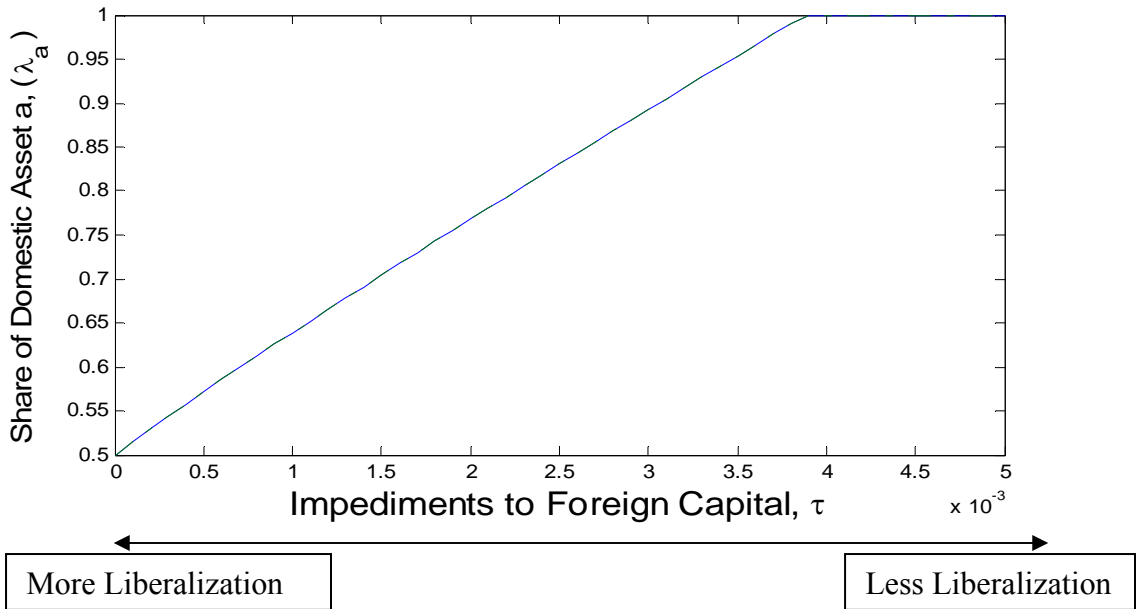
Note: This Figure is used to explain the mapping of any of the financial liberalization indicators in the model.

Figure 2.4: Distribution of Constructed Liberalization Measures



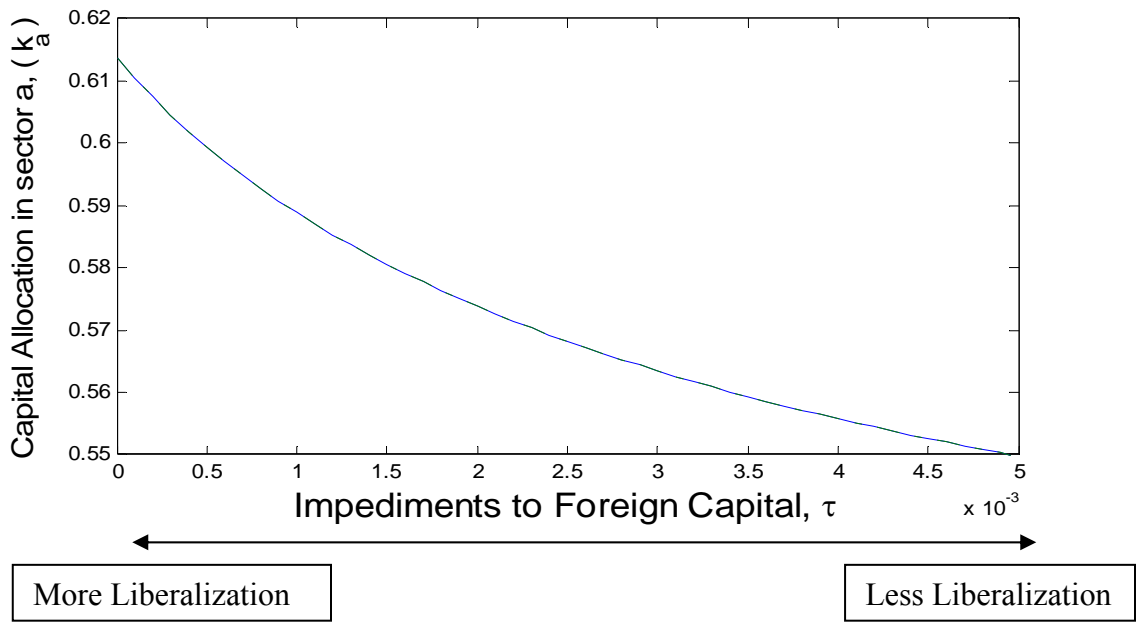
Note: This Figure shows the distribution of the constructed measures of financial liberalization as explained in the text. Each indicator is standardized from 0 (most open) to 1 (most closed) and then the variable $1/(2-\text{indicator})$ is constructed.

Figure 3.1: Liberalization and Home Portfolio Share



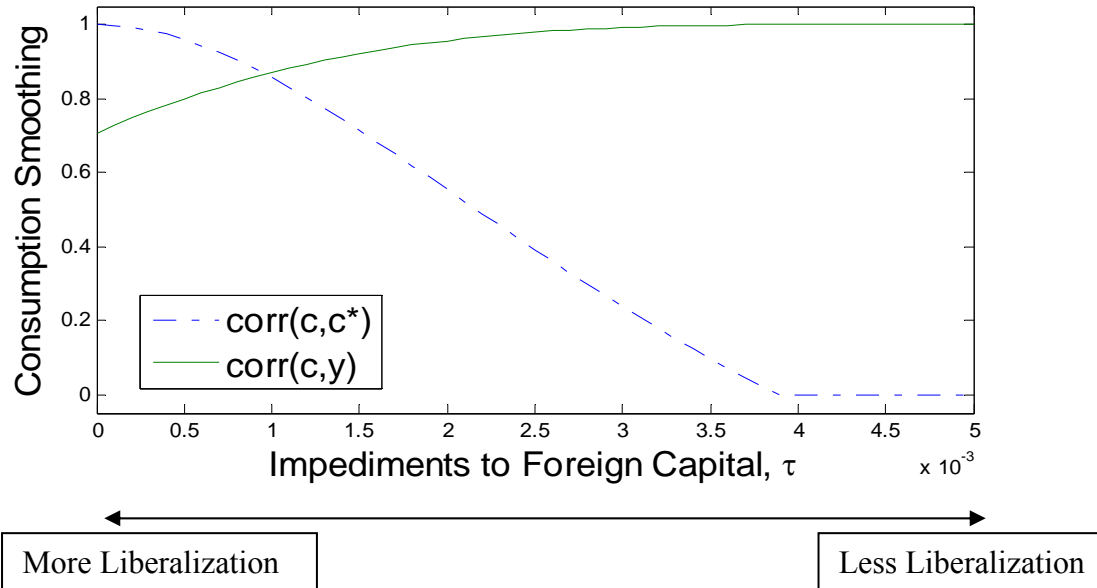
Note: The x-axis represents impediments to trade in foreign capital. On the right side, frictions in capital markets are high and the markets can be closed (no trade in financial assets takes place). On the left side, frictions in capital markets are low and the markets can be open (trade in financial assets takes place). As taxes to foreign capital approach to zero, we can see the share of domestic assets in home portfolio decrease.

