Financial Integration and Consumption Smoothing: Bridging

Theory and Empirics*

Ergys Islamaj †

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Abstract

Does financial liberalization increase consumption smoothing? Yes. This paper develops an empirical framework based on a firmly grounded theoretical model and provides empirical evidence that more financial liberalization improves consumption smoothing. Everything else equal, financial liberalization improves consumption smoothing, although in a nonlinear fashion. On the other hand, increased cross-country productivity correlations provide fewer incentives for risk sharing. The extent of consumption risk sharing also depends on the level of impediments to trade in foreign capital. Empirical results show a stronger effect of financial liberalization on consumption smoothing for more open economies.

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†Department of Economics, Vassar College, 125 Raymond Av, #165, Poughkeepsie, NY 12603. email: erislamaj@vassar.edu
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 sharing\textsuperscript{1}. 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 consumption 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 unambiguously show 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.\textsuperscript{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

\textsuperscript{1}Mace(1991), Lewis(1996), Obstfeld and Rogoff (1996)
\textsuperscript{2}a notable exception would be Lewis(1996)
have been more pragmatic and chosen to interpret the magnitudes of these measures as deviations from the 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 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 shows that these benefits can be large for developing economies. (See Kose, Prasad, Rogoff and Wei (2007) for a review.) For example, Athanassoulis 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. 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 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 types of models predict that in the absence of trade in goods and financial assets (the case of autarky), the correlations of domestic

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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.
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 integrated financial markets.

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 (2009) 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), Beckaert, 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 into empirical studies to date.

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4This is a direct consequence of the fact that under integrated markets marginal utilities of consumption between the two countries would be perfectly correlated.
This study will argue that among the key problems with the existing empirical literature 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 3 offers a review of the different available indicators as well as a discussion of their strengths and weaknesses, before moving into a more formal empirical analysis. Section 4 describes the data used and Section 5 shows the results of the empirical tests. Some robustness analysis is discussed in Section 6 and Section 7 summarizes the conclusions and offers some discussion for suggested future work.

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 shocks. 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 to be 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 income.

### 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 consumption 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 1-3 give a summary of studies investigating the effects of financial integration on consumption smoothing. 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

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5 Previous studies have looked at the regression: 

$$
\log\left(\frac{C_{j,t+1}}{C_{j,t}}\right) = \beta_1 \log\left(\frac{C_{a,t+1}}{C_{a,t}}\right) + \beta_2 \log\left(\frac{X_{j,t+1}}{X_{j,t}}\right) + \epsilon_{j,t+1},
$$

where $c_j^t, c_a^t, X_j^t$ denote country’s $j$ consumption, aggregate consumption and country’s $j$ income respectively. In a financially open world we would expect a statistically significant (and high) $\beta_1$ and an insignificant (and close to zero) $\beta_2$.

6 Note that some studies have looked at more than one hypothesis of consumption smoothing and can appear in more than one table.
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 studies that look at international consumption risk sharing in Table 1, one finds mixed evidence of perfect consumption smoothing, whereas nine others reject the hypothesis of perfect risk sharing at very high levels of statistical significance. In addition, one 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 therefore, 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 consumption risk sharing, we should expect to see a lower correlation for countries with more open financial markets. Table 2 summarizes these studies. All the ten studies in Table 2 show evidence of consumption smoothing for more financially open economies. Among them, two studies differentiate countries based on available indicators of financial openness\(^7\), whereas the rest assume that developed countries are more open than developing economies. In addition, two of these studies suggest that business cycle properties matter.

Second, the literature has asked what happens to consumption smoothing across time. Table 3 summarizes these results. Out of eleven studies looking at the extent of consumption risk sharing across time, seven find that there have been improvements in consumption smoothing as countries have become more liberalized. Among them, 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 time\(^8\) and are able to find evidence of consumption smoothing only for the group of developed countries. From the remaining studies, two show mixed evidence of consumption smoothing and two show that consumption smoothing has deteriorated even for the developed economies.

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 ef-

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\(^7\)Lewis (1996) uses capital account restrictions reported from IMF’s Annual Reports on Exchange Arrangements and Exchange Restrictions (AREAER) and Bekaert, Harvey and Lundblad (2005) use equity market openness measures.