Figure 3.2: Liberalization and Specialization



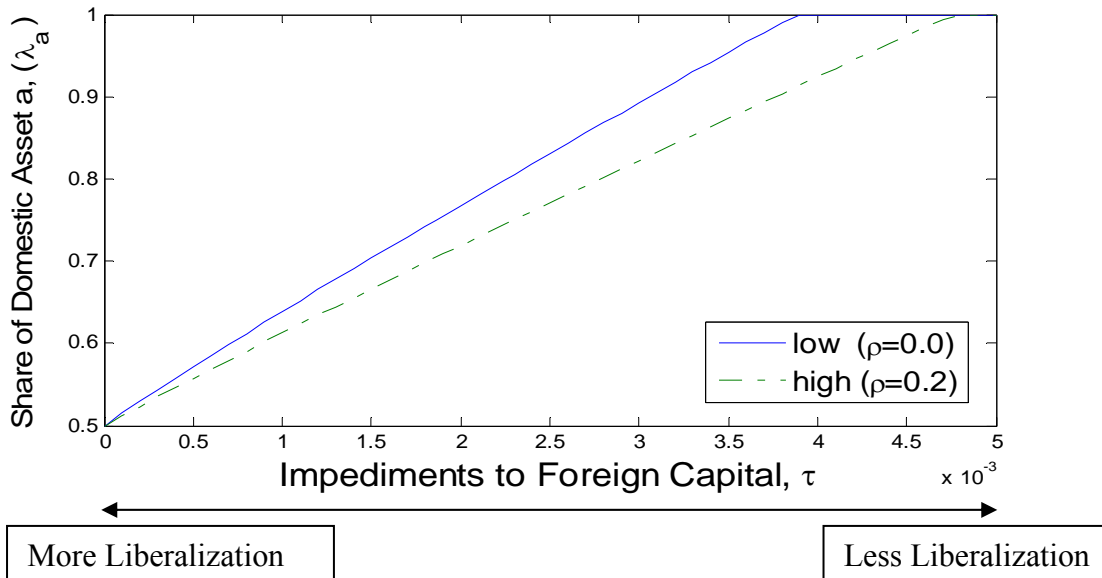
Note: The x-axis represents impediments to trade in foreign capital. As the country gets more financially liberalized more capital gets allocated in the most productive sector (y-axis).

Figure 3.3: Liberalization and Consumption Smoothing



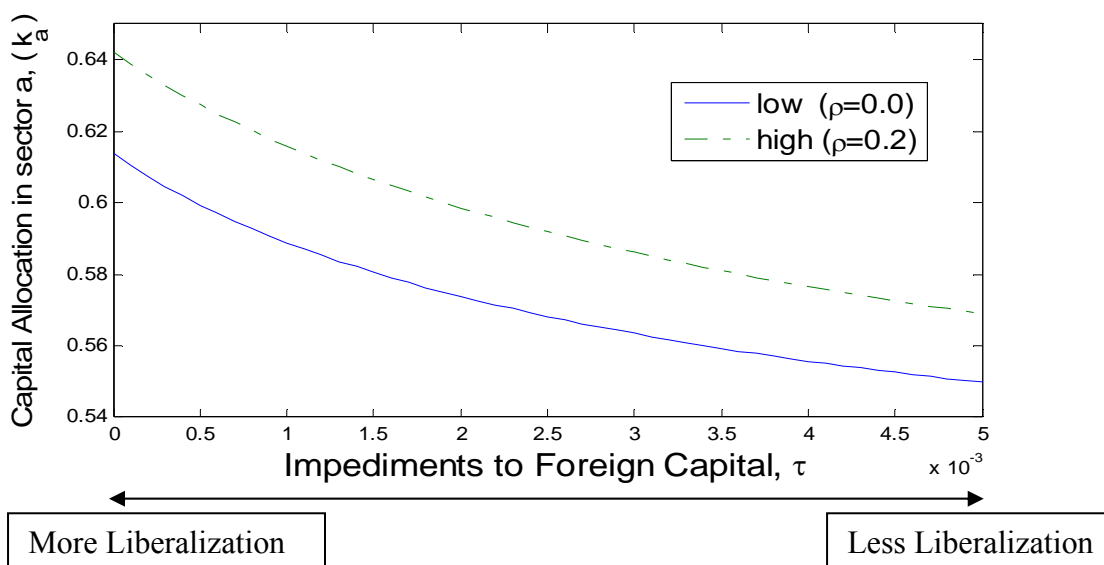
Note: The x-axis represents impediments to trade in foreign capital. The y-axis shows consumption smoothing. As consumptions correlation, $\text{corr}(c, c^*)$, increases consumption smoothing improves, whereas, as correlation between domestic consumption and output, $\text{corr}(c, y)$, increases consumption smoothing deteriorates. For high impediments, financial markets are closed and there is no change in consumption smoothing as countries liberalize.

Figure 3.4: Portfolio Holdings and Cross-Sector Productivity Correlations



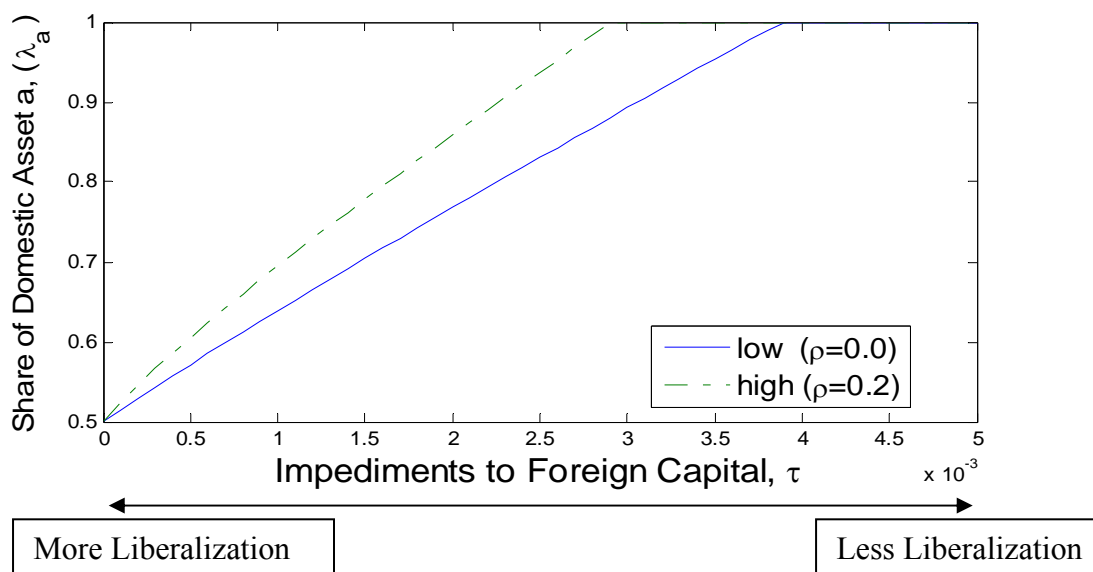
Note: The x-axis represents impediments to trade in foreign capital. For higher cross-sector productivity correlations consumers hold less shares of domestic asset in home portfolio.

Figure 3.5: Specialization and Cross-Sector Productivity Correlations



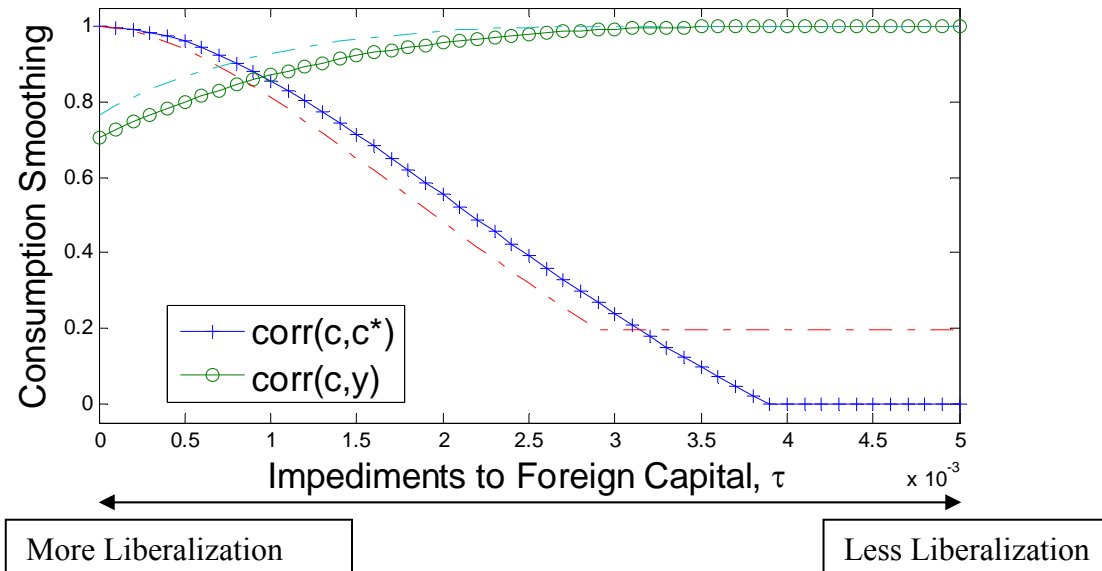
Note: The x-axis represents impediments to trade in foreign capital. Y-axis shows that as productivity processes across sectors become more similar, countries allocate more capital to the most productive sector.

Figure 3.6: Portfolio Holdings and Cross-Country Productivity Correlations



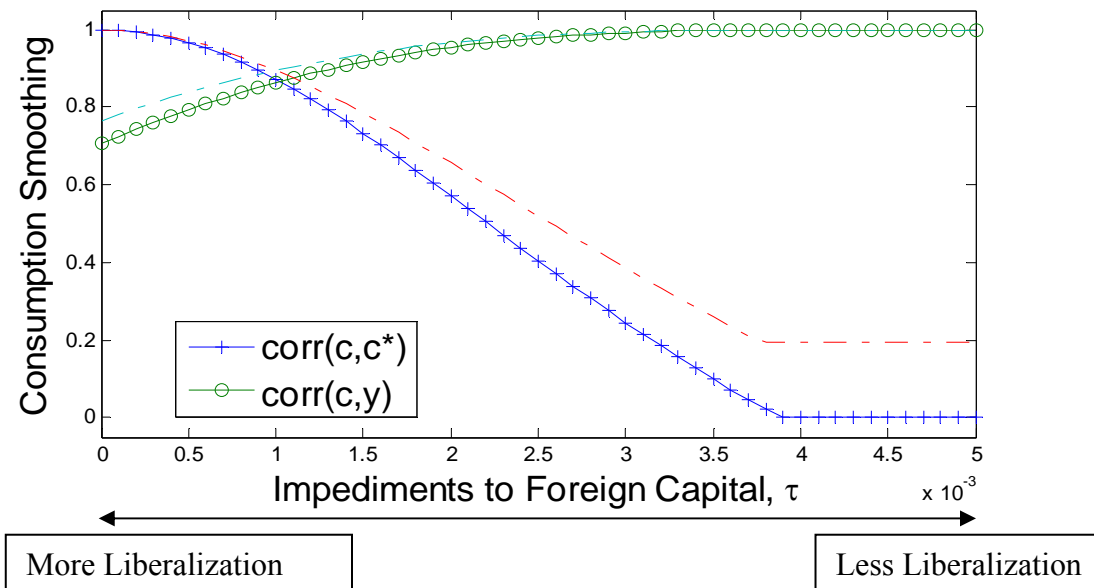
Note: The x-axis represents impediments to trade in foreign capital. On the right side, frictions in capital markets are high and the markets can be closed (no trade in financial assets takes place). On the right side, frictions in capital markets are high and the markets can be closed (no trade in financial assets takes place). As taxes to foreign capital approach to zero, we can see share holdings of domestic asset in home portfolio decrease. For higher cross-country productivity correlations, consumers hold less foreign assets.

Figure 3.7: Consumption Smoothing and Cross-Country Productivity Correlations



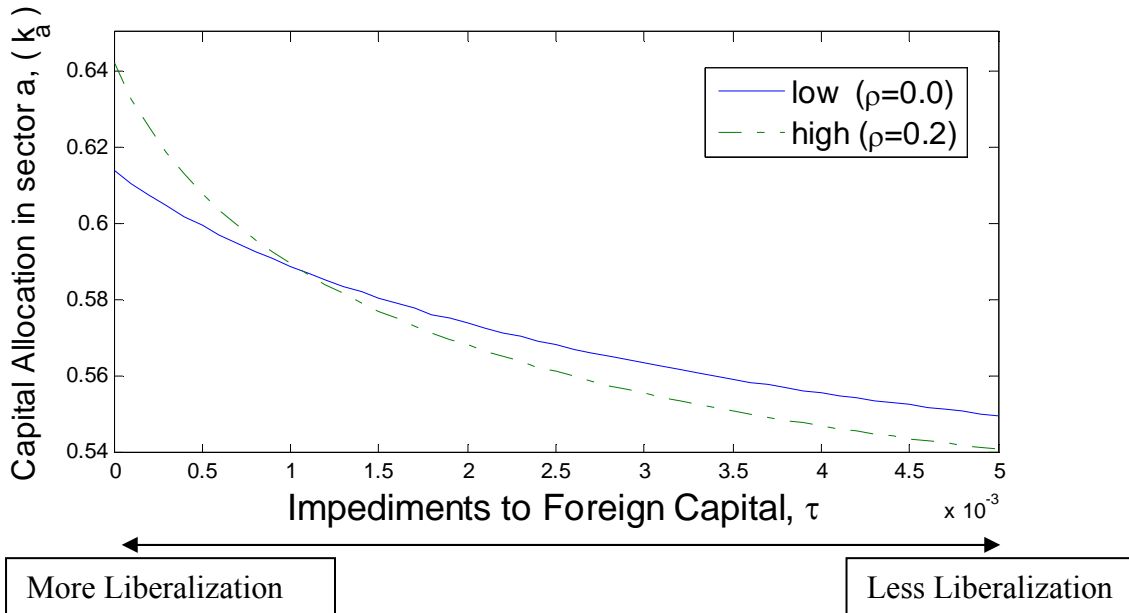
Note: The x-axis represents impediments to trade in foreign capital. For higher cross-country productivity correlations both measures of consumption risk sharing show deterioration in consumption smoothing ($\text{corr}(c,c^*)$ shifts down and $\text{corr}(c,y)$ shifts up).

Figure 8: Productivity Correlations – Horse Race



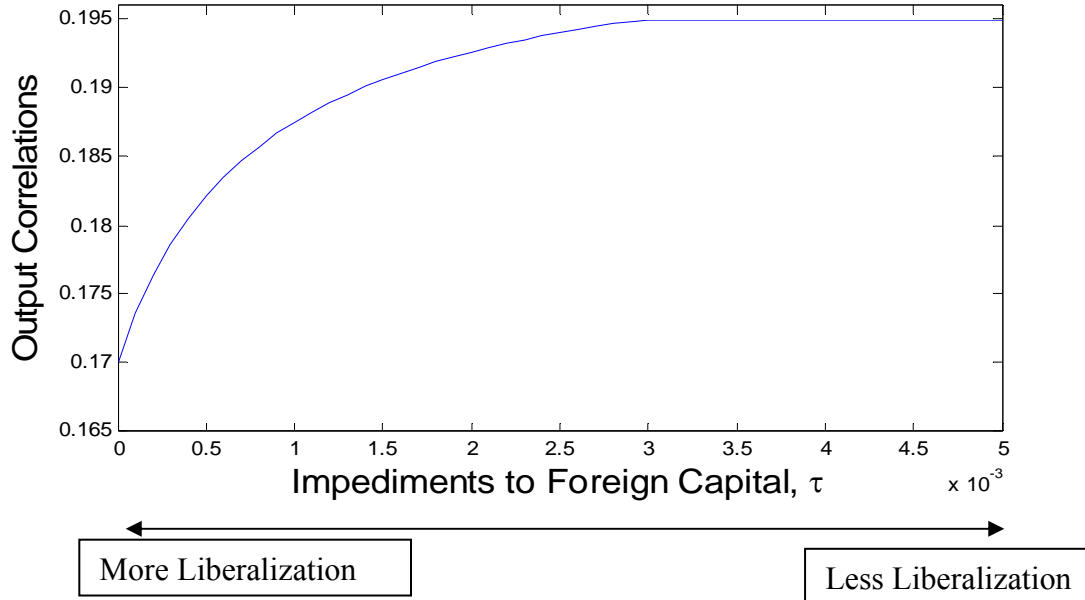
Note: The x-axis represents impediments to trade in foreign capital. Y-axis shows what happens to both measures of consumption smoothing as both cross-country and cross-sector productivity correlations increase. Both curves jump up, but consumption smoothing has deteriorated according to the $\text{corr}(c,y)$ measure (dotted turquoise line) and improved according to the $\text{corr}(c,c^*)$ measure (dotted red line).