\(^8\)Evidence 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.
fects 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 them to study what happens to consumption smoothing as markets change from autarky, to partial integration, to full integration under a unified framework.

Tables 2 and 3 also show that in some cases studies have been successful in finding improvements in consumption smoothing, once they account for properties of business cycles. Heathcote and Perri (2004) investigate 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 sharing. For example, Kose, Prasad and Terrones (2003) find empirical evidence that financial liberalization improves consumption smoothing only after a threshold level on financial flows is reached. 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.

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10 Kose, Prasad and Terrones (2003), Heathcote and Perri (2004).
that are associated with other ad-hoc studies.

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.

Consider a two-country exchange (Lucas tree) economy. Capital (the tree) 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 $\theta_f$ 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 $\theta_f$ of the foreign tree subject to the budget constraint:

$$\theta_f P^* = (1-\tau)(P - \theta P)$$

where $\tau$ is and iceberg cost.

One can find the foreign share as,
\[ \theta P + \theta_f \frac{P^*}{1 - \tau} = P \implies \theta_f = (1 - \tau) \frac{P}{P^* (1 - \theta)} \]

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 foreign capital is subject to a proportional tax, \( \tau \). This will represent transaction costs in purchasing foreign capital and later will allow us to define financial liberalization. The advantage of defining financial liberalization in this manner is that it allows us to map the effect of the degree of liberalization on consumption smoothing for each level of financial impediments. Given a choice for \( \theta \), consumption in state \( s \) is given by:

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

where \( \theta \) represents fraction of domestic output held, \( X(s) \) and \( Y(s) \) represent domestic and foreign outputs, respectively, and \( \tau \) represents impediments to trade in foreign capital\(^{11} \).

The domestic household solves:

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

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

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\(^{11}\)Market clearing for stocks implies: \( \theta + \lambda_f = 1 \) and \( \theta_f + \lambda = 1 \), where \( \lambda_f \) and \( \lambda_f \) represent the holdings of domestic and foreign capital share of the foreign consumer. Market clearing for consumption good requires: \( c(s) + c^* + (\theta_f Y(s) + \lambda_f X(s))\tau = X(s) + Y(s) \).
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 \( \mu_x \) and \( \mu_y \), respectively, equal variance \( \sigma^2 \) and correlation coefficient \( \rho \).\(^{12}\)

It can be shown that, \( \theta \), the amount of domestic endowment that a consumer chooses to keep, can be determined endogenously, and is a function of \( \tau, \rho, \mu_x \) and \( \mu_y \). This is an interesting observation since it relates the actual amount of financial flows to the financial restrictions imposed on the international markets. In that case, we can derive \( \theta \), the holdings of the domestic tree as:\(^{13}\):

\(^{12}\)Initially assume \( \mu_x = \mu_y = \mu \). In that case, the joint distribution over foreign and domestic endowments is perfectly symmetric and as a result \( P = P^* \).

\(^{13}\)Note that if \( \tau \to 0 \implies \theta \to \frac{1}{\tau} \), and if \( \tau \to 1 \implies \theta \to 1 \)
This would suggest that studies that use financial flows as a measure of financial integration may suffer from an endogeneity problem. Given an expression for $\theta$, we can derive expressions for all the measures of consumption smoothing used in the literature that depend only on $\tau$, $\rho$ and $\mu$. $\rho$ is the cross-country correlation of productivity shocks and $\mu$ can be interpreted as the mean of output in each country. $\tau$ 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 fashion, and second, that consumption smoothing depends not only on the degree of financial openness, but also on the nature of the underlying shocks. These points will be discussed in detail in the next subsection.

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.

### 2.3 Testable Implications

The fraction of domestic and foreign assets held (portfolio choice) will depend on $\tau$, 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 1 and 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 1 and 2 $\mu = 2$, $\sigma = 0.1$ and $A = 1$. At a consumption level $\mu$, these values translate to a coefficient of relative risk aversion (corresponding to $A\mu$) of $2^{14}$. Figure 1 shows what happens to the correlation between domestic consumption and domestic output as transactions costs decrease$^{15}$ and Figure 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.