Figure 3.9: Specialization and Cross-Country Productivity Correlations



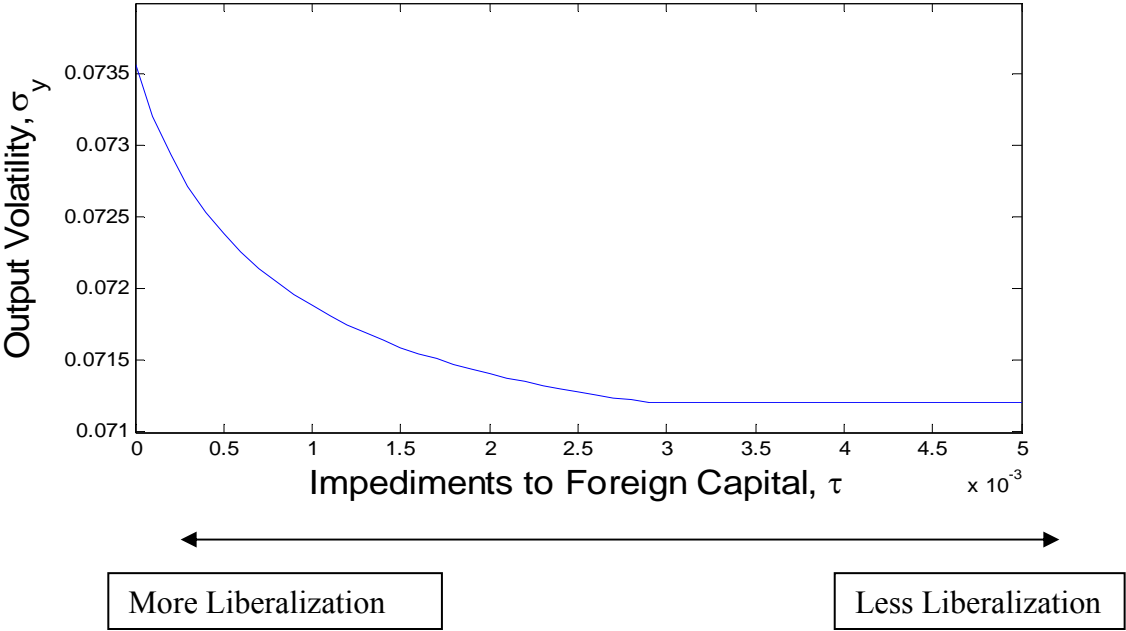
Note: The x-axis represents impediments to trade in foreign capital. As cross-country productivity correlations increase, two opposing effects affect production specialization.

Figure 3.10: Liberalization and Cross-Country Output Correlations



Note: The x-axis represents impediments to trade in foreign capital. On the right side, frictions in capital markets are high and the markets can be closed (no trade in financial assets takes place). As financial liberalization increases, countries allocate more capital in the most productive sector, increasing specialization, which in turn reduces output correlations across countries.

Figure 3.11: Liberalization and Output Volatility



Note: The x-axis represents impediments to trade in foreign capital. On the right side, frictions in capital markets are high and the markets can be closed (no trade in financial assets takes place). As financial liberalization increases, countries allocate more capital in the most productive sector, increasing specialization, which in turn increase output volatility.

Table 1.1a: Consumption Smoothing: Developing Countries.

Countries	Periods	Impediments to					
		Capital, τ		Corr(c,X)		$\rho(\text{Rho})$	
Brazil	80-87	1.94	-	0.83	-	0.17	-
	96-03	1.58	-	0.69	-	0.11	-
Chile	83-89	1.89	-	0.84	-	0.08	-
	99-03	1.42	-	0.78	-	0.05	-
Philippines	83-91	1.77	-	0.88	-	-0.02	-
	94-02	1.52	-	0.06	-	0.32	-
Korea	82-87	1.90	-	0.33	+	-0.01	+
	88-03	1.66	-	0.92	+	0.13	+
Mexico	83-88	1.92	-	0.74	+	0.17	+
	92-02	1.40	-	0.87	+	0.36	+
Argentina	82-88	1.88	-	0.96		0.09	-
	90-00	1.27	-	0.94		0.05	-
Colombia	83-89	1.90	-	0.40	+	-0.14	
	96-02	1.64	-	0.78	+	-0.13	
Malaysia	73-78	1.60	-	-0.59	+	0.35	-
	82-97	1.21	-	0.57	+	0.13	-

Table 1.1b: Developed Countries.

Countries	Periods	Impediments to					
		Capital, τ		Corr(c,X)		$\rho(\text{Rho})$	
Denmark	82-87	1.53	-	0.88	-	0.35	-
	89-03	1.05	-	0.63	-	0.32	-
Italy	83-89	1.52	-	0.92	-	0.17	+
	93-03	1.07	-	0.78	-	0.40	+
Norway	80-87	1.67	-	0.36	-	0.24	+
	93-03	1.13	-	0.01	-	0.33	+
Finland	73-85	1.69	-	0.32	+	0.13	+
	90-03	1.10	-	0.51	+	0.20	+
Spain	83-91	1.51	-	0.88	+	0.12	+
	93-03	1.14	-	0.91	+	0.33	+
Sweden	73-83	1.50	-	0.23	+	0.21	+
	94-03	1.12	-	0.41	+	0.66	+
France	73-84	1.61	-	-0.34	+	0.53	-
	94-03	1.09	-	0.72	+	0.49	-
Japan	73-80	1.60	-	0.71	+	0.32	-
	84-03	1.16	-	0.84	+	0.00	-
Portugal	80-85	1.89	-	0.52	+	0.09	-
	93-03	1.10	-	0.82	+	0.05	-
UK	73-78	1.64	-	0.73	+	0.54	-
	79-03	1.03	-	0.83	+	0.08	-

Source: Consumption and Output data are taken from WDI. ρ and τ are constructed as explained in text.

Table 2.1: Studies Investigating Perfect Consumption Risk Sharing

Study	Data	Methodology	Risk Sharing	Comments
Cochrane (1991)	PSDI 1980-1983	<ul style="list-style-type: none"> • Cross-Sectional • Regress consumption growth on independent variables. 	Yes	<ul style="list-style-type: none"> • For short unemployment and involuntary move. • Income not a good variable
Mace (1991)	CES 1980-1983	<ul style="list-style-type: none"> • Panel • Consumption Growth on aggregate consumption growth and income growth 	Mixed	<ul style="list-style-type: none"> • True for exponential utility, not true for power utility
Obstfeld (1993)	PWT 5, G-7 1950-1988	<ul style="list-style-type: none"> • Check correlations btw consumption growth rates, and world consumption (output) growth. • Regress consumption growth on world consumption growth. 	No	<ul style="list-style-type: none"> • Using world consumption produces less bias • Low degree of freedom • Cross-country consumption correlations lower than cross-country output correlations
Backus, Kehoe and Kydland (1995)	OECD 1970:1-1990:2	<ul style="list-style-type: none"> • Hodrick-Prescott filtered cross-correlation of consumption and output btw US and other OECD 	No	<ul style="list-style-type: none"> • Cross-country correlations of consumption lower than output counterparts
Asdrubali, Sorensen and Yosha (1996)	US states, 1963-1990	<ul style="list-style-type: none"> • Decompose the cross-sectional variance of gross state product data into various components representing different channels of risk sharing 	No	<ul style="list-style-type: none"> • 39% of shocks to gross state product are insured by capital markets, 13 by government and 23 by credit markets
Sorensen and Yosha (1998)	OECD, 1966-1990	<ul style="list-style-type: none"> • Decompose GDP for each country into various components 	No	<ul style="list-style-type: none"> • Only 40% of the income risk is smoothed mainly through domestic savings and budget deficits
Pakko (1998)	OECD and PWT 5 all years	<ul style="list-style-type: none"> • Cross-country consumption and output correlations • Correlation of consumption with own and world output • Both Hodrick-Prescott and First-Differenced 	No	<ul style="list-style-type: none"> • Cross-country correlation low • Not robustly lower than output correlations • Correlation of consumption with own output robustly higher than with world output
Lewis (1996)	PWT 5, 73 countries 1950-	<ul style="list-style-type: none"> • Regress tradeables' consumption growth on 	No	<ul style="list-style-type: none"> • Hypothesis of perfect risk sharing rejected.

	1992 Disaggregated consumption 48 countries 5-year periods 1950-1985	<ul style="list-style-type: none"> output, non-tradeables and leisure Use capital market restrictions panel 		
Canova and Ravn (1996)	9 OECD countries, 1970-1990	<ul style="list-style-type: none"> Regress proxies for real, fiscal, monetary and demographic factors on errors from regression of domestic to foreign consumption GMM 	Yes for short-term, no in long-run	<ul style="list-style-type: none"> Full insurance against high frequency fluctuations in real, fiscal, monetary and demographic variables Aggregate consumption co-varies with lagged demographic and labor market variable in medium-long run Cross-country consumption correlations are different from 1
Bai and Zhang (2005)	21 developed 19 developing 1973-1998 IFS, WDI, PWT 6.1	<ul style="list-style-type: none"> Regress cross sectionally consumption growth on GDP growth Regress in a panel and use World consumption as control 	No	<ul style="list-style-type: none"> Respective coefficients very different from 1 and zero
Amler, Cardia and Zimmermann (2004)	OECD 1960:1-2000:4	<ul style="list-style-type: none"> Use GMM to estimate and test hypothesis concerning pair wise cross-country correlations of macroeconomic variables 	No	<ul style="list-style-type: none"> Cross-country correlations of consumption are low and not higher than output correlations
Pakko (2004)	OECD 1973:1-2002:4	<ul style="list-style-type: none"> Correlations with rest of the world (consumption and output) Spectral decomposition 	No	<ul style="list-style-type: none"> Non-uniform ranking of consumption and output co-movements across different frequency bands Cross-country output and consumption correlations may not be a robust measure of international risk sharing
Kose, Otrok and Whiteman (2003)	1960-1990 PWT, 60 countries	<ul style="list-style-type: none"> Bayesian dynamic latent factor model to study co-movement of macroeconomic aggregates across the world, across regions and within countries 	No	<ul style="list-style-type: none"> Evidence of world cycle, which drives output growth fluctuations and is persistent across time Consumption dynamics driven by country and idiosyncratic factors

Table 2.2: Studies Investigating Consumption Risk Sharing Across (Groups of) Countries

Study	Data	Methodology	Risk Sharing	Comments
Lewis (1996)	PWT 5, 73 countries 1950-1992 Disaggregated consumption 48 countries 5-year intervals 1950-1985	<ul style="list-style-type: none"> • Regress tradeables' consumption growth on output, non-tradeables, leisure and capital market restrictions • panel 	Yes	<ul style="list-style-type: none"> • Restricted countries' consumptions are more correlated to domestic output • AREAER measure used for restrictions
Canova and Ravn (1996)	9 OECD 1970-1990	<ul style="list-style-type: none"> • See Table 1 	Yes	<ul style="list-style-type: none"> • Consumption correlations are higher for Europe
Crucini (1999)	Canadian Provinces, US states and G-7 Various years	<ul style="list-style-type: none"> • Adapt a permanent income model to allow for various degrees of income pooling • Consumption equation consistent with range from complete markets to autarky • 2-stage estimation 	Yes	<ul style="list-style-type: none"> • Canadian Provinces and US states risk share more than G-7 countries
Kose, Prasad and Terrones (2003)	76 countries -21 industrial and 55 developing MFIE (22) and LFIE (33) WDI, IFS 1960-1999	<ul style="list-style-type: none"> • Volatility of consumption and output -10 years and whole sample • Volatility of consumption over income Q (adjusted by TOT) • Regress volatility of consumption/income on financial flows (+square term) current and capital account restrictions, trade openness, income, ToT, M2, inflation • Panel 	yes	<ul style="list-style-type: none"> • C, Y, Q less volatile in industrialized countries
Bai and Zhang (2005)	See Table 1	See Table 1	Yes	<ul style="list-style-type: none"> • Coefficient of domestic C on output is lower for industrialized countries and the one on world C is higher
Artis and Hoffmann (2004)	See table 3	See table 3	Yes	<ul style="list-style-type: none"> • US states risk share more than OECD countries • US states do not perfectly risk share
Artis and Hoffmann (2006)	OECD vs US states 1960-1990	<ul style="list-style-type: none"> • Regress level C on level world C and level output • Argues that level regressions are better suited at capturing country-fixed effects • Panel OLS • Panel dynamic OLS 	Yes	<ul style="list-style-type: none"> • US states risk share more • They still share only 50% of risks • Countries with higher degrees of integration (measured by the amount of international assets they trade) risk

					share more
Artis and Hoffmann (2007)	OECD, E(M)U 1990-2004	<ul style="list-style-type: none"> • Panel OLS • Levels 		Yes	<ul style="list-style-type: none"> • E(M)U countries risk share more than OECD
Bekaert, Harvey and Lundblad (2005)	See table 3	<ul style="list-style-type: none"> • See table 3 		Yes	<ul style="list-style-type: none"> • Countries with open capital accounts experience greater reduction in consumption growth volatility after opening equity markets
Kose, Prasad and Terrones (2007)	PWT+WDI 1960-2004 72 countries	<ul style="list-style-type: none"> • Co-movement with national output • w/ world output/consumption • regressions 		Yes	<ul style="list-style-type: none"> • industrial countries have been better able to smooth consumption

Table 2.3: Studies Investigating Consumption Risk Sharing Across Time

Study	Data	Methodology	Risk Sharing	Comments
Obstfeld (1993)	PWT 5, G-7 1951-72 vs 1973-88	<ul style="list-style-type: none"> • Cross-country consumption correlations • Volatility of consumption • Correlation btw domestic and world consumption • Regress domestic consumption growth on world consumption growth for each sub-period 	Yes	<ul style="list-style-type: none"> • Slight evidence of risk sharing • Small number of observations in each regression • Identifies two periods with different financial integration
Heathcote and Perri (2004)	US, Canada, Europe and Japan 1972:1-1986:2 1986:3-2000:4	<ul style="list-style-type: none"> • Cross-country correlations • H-P filtered, alternative detrending methods 	No	<ul style="list-style-type: none"> • Consumption and output correlations btw US and Rest of World have decreased • Btw US and Canada has increased • Volatility of output and consumption for US and RoW has decreased
Kose, Prasad and Terrones (2003)	76 countries - 21 industrial and 55 developing MFIE (22) and LFIE (33) WDI, IFS 1960-1999	<ul style="list-style-type: none"> • Volatility of consumption and output -10 years and whole sample • Volatility of consumption over income Q (adjusted by TOT) • Regress volatility of consumption/income on financial flows (+square term) current and capital account restrictions, trade openness, income, ToT, M2, inflation • Panel 	Yes/ No	<ul style="list-style-type: none"> • Volatility of C (growth), Q (growth) has increased for MFIE, but has decrease for industrialized countries • Crises do not explain increase in C volatility for MFIE • C/Q volatility increases up to a certain threshold of financial flows, than decreases
Bai and Zhang (2005)	1973-1985, 1986-1998 See Table 1	See Table 1	No	<ul style="list-style-type: none"> • Extent of risk sharing has not changed over time
Artis and Hoffmann (2006)	OECD, E(M)U 1980-1990 1990-2004	<ul style="list-style-type: none"> • Panel OLS • Levels 	Yes	<ul style="list-style-type: none"> • Both groups risk share more • Significant effect of EMU and equity holdings for 1999-2004
Artis and Hoffmann (2004)	OECD 1960-1990 1980-2000 1990-2000 US states 1960-2000	<ul style="list-style-type: none"> • Differentiate btw permanent and transitory shocks • Only permanent shocks require countries to insure <i>ex-ante</i> • Regress consumption on permanent income • 2-stage LS 	Yes	<ul style="list-style-type: none"> • Countries are smoothing permanent shocks • Consumption can react to permanent shocks in output and its adjustment can make it more volatile than output • Business cycle properties matter • Consumption correlations have fallen due to a decrease in trend output volatility, which is a common component is domestic and rest of the world

					C
Artis and Hoffmann (2006)	OECD 1960-1990 1990-2004	See table 2	Yes		<ul style="list-style-type: none"> level regressions capture long term-effects limited risk sharing in the short-term evidence of risk sharing in the medium and long run
Islamaj (2008)	WDI Periods based on relatively open vs closed periods	<ul style="list-style-type: none"> using available <i>rule-based</i> financial integration indicators identify open and closed periods for each country check correlations of domestic consumption growth and domestic output growth for each sub-period control for productivity shock correlations with rest of the world 	Yes		<ul style="list-style-type: none"> preliminary evidence suggest that after controlling for productivity shock correlations with rest of the world, we can explain the lack of consumption smoothing as countries have become more integrated
Sorensen, Wu, Yosha and Zhu (2008)	24 OECD 1993-2003	<ul style="list-style-type: none"> Panel OLS growth 	Yes		<ul style="list-style-type: none"> Risk sharing increased Home bias decreased FDI is better than debt for consumption risk sharing
Bekaert, Harvey and Lundblad (2005)	95 countries 40 emerging markets 1980-2000 5-year	<ul style="list-style-type: none"> Volatility 5 years before and after equity market liberalization Panel Various indicators of financial liberalization 	Yes		<ul style="list-style-type: none"> Less volatility of consumption growth to GDP growth Results are weaker for emerging markets
Kose, Prasad and Terrones (2007)	PWT+WDI 1960-1984 1985-2004 72 countries	<ul style="list-style-type: none"> Co-movement with national output w/ world output/consumption 9-year rolling window Regressions for each sub-period Effects of financial flows on risk sharing 	Mixed		<ul style="list-style-type: none"> industrial countries have been better able to smooth consumption over time no evidence for emerging markets and other developing countries financial flows have improved risk sharing in industrial countries composition can't explain