2.3.1 Correlation between domestic consumption and output:

Figure 1 shows what happens to the correlation between domestic consumption and domestic output as impediments to trading foreign capital, $\tau$, decrease. A low correlation between consumption and output means that countries are better able to share consumption risks. For a given $\rho$, 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 high values of $\tau$ there is little or no change in consumption smoothing when $\tau$ decreases). Figure 1 also highlights that for fixed values of $\tau$, as $\rho$ increases (this is shown by an upward shift in the curve in Figure 1 consumption smoothing deteriorates (the correlation between consumption and output increases). The intuition would be that as $\rho$ increases, productivity processes between the domestic country and the rest of the world become more similar, making the gains from diversifying consumption risk smaller. Even if the country liberalizes, the net result may be deterioration in consumption smoothing if $\rho$ has increased. This might be shown by moving from point A to point B in Figure 1.

$^{14}$and a percentage deviation of output (corresponding to $100 \times \frac{\sigma}{\mu}$) of 5 percent.

$^{15}$Figures 1-2 assume $\mu = 2$, $A = 1$ and $\sigma = 0.1$
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, $\tau$ 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), will be used to estimate these implications. They may represent only a subset of $\tau$ 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.

### 2.3.2 Cross-Country Consumption Correlations:

Figure 2 shows the relationship between financial restrictions and cross-country consumption correlations for different $\rho$. 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 $\tau$ 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 $\tau$, 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, $\rho$, by definition. For low levels of financial restrictions, a higher $\rho$ corresponds to deterioration in consumption smoothing. This might seem a little counter-intuitive as an increase in $\rho$ will increase output correlations by definition, and in return will increase
consumption correlations. But, on the other hand, an increase in \( \rho \) has a huge negative effect on the portfolio share of foreign assets, which in turn decreases cross-country correlations for plausible parameter values. The second effect dominates and a higher \( \rho \) 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 between 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 \( \rho \) (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 \( \tau \) would show more improvement in risk sharing if one calculates risk sharing using \( \text{corr}(c, X) \) than if one uses cross-country correlations of consumption (note that for low impediments the graph for \( \text{corr}(c, X) \) is steeper than the graphs for \( \text{corr}(c, c^*) \)). The opposite is true for high (but non-restrictive) impediments to foreign capital. When using \( \text{corr}(c, X) \) to measure consumption risk sharing, financial liberalization improves consumption smoothing with increasing returns, whereas, when using \( \text{corr}(c, c^*) \) 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 similarly 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 smoothing\textsuperscript{16}. Islamaj 2009b 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.

2.4 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, I am making a direct link between theory and empirics.

Remember equation (1) that says: \( c(s) = \theta X(s) + \theta Y(s) \)

i.e., at the end of each period, once the state of nature is realized, the domestic consumer gets his portion of the domestic output and what he owns of the foreign output.

\textsuperscript{16}This is the reported value for \textit{corr}(c, X) when \( \tau = 0 \) and \( \rho = 0 \). The y-intercept will change for different values of \( \rho \).
One can estimate:

\[ c_t = \beta_{1t} X_t + \beta_{2t} Y_t \]  

(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 estimate\(^{17}\):

\[ \beta_{1t} = \gamma_1 \tau'_t + \gamma_2 \rho'_t + \gamma_3 \rho'_t \tau'_t \]  

(3)

\[ \beta_{2t} = \delta_0 + \delta_1 \tau'_t + \delta_2 \rho'_t + \delta_3 \rho'_t \tau'_t \]  

(4)

where\(^{18}\)

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

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\(^{17}\)See the Appendix (2.8) for more detail. Note that \( \beta_{1t} \) is positively related to \( \tau \).

\(^{18}\)\( \gamma_1 = 1, \gamma_2 = 1 - \frac{\mu}{\lambda \sigma^2}, \gamma_3 = 2(\frac{\mu}{\lambda \sigma^2} - 1), \delta_0 = 1, \delta_1 = 1, \delta_2 = \frac{\mu}{\lambda \sigma^2} - 1, \delta_3 = 2(1 - \frac{\mu}{\lambda \sigma^2}) \) Note that \( \tau \) is positively related to \( \tau'_t \)
According to our model, one should expect \( \tau \) to be positively related to \( \beta_{1t} \) and negatively related to \( \beta_{2t} \).

Based on the discussion in the previous subsection, the relationship between financial liberalization and consumption smoothing is nonlinear and also dependent on \( \rho \). Note that \( \rho \) 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 \( \tau \) and \( \rho \) on \( \beta_{1t} \) will be positive and statistically significant, and on \( \beta_{2t} \) negative and statistically different from zero.

The net effects of a change in \( \tau \) and \( \rho \) can be written as:

\[
\frac{\partial \beta_{1t}}{\partial \tau} = \gamma_1 + \gamma_3 \rho' \geq 0 \\
\frac{\partial \beta_{1t}}{\partial \rho} = \gamma_2 + \gamma_3 \tau' \geq 0 \\
\frac{\partial \beta_{2t}}{\partial \tau} = \delta_1 + \delta_3 \rho' \leq 0 \\
\frac{\partial \beta_{2t}}{\partial \rho} = \delta_1 + \delta_3 \tau' \leq 0
\] 

The hypotheses above can be tested for different values of \( \tau \) and \( \rho \). To perform the test, I substitute (3) and (4) into (2) and estimate:
\[ \Delta c_t = \Delta(\beta_1 t X_t) + \Delta(\beta_2 t Y_t) + \varepsilon_t \]  \hspace{1cm} (9) 

\[ \frac{c_t}{Y_t} = \beta_{1t} \frac{X_t}{Y_t} + \beta_{2t} + \xi_t \]  \hspace{1cm} (10) 

\[ c_t = \beta_{1t} X_t + \beta_{2t} Y_t + \nu_t \]  \hspace{1cm} (11) 

where \( \varepsilon_t, \xi_t \) and \( \nu_t \) represent measurement error. The null hypotheses test whether the net effects of a change in \( \tau \) or \( \rho \) are statistically significant and if they have the predicted sign. Equation (9) comes from first-differencing equation (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 smoothing\(^{19}\). 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 (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

\(^{19}\)In the short run, consumption might also be affected by expected future changes in income, as suggested by the 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).
is imposed by dividing by foreign 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 world
output on both the RHS and LHS of equation (10) may bias the results. Another way is to test like in
equation (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.

3 Rule Based Measures of Financial Liberalization

A natural starting point for any data-based discussion of the effects of financial integration on consump-
tion 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 \( \tau \) 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 inte-
gration is a challenging enterprise (Edison et al. (2002)).

It is important to understand how to interpret financial liberalization. In our model financial liberal-
ization is represented by a tax, \( \tau \), in trading foreign capital. For \( \tau = 0 \) the markets are fully open and
consumers can insure against idiosyncratic country risk ex-ante. For \( \tau = 1 \) the country is said to be in
financial autarky. The model also tells us that \( \tau \) should be interpreted as a rule-based measure of finan-
cial 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 factors\textsuperscript{20}), and the actual flows of foreign capital in and out of a country can be represented by $\theta$, which is also a function of $\tau$.

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 $\tau$ 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 the case of any restrictions on the capital account. As discussed, $\tau$ in the model would correspond to an array of policy and institutional arrangements that would allow for the \textit{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 point C to zero in our model, or a move form point B to point A as shown in the Figure 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 4 shows different indicators of financial liberalization. The IMF indicator, reported in Annual Reports on Exchange Arrangements and Exchange Restrictions (AREAER), has been available for a large

\textsuperscript{20}See Eichengreen (2001) for a review.
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 in the 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.

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 1970-2003\textsuperscript{21}. Output and consumption per capita data come from Penn World Tables, version PWT 6.2.

Financial liberalization data come from the sources in Table 4 which are publicly available. All data are turned into yearly format and are normalized between zero and one, where zero means no restrictions,

\textsuperscript{21}Check Bosworth and Collins (2003) for a list of countries.
and one means closed markets. Then $\tau'_0$ and $\rho'_0$ are constructed using $\tau$ and $\rho$ 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, productivity correlations with rest of the world are constructed by taking the weighted average of the bilateral correlations, where the weights are import shares as reported by the 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.