Table 2.4: A Review of Different Measures of Financial Liberalization

Indicator	Years	Coding	Advantages	Disadvantages
IMF AREAER	1966-95, All IMF members	0/1 dummy for controls on outflows	Extensive coverage.	Only controls in outflows. Limited information about intensity. Based only on residents.
IMF	1996-present	Average of all 0/1 dummies in the new AREAER	Discriminates between outflows and inflows.	Only available for 1996-
Brune et. al. (2001)	1973-1999 173 countries	Sum of 0/1 AREAER dummies over 5 categories	Extensive coverage Discriminates btw outflows and inflows	Not publicly available Still limited
Quinn	1958- for 22 developed and only 1958, 1973, 1982 and 1988 for 42 developing countries	Using info on AREAER regarding capital account receipts and payments. Assigns values btw 0 and 2 in increments of 0.5	Takes into account intensity of restrictions Discriminates btw inflows and outflows	Limited public availability. Limited disaggregation.
Miniane	1983-2004, 34 countries	Average of AREAER dummies over 13 categories of capital account transactions	Substantial disaggregation	Limited country coverage No distinction btw controls on inflows and outflows.
Bekaert,Harvey and Lundblad	95 countries 43 success stories	Dates of stock market liberalization	Extra information	Equity liberalization may be a small subset of financial globalization
Chinn-Ito	1970-2006 163 countries	Calculate the first standardized principal component of the 4 major categories of AREAER For capital account restrictions use a 5- year window	Extensive coverage More information on current account, multiple exchange rates, and the requirement of the surrender of export proceeds	No distinction between restrictions on inflows and outflows
Kaminsky and Schmukler	1973-2002 28 countries Available monthly	3 degrees of intensity of liberalization for capital account, domestic financial system and stock markets	More information on intensity Not based only on capital accounts Discriminates btw inflows and outflows	Limited country average Limited degree of intensity
Abiad and Mody	1973-1996 35 countries	4 degrees of liberalization (0-3) over 6 policy dimensions	More dimensions Degree of intensity More country coverage than other studies of the same spirit	Still limited country coverage No distinction between inflows and outflows
Edwards	1970-2000 72 countries	0-100, combining Quinn, Mody& Murshid and country- specific data	Large coverage Degree of intensity	Some data is imputed

Table 2.5: Net Effect of Liberalization and Cross-country Productivity Correlations, eqn (5).

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky &Shmukler	Abiad & Mody	Edwards
$\partial\beta_1/\partial\tau$	0.16 [0.000]***	0.13 [0.000]***	0.06 [0.000]***	0.06 [0.000]***	0.16 [0.000]***	0.13 [0.000]***	0.20 [0.000]***
$\partial\beta_2/\partial\tau$	-0.25 [0.008]***	-0.10 [0.000]***	-0.06 [0.000]***	-0.05 [0.000]***	-0.19 [0.000]***	-0.11 [0.017]**	-0.16 [0.000]***
$\partial\beta_1/\partial\rho$	0.04 [0.364]	0.01 [0.000]***	0.05 [0.000]***	0.03 [0.000]***	0.03 [0.429]	0.05 [0.353]	-0.02 [0.000]***
$\partial\beta_2/\partial\rho$	-0.11 [0.038]**	-0.03 [0.000]***	-0.10 [0.000]***	-0.05 [0.000]***	-0.06 [0.636]	-0.14 [0.051]*	0.012 [0.000]***

Note: This Table shows the net effect of financial liberalization and cross-country productivity correlations on β_1 and β_2 for the equation in differences. The coefficients estimated are shown in Table X in the Appendix. p -values are shown in parenthesis. The effect of a change in tax τ is calculated for the median productivity correlation with rest of the world $\rho=0.09$, whereas the effect of a change in ρ corresponds to low τ for reasons explained in the text.

Table 2.6: Effects of Liberalization and Cross-country Productivity Correlations, eqn (6).

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky &Shmukler	Abiad & Mody	Edwards
$\partial\beta_1/\partial\tau$	0.26 [0.000]***	0.18 [0.000]***	0.15 [0.000]***	0.10 [0.000]***	0.20 [0.000]***	0.05 0.0183**	0.27 [0.000]***
$\partial\beta_2/\partial\tau$	-0.45 [0.000]***	-0.16 [0.000]***	-0.19 [0.000]***	-0.12 [0.000]***	-0.18 [0.000]***	0.03 0.2526	-0.18 [0.000]***
$\partial\beta_1/\partial\rho$	-0.01 [0.212]	0.01 [0.070]*	0.09 [0.000]***	0.03 [0.000]***	0.01 [0.185]	0.0314 [0.044]**	-0.03 [0.000]***
$\partial\beta_2/\partial\rho$	0.04 [0.259]	-0.04 [0.000]***	-0.18 [0.000]***	-0.08 [0.000]***	-0.05 [0.044]*	-0.16 [0.000]***	0.00 [0.773]

Note: This Table shows the net effect of financial liberalization and cross-country productivity correlations on β_1 and β_2 for the equation that divides by World GDP. The coefficients estimated are shown in Table X in the Appendix. p -values are shown in parenthesis. The effect of a change in tax τ is calculated for the median productivity correlation with rest of the world $\rho=0.09$, whereas the effect of a change in ρ corresponds to low τ for reasons explained in the text.

Table 2.7: Effects of Liberalization and Cross-country Productivity Correlations, eqn (6).

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky &Shmukler	Abiad & Mody	Edwards
$\partial\beta_1/\partial\tau$	0.26 [0.000]***	0.19 [0.000]***	0.18 [0.000]***	0.09 [0.000]***	0.25 [0.000]***	0.03 [0.154]	0.31 [0.000]***
$\partial\beta_2/\partial\tau$	-0.48 [0.000]***	-0.19 [0.000]***	-0.22 [0.000]***	-0.13 [0.000]***	-0.16 [0.000]***	0.03 [0.407]	-0.23 [0.000]***
$\partial\beta_1/\partial\rho$	-0.06 [0.000]***	0.02 [0.001]***	0.08 [0.000]***	0.01 [0.059]*	-0.01 [0.381]	0.01 [0.655]	-0.04 [0.000]***
$\partial\beta_2/\partial\rho$	0.15 [0.001]***	-0.07 [0.016]**	-0.17 [0.000]***	-0.05 [0.000]***	0.00 [0.938]	-0.14 [0.000]***	0.00 [0.5089]

Note: This Table shows the net effect of financial liberalization and cross-country productivity correlations on β_1 and β_2 for the equation in levels. The coefficients estimated are shown in Table X in the Appendix. p -values are shown in parenthesis. The effect of a change in tax τ is calculated for the median productivity correlation with rest of the world $\rho=0.09$, whereas the effect of a change in ρ corresponds to low τ for reasons explained in the text.

Table 2.8. Effects of Financial Liberalization for Low and High Levels of Liberalization

		Miniane	Chinn-Ito	Kaminsky &Shmukler	Abiad & Mody	Edwards
$\partial\beta_1/\partial\tau$	Low	0.22 [0.000]***	0.14 [0.000]***	0.11 [0.000]***	0.03 [0.422]	0.21 [0.000]***
	High	0.35 [0.000]***	0.18 [0.000]***	0.44 [0.000]***	0.01 [0.797]	0.45 [0.000]***
$\partial\beta_2/\partial\tau$	Low	-0.35 [0.000]***	-0.13 [0.000]***	-0.10 [0.005]***	0.05 [0.198]	-0.05 [0.182]
	High	-0.67 [0.000]***	-0.14 [0.000]***	-0.26 0.0137**	0.064 [0.265]	-0.54 [0.000]***

Note: This Table shows the net effect of financial liberalization and cross-country productivity correlations on β_1 and β_2 for the equation in levels. The coefficients estimated are shown in Table X in the Appendix. p -values are shown in parenthesis. In each case, the upper row (Low) uses the 75% least open tail of the sample and the lower row uses the 75% most open part of the sample.

Table 2.9: Effects of Financial Liberalization and Productivity Correlations with ROW in differences.