5 Results

Test results for equation number (9) are shown in Table 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 4. The results presented are for 10-year rolling windows of productivity correlations for the variable $\rho$, but the results are robust to different window lengths.

Table 5 shows the net effects of financial liberalization and changes in cross-country productivity correlations on $\beta_{1t}$ and $\beta_{2t}$. $p$-values are shown in parenthesis. The effects of liberalization are estimated for the average values of $\rho$, whereas the effects of a change in $\rho$ are estimated for low values of $\tau$ (25th percentile), as for high $\tau$ 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 $\tau$, 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 $\tau'_t$) has decreased $\beta_{1t}$, the regression coefficient of 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 $\rho'_t$ by one unit would decrease $\beta_{2t}$ 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 6 shows results for equation (10). Again, the results suggest strong effects of financial liberalization and cross-country productivity correlations on consumption smoothing. A one unit decrease in financial restrictions affects $\beta_{1t}$ by 0.26 units and $\beta_{2t}$ by -0.45 units. A higher estimate compared to the results in Table 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 the Permanent Income Hypothesis (PIH), consumers may adjust their consumption in anticipation of future expected changes of their permanent income and this may be one reason why in certain periods their consumption may de-link from their income, even though there is no change in financial openness.

On the other hand, the results of equation (10) may be influenced by the foreign output, $Y$, which appears in the denominator of both right and left hand sides of the equation. Fluctuations in aggregate world income that may not have necessarily been reflected in country’s consumption and output may be erroneously captured by equation (10). One can also estimate equation (11) which uses data on the levels
of 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 is used\textsuperscript{22}. 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 numbers of leads and lags show similar results and Table 7 presents the results for one lead and one lag. As shown in Table 7, the effects of financial liberalization on $\beta_{1t}$ are stronger in this case, compared to Table 5. In the case of the Miniane measure of financial openness, a decrease in impediments to trading foreign capital that decreases $\tau^t$ by one unit would decrease $\beta_{1t}$ by 0.26 units, suggesting a strong effect of financial liberalization on consumption smoothing. For example, if a country goes from being completely closed to completely open, like the Miniane indicator suggests for Denmark, Finland, etc, the decrease in financial impediments would have decreased $\beta_{1t}$ by approximately 0.26 units (Table 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 indicators. Figure 4 shows the distribution for four of the constructed measures of financial liberalization used in the regressions above. As 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 nontrivial

\textsuperscript{22}Mark and Sul (2003).
distribution.

Table 8 shows the results for equation (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 1, this can be interpreted as being at the left side of Figure 1. The results suggest that the effects are indeed stronger for the most open part of the sample. 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 realizations. 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 correlations 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.

6 Robustness Analysis

Pair-wise correlations between the different measures (not reported here) show that the measures are somewhat correlated with each other (coefficients between .387-.86), 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

---

23 t-tests comparing that one coefficient is statistically greater that the other confirm these results.
24 Coefficient estimates can be found in Table 8.
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 as better than the others, but make use of all the information they provide.

The results presented in Tables 5-8 used cross-country productivity correlations for 10-year rolling windows. The same tests were carried out for different time lengths. 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 the Direction of Trade Statistics Yearbook. The results presented here were done using the weights 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 from 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, \( \rho \).

Estimates of \( \rho \) suggest that the correlations of productivity processes in the developed countries are higher than those of the developing countries and that they have been changing over time\(^{25}\). For example, the average \( \rho \) 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 the US and

\(^{25}\)The 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.
other European countries\textsuperscript{26}. 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.

Results are similar 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 size\textsuperscript{27}. For the regressions in levels, the results were robust to using different leads and lags in the PDOLS methodology.

The regressions in this study were not constrained, but the estimates suggest that for all actual values of $\tau$ and $\rho$ the shares of domestic output will be lower than 1, which was the upper bound on $\theta$ 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.

\textsuperscript{26}$\rho$ is 0.2 for the US, 0.17 for the UK, 0.3 for Denmark, and relatively high for Europe. Contact the author for more detailed statistics.

\textsuperscript{27}The results still hold when the sample is dictated by the Miniane indicator only and by the Kaminsky and Schmukler indicator only.
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 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 direct effect of cross-country productivity similarities on consumption risk sharing appears to be low, but the analysis presented in this paper suggests that they should be considered by the literature as they can deteriorate measures of consumption smoothing via their interaction with measure of financial impediments.

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 strengths 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 correlation with the rest of the world. The more similar the productivity processes
between countries, the fewer incentives there are 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 assets 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 exogeneous and not related to financial liberalization. Future work could focus 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 could 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 in 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 a 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 studying 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.

8 Appendix

At the start of the period, the domestic household buys a fraction $\theta_f$ of the foreign tree subject to the budget constraint(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 $\theta$, consumption in state $s$ is given by:

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

(12)

where $\theta$ represents fraction of domestic output held, $X(s)$ and $Y(s)$ represent domestic and foreign out-
puts, respectively, and $\tau$ represents impediments to trade in foreign capital.

The domestic household solves:

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

such that (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

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

where $\lambda$ is the coefficient of risk aversion.

Assume that $X$ and $Y$ are jointly normally distributed with means $\mu_x$ and $\mu_y$, respectively, equal variance $\sigma^2$ and correlation coefficient $\rho$.\(^{28}\)

Then:

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

\(^{28}\)Initially 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.
\[
cov(u'(c_t(s)), X_t(s)) + E[u'(c_t(s))]E[X_t(s)] = (1 - \tau)\{\cov(u'(c_t(s)), Y_t(s)) + E[u'(c_t(s))]E[Y_t(s)]\}
\]

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: \(c(s) = \theta X(s) + (1 - \theta) Y(s)\)

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

and

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

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

\[
= \frac{1}{2 - \tau} + 1 - \frac{2}{2 - \tau} \frac{1}{1 - \rho} + 2 \frac{1}{2 - \tau} \frac{1}{1 - \rho} + \frac{\mu}{A \sigma^2} \frac{1}{1 - \rho} - \frac{2\mu}{A \sigma^2} \frac{1}{2 - \tau} \frac{1}{1 - \rho}
\]

\[
= 1 - \frac{1}{2 - \tau} + (\frac{\mu}{A \sigma^2} - 1)\frac{1}{1 - \rho} + 2(1 - \frac{\mu}{A \sigma^2})\frac{1}{1 - \rho} \frac{1}{2 - \tau}
\]
References