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky & Shmukler	Abiad & Mody	Edwards
$\tau^* \text{GDP}$	0.541 [0.051]***	0.533 [0.039]***	0.312 [0.026]***	0.426 [0.046]***	0.698 [0.042]***	0.587 [0.041]***	0.71 [0.032]***
$\rho^* \text{GDP}$	0.236 [0.028]***	0.223 [0.019]***	0.169 [0.014]***	0.197 [0.019]***	0.275 [0.021]***	0.304 [0.025]***	0.253 [0.015]***
$\rho^* \tau^* \text{GDP}$	-0.347 [0.040]***	-0.371 [0.034]***	-0.229 [0.019]***	-0.33 [0.039]***	-0.486 [0.039]***	-0.42 [0.038]***	-0.463 [0.029]***
Υ	0.734 [0.156]***	0.376 [0.136]***	0.36 [0.035]***	0.296 [0.052]***	0.458 [0.125]***	0.437 [0.156]***	0.352 [0.158]**
$\tau^* \Upsilon$	-0.901 [0.105]***	-0.489 [0.039]***	-0.401 [0.038]***	-0.398 [0.034]***	-0.819 [0.071]***	-0.911 [0.080]***	-0.596 [0.058]***
$\rho^* \Upsilon$	-0.442 [0.079]***	-0.242 [0.026]***	-0.249 [0.030]***	-0.211 [0.022]***	-0.344 [0.046]***	-0.582 [0.065]***	-0.228 [0.033]***
$\rho^* \tau^* \Upsilon$	0.597 [0.093]***	0.361 [0.035]***	0.309 [0.033]***	0.316 [0.030]***	0.575 [0.065]***	0.735 [0.076]***	0.4 [0.047]***
R^2	0.773	0.545	0.503	0.517	0.729	0.68	0.613
Obs	620	2588	2367	2367	725	736	1962

Note: This table shows regression results for equation (2.9) in the text. The dependent variable is consumption per capita in differences. GDP and consumption per capita data come from PWT 6.2. *** denotes statistical significance at 99%. The regressions control for country and year fixed effects.

Table 2.10: Effects of Financial Liberalization and Productivity Correlations with ROW, by world GDP

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky & Shmukler	Abiad & Mody	Edwards
$\tau^* \text{GDP/Y}$	0.758 [0.033]***	0.838 [0.021]***	0.666 [0.020]***	0.839 [0.025]***	0.904 [0.034]***	0.687 [0.036]***	0.908 [0.025]***
$\rho^* \text{GDP/Y}$	0.243 [0.022]***	0.341 [0.010]***	0.318 [0.008]***	0.368 [0.011]***	0.332 [0.012]***	0.38 [0.020]***	0.304 [0.014]***
$\rho^* \tau^* \chi/Y$	-0.457 [0.039]***	-0.598 [0.018]***	-0.465 [0.016]***	-0.676 [0.027]***	-0.637 [0.031]***	-0.581 [0.028]***	-0.579 [0.024]***
τ'	-0.848 [0.089]***	-0.773 [0.044]***	-0.892 [0.036]***	-0.825 [0.034]***	-1.026 [0.083]***	-0.908 [0.095]***	-0.736 [0.086]***
ρ'	-0.168 [0.078]**	-0.37 [0.029]***	-0.5 [0.028]***	-0.401 [0.025]***	-0.434 [0.049]***	-0.675 [0.083]***	-0.288 [0.050]***
$\rho^* \tau'$	0.364 [0.087]***	0.556 [0.036]***	0.639 [0.029]***	0.647 [0.029]***	0.77 [0.071]***	0.858 [0.093]***	0.509 [0.073]***
Constant	0.497 [0.080]***	0.602 [0.039]***	0.807 [0.039]***	0.65 [0.033]***	0.467 [0.062]***	1.163 [0.084]***	0.507 [0.061]***
R^2	0.996	0.991	0.986	0.987	0.992	0.994	0.99
Obs	651	2679	2436	2436	750	768	2031

Note: This table shows regression results for equation (2.10) in the text. See Notes in Table 2.9.

Table 2.11: Effects of Financial Liberalization and Productivity Correlations with ROW in levels. PDOLS

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky & Shmukler	Abiad & Mody	Edwards
τ^*GDP	0.875 [0.040]***	0.902 [0.022]***	0.745 [0.023]***	0.921 [0.024]***	1.045 [0.040]***	0.771 [0.036]***	0.964 [0.025]***
$\rho^* GDP$	0.254 [0.027]***	0.358 [0.011]***	0.336 [0.009]***	0.39 [0.010]***	0.351 [0.013]***	0.413 [0.021]***	0.304 [0.017]***
$\rho^*\tau^*GDP$	-0.556 [0.047]***	-0.652 [0.020]***	-0.518 [0.019]***	-0.754 [0.022]***	-0.724 [0.031]***	-0.674 [0.026]***	-0.599 [0.027]***
Y	1.151 [0.111]***	0.605 [0.046]***	0.812 [0.046]***	0.609 [0.033]***	0.571 [0.074]***	1.205 [0.098]***	0.53 [0.076]***
τ^*Y	-0.614 [0.125]***	-0.812 [0.054]***	-0.96 [0.046]***	-0.855 [0.040]***	-1.119 [0.108]***	-1.011 [0.101]***	-0.799 [0.111]***
ρ^*Y	0.086 [0.114]	-0.366 [0.037]***	-0.508 [0.036]***	-0.379 [0.027]***	-0.436 [0.062]***	-0.709 [0.089]***	-0.289 [0.065]***
$\rho^*\tau^*Y$	0.121 [0.126]	0.571 [0.046]***	0.678 [0.036]***	0.66 [0.033]***	0.877 [0.086]***	0.945 [0.098]***	0.523 [0.093]***
R^2	0.999	0.996	0.995	0.996	0.998	0.998	0.997
Obs	589	2500	2297	2298	700	704	1893

Note: This table shows regression results for equation (2.11) in the text. The dependent variable is consumption per capita. PDOLS methodology is used. GDP and consumption per capita data come from PWT 6.2. *** denotes statistical significance at 99%. The regressions control for country and year fixed effects.

Table 2.12: Effects of Financial Liberalization and Productivity Correlations with ROW, for low and high levels of liberalization; in levels PDOLS

	Miniane			Chinn-Ito			Kaminsky & Shmukler		
	Low	All	High	Low	All	High	Low	All	High
τ^*GDP	0.793 [0.037]***	0.875 [0.040]***	0.88 [0.059]***	0.788 [0.025]***	0.902 [0.022]***	0.909 [0.030]***	0.768 [0.038]***	1.045 [0.040]***	1.225 [0.054]***
$\rho^* GDP$	0.316 [0.041]***	0.254 [0.027]***	0.185 [0.048]***	0.419 [0.020]***	0.358 [0.011]***	0.338 [0.014]***	0.386 [0.014]***	0.351 [0.013]***	0.303 [0.028]***
$\rho^*\tau^*GDP$	-0.522 [0.049]***	-0.556 [0.047]***	-0.485 [0.084]***	-0.59 [0.030]***	-0.652 [0.020]***	-0.663 [0.028]***	-0.601 [0.027]***	-0.724 [0.031]***	-0.712 [0.060]***
Y	0.997 [0.152]***	1.151 [0.111]***	1.364 [0.155]***	0.519 [0.054]***	0.605 [0.046]***	0.499 [0.076]***	0.549 [0.073]***	0.571 [0.074]***	0.101 [0.202]
τ^*Y	-0.934 [0.190]***	-0.614 [0.125]***	-0.999 [0.257]***	-0.63 [0.063]***	-0.812 [0.054]***	-0.821 [0.110]***	-0.837 [0.108]***	-1.119 [0.108]***	-0.392 [0.340]
ρ^*Y	-0.341 [0.203]*	0.086 [0.114]	0.061 [0.174]	-0.347 [0.049]***	-0.366 [0.037]***	-0.333 [0.061]***	-0.412 [0.060]***	-0.436 [0.062]***	0.055 [0.172]
$\rho^*\tau^*Y$	0.535 [0.220]**	0.121 [0.126]	0.302 [0.268]	0.457 [0.060]***	0.571 [0.046]***	0.62 [0.094]***	0.675 [0.086]***	0.877 [0.086]***	0.119 [0.288]
R^2	0.999	0.999	0.999	0.997	0.996	0.997	0.999	0.998	0.999
Obs	390	589	424	1881	2500	1362	442	700	485

Note: This table shows regression results for equation (2.11) in the text. The dependent variable is consumption per capita. GDP and consumption per capita data come from PWT 6.2. *** denotes statistical significance at 99%. The regressions control for country and year fixed effects. The first column for each indicator uses the whole sample and the results are the same as in Table 2.5 and the second column uses only the 75% most open part of the sample.

Table 2.12: continued...