<table>
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  • Regress consumption growth on independent variables. | Yes | • For short unemployment and involuntary move.  
  • Income not a good variable |
  • Consumption Growth on aggregate consumption growth and income growth | Mixed | • True for exponential utility, not true for power utility |
  • Regress consumption growth on world consumption growth. | No | • Using world consumption produces less bias  
  • Low degree of freedom  
  • Cross-country consumption correlations lower than cross-country output correlations |
| Asdrubali, Sorensen and Yosha (1996) | US states, 1963-1990 | • Decompose the cross-sectional variance of gross state product data into various components representing different channels of risk sharing | No | • 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 | • Decompose GDP for each country into various components | No | • Only 40% of the income risk is smoothed mainly through domestic savings and budget deficits |
| Pakko (1998) | OECD and PWT 5 all years | • Cross-country consumption and output correlations  
  • Correlation of consumption with own and world output  
  • Both Hodrick-Prescot and First-Differenced | No | • 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 1950-1992  
Disaggregated consumption 48 countries 5-year periods 1950-1985 | • Regress tradeables’ consumption growth on output, non-tradeables and leisure  
  • Use capital market restrictions  
  • panel | No | • Hypothesis of perfect risk sharing rejected. |
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<td>9 OECD countries,</td>
<td>Regress proxies for real, fiscal, monetary and demographic factors on errors from regression of domestic to foreign consumption</td>
<td>Yes for short-term, no in long-run</td>
<td>Full insurance against high frequency fluctuations in real, fiscal, monetary and demographic variables</td>
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<td>Aggregate consumption co-varies with lagged demographic and labor market variable in medium-long run</td>
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<td>GMM</td>
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<td>Bai and Zhang (2005)</td>
<td>21 developed 19</td>
<td>Regress cross-sectionally consumption growth on GDP growth</td>
<td>No</td>
<td>Respective coefficients very different from 1 and zero</td>
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<td>Regress in a panel and use World consumption as control</td>
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<td>1973-1998</td>
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<td>IFS, WDI, PWT 6.1</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amler, Cardia and Zimmermann (2004)</td>
<td>OECD 1960:1-2000:4</td>
<td>Use GMM to estimate and test hypothesis concerning pair wise cross-country correlations of macroeconomic variables</td>
<td>No</td>
<td>Cross-country correlations of consumption are low and not higher than output correlations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spectral decomposition</td>
<td></td>
<td>Cross-country output and consumption correlations may not be a robust measure of international risk sharing</td>
</tr>
<tr>
<td>Kose, Otrok and Whiteman (2003)</td>
<td>1960-1990 PWT, 60</td>
<td>Bayesian dynamic latent factor model to study co-movement of macroeconomic aggregates across the world, across regions and within countries</td>
<td>No</td>
<td>Evidence of world cycle, which drives output growth fluctuations and is persistent across time</td>
</tr>
<tr>
<td></td>
<td>countries</td>
<td></td>
<td></td>
<td>Consumption dynamics driven by country and idiosyncratic factors</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Country factors less persistent than world factors</td>
</tr>
<tr>
<td>Study</td>
<td>Data</td>
<td>Methodology</td>
<td>Risk Sharing</td>
<td>Comments</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Lewis (1996)          | PWT 5, 73 countries 1950-1992 Disaggregated consumption 48 countries 5-year intervals 1950-1985 | • Regress tradeables’ consumption growth on output, non-tradeables, leisure and capital market restrictions  
                           • panel                                                                                                                                | Yes          | • Restricted countries’ consumptions are more correlated to domestic output  
                           • AREAER measure used for restrictions                                                                                              |
| Canova and Ravn (1996)| 9 OECD 1970-1990                                                    | • See Table 1                                                                                                                                | Yes          | • Consumption correlations are higher for Europe                                                            |
| Crucini (1999)        | Canadian Provinces, US states and G-7 Various years                  | • 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          | • 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 | • 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          | • C, Y, Q less volatile in industrialized countries                                                        |
| Bai and Zhang (2005)  | See Table 1                                                          | See Table 1                                                                                                                                | Yes          | • 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          | • 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                                         | • 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          | • 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 |
<table>
<thead>
<tr>
<th>Study</th>
<th>Dataset</th>
<th>Methodology</th>
<th>Findings</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artis and Hoffmann (2007)</td>
<td>OECD, E(M)U 1990-2004</td>
<td>• Panel OLS • Levels</td>
<td>Yes</td>
<td>E(M)U countries risk share more than OECD</td>
</tr>
<tr>
<td>Bekaert, Harvey and Lundblad (2005)</td>
<td>See table 3</td>
<td>• See table 3</td>
<td>Yes</td>
<td>Countries with open capital accounts experience greater reduction in consumption growth volatility after opening equity markets</td>
</tr>
<tr>
<td>Kose, Prasad and Terrones (2007)</td>
<td>PWT+WDI 1960-2004 72 countries</td>
<td>• Co-movement with national output w/ world output/consumption • regressions</td>
<td>Yes</td>
<td>Industrial countries have been better able to smooth consumption</td>
</tr>
<tr>
<td>Study</td>
<td>Data</td>
<td>Methodology</td>
<td>Risk Sharing</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Obstfeld (1993)              | PWT 5, G-7 1951-72 vs 1973-88                                       | • 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          | • Slight evidence of risk sharing  
• Small number of observations in each regression  
• Identifies two periods with different financial integration |
• H-P filtered, alternative de-trending methods                                  | No           | • Consumption and output correlations btwn 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 countries  
MFIE (22) and LFIE (33)  
WDI, IFS 1960-1999                  | • 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       | • 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 |
| Artis and Zhang (2005)       | 1973-1985, 1986-1998 See Table 1                                     | See Table 1                                                                 | No           | • Extent of risk sharing has not changed over time                       |
• Levels                                                                     | Yes          | • Both groups risk share more  
• Significant effect of EMU and equity holdings for 1999-2004               |
US states 1960-2000            | • Differentiate btw permanent and transitory shocks  
• Only permanent shocks require countries to insure *ante*  
• Regress