	Abiad & Mody			Edwards		
	Low	All	High	Low	All	High
τ^*GDP	0.675 [0.044]***	0.771 [0.036]***	0.797 [0.044]***	0.84 [0.038]***	0.964 [0.025]***	0.94 [0.035]***
$\rho^* GDP$	0.458 [0.025]***	0.413 [0.021]***	0.394 [0.023]***	0.381 [0.029]***	0.304 [0.017]***	0.221 [0.023]***
$\rho^*\tau^*GDP$	-0.586 [0.035]***	-0.674 [0.026]***	-0.717 [0.033]***	-0.572 [0.045]***	-0.599 [0.027]***	-0.447 [0.040]***
Y	0.625 [0.107]***	1.205 [0.098]***	1.331 [0.119]***	0.547 [0.082]***	0.53 [0.076]***	0.634 [0.115]***
τ^*Y	-0.588 [0.118]***	-1.011 [0.101]***	-1.237 [0.182]***	-0.753 [0.116]***	-0.799 [0.111]***	-1.059 [0.174]***
ρ^*Y	-0.487 [0.101]***	-0.709 [0.089]***	-0.747 [0.116]***	-0.438 [0.076]***	-0.289 [0.065]***	-0.247 [0.091]***
$\rho^*\tau^*Y$	0.579 [0.115]***	0.945 [0.098]***	1.184 [0.156]***	0.639 [0.105]***	0.523 [0.093]***	0.472 [0.145]***
R^2	0.998	0.998	0.999	0.996	0.997	0.998
Obs	499	704	493	1185	1893	1188

Note: This table shows regression results for equation (2.11) in the text. The dependent variable is consumption per capita. GDP and consumption per capita data come from PWT 6.2. *** denotes statistical significance at 99%. The regressions control for country and year fixed effects. The first column for each indicator uses the whole sample and the results are the same as in Table 2.5 and the second column uses only the 75% most open part of the sample.

Table 2.13: Correlation between different measures

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky & Shmukler	Abiad & Mody	Edwards
Miniane	1						
Chinn-Ito	0.8591*	1					
Capital Account	0.7747*	0.7734*	1				
Current Account	0.7114*	0.8223*	0.5643*	1			
Kaminsky & Shmukler	0.6251*	0.5466*	0.5213*	0.3867*	1		
Abiad & Mody	0.6482*	0.5845*	0.4796*	0.5033*	0.7677*	1	
Edwards	0.8400*	0.7481*	0.6668*	0.6219*	0.6913*	0.6260*	1

Note: This Table calculates pair-wise correlations. * signifies that the coefficients are significant at 1% or better.

Table 2.14: Effects of Financial Liberalization and Productivity Correlations with ROW in differences.

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky & Shmukler	Abiad & Mody	Edwards
$\tau^* \text{GDP}$	0.712 [0.080]***	0.787 [0.091]***	0.485 [0.056]***	0.863 [0.110]***	0.889 [0.100]***	0.85 [0.079]***	0.86 [0.064]***
$\rho^* \text{GDP}$	0.293 [0.059]***	0.272 [0.072]***	0.219 [0.041]***	0.36 [0.048]***	0.328 [0.074]***	0.336 [0.039]***	0.3 [0.034]***
$\rho^* \tau^* \text{GDP}$	-0.5 [0.115]***	-0.513 [0.160]***	-0.228 [0.072]***	-0.702 [0.115]***	-0.671 [0.173]***	-0.586 [0.069]***	-0.555 [0.064]***
Y	0.531 [0.236]**	0.497 [0.183]***	1.264 [0.153]***	0.484 [0.169]***	0.196 [0.197]	0.892 [0.263]***	0.798 [0.217]***
$\tau^* Y$	-0.761 [0.219]***	-0.63 [0.200]***	-1.149 [0.146]***	-0.64 [0.160]***	-0.372 [0.265]	-1.177 [0.163]***	-1.255 [0.166]***
$\rho^* Y$	-0.184 [0.180]	-0.116 [0.146]	-0.51 [0.098]***	-0.24 [0.068]***	0.011 [0.153]	-0.541 [0.121]***	-0.49 [0.106]***
$\rho^* \tau^* Y$	0.342 [0.248]	0.249 [0.254]	0.532 [0.135]***	0.495 [0.139]***	0.1 [0.290]	0.829 [0.170]***	0.862 [0.153]***
R^2	0.953	0.951	0.949	0.949	0.952	0.861	0.843
Obs	379	379	379	379	379	168	318

Note: This table shows regression results for equation (2.9) in the text. The dependent variable is consumption per capita in differences. GDP and consumption per capita data come from PWT 6.2. *** denotes statistical significance at 99%. The regressions control for country and year fixed effects.

Table 2.15: Effects of Financial Liberalization and Productivity Correlations with ROW, by world GDP

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky &Shmukler	Abiad& Mody	Edwards
τ^*GDP/Y	0.83 [0.044]***	0.882 [0.069]***	0.571 [0.046]***	1.015 [0.047]***	1.03 [0.053]***	0.831 [0.053]***	0.871 [0.056]***
$\rho^* GDP/Y$	0.24 [0.030]***	0.305 [0.030]***	0.272 [0.021]***	0.39 [0.029]***	0.338 [0.030]***	0.453 [0.028]***	0.223 [0.039]***
$\rho^*\tau^* \chi/Y$	-0.478 [0.057]***	-0.561 [0.082]***	-0.335 [0.047]***	-0.835 [0.062]***	-0.726 [0.073]***	-0.737 [0.056]***	-0.43 [0.079]***
τ^*	-0.764 [0.099]***	-1.074 [0.097]***	-1.209 [0.065]***	-0.814 [0.081]***	-0.81 [0.139]***	-1.522 [0.157]***	-0.862 [0.225]***
ρ^*	-0.055 [0.085]	-0.389 [0.075]***	-0.646 [0.049]***	-0.239 [0.059]***	-0.199 [0.084]**	-0.931 [0.105]***	-0.254 [0.149]**
$\rho^*\tau^*$	0.243 [0.100]**	0.653 [0.091]***	0.734 [0.065]***	0.594 [0.075]***	0.519 [0.133]***	1.43 [0.159]***	0.482 [0.215]**
Constant	0.648 [0.086]***	0.861 [0.097]***	1.276 [0.057]***	0.591 [0.064]***	0.551 [0.090]***	1.175 [0.104]***	0.688 [0.160]***
R^2	0.996	0.996	0.995	0.995	0.996	0.999	0.996
Obs	380	380	380	380	380	182	339

Note: This table shows regression results for equation (2.10) in the text. The dependent variable is consumption per capita divided by world GDP per capita. GDP and consumption per capita data come from PWT 6.2. *** denotes statistical significance at 99%. The regressions control for country and year fixed effects.

Table 2.16: Effects of Financial Liberalization and Productivity Correlations with ROW in levels. PDOLS

	Miniane	Chinn-Ito	Capital Account	Current Account	Kaminsky &Shmukler	Abiad & Mody	Edwards
τ^*GDP	1.001 [0.063]***	0.955 [0.087]***	0.637 [0.079]***	1.028 [0.086]***	1.062 [0.072]***	0.746 [0.070]***	0.885 [0.072]***
$\rho^* GDP$	0.227 [0.042]***	0.306 [0.038]***	0.282 [0.030]***	0.374 [0.051]***	0.316 [0.048]***	0.506 [0.033]***	0.207 [0.058]***
$\rho^*\tau^* GDP$	-0.571 [0.072]***	-0.601 [0.100]***	-0.367 [0.078]***	-0.831 [0.114]***	-0.711 [0.106]***	-0.769 [0.067]***	-0.431 [0.115]***
Y	0.312 [0.144]**	0.795 [0.115]***	1.278 [0.080]***	0.57 [0.100]***	0.313 [0.157]**	1.632 [0.179]***	0.434 [0.224]**
τ^*Y	-0.503 [0.165]***	-1.024 [0.129]***	-1.232 [0.099]***	-0.769 [0.112]***	-0.36 [0.271]	-2.154 [0.273]***	-0.337 [0.329]
ρ^*Y	0.299 [0.158]**	-0.313 [0.092]***	-0.634 [0.064]***	-0.159 [0.085]**	0.027 [0.153]	-1.355 [0.178]***	-0.031 [0.214]
$\rho^*\tau^*Y$	-0.086 [0.172]	0.576 [0.125]***	0.727 [0.087]***	0.481 [0.107]***	0.126 [0.259]	2.083 [0.277]***	0.087 [0.316]
R^2	0.999	0.999	0.999	0.999	0.999	1	0.999
Obs	340	340	340	340	340	154	297

Note: This table shows regression results for equation (2.11) in the text. See notes in Table 2.15

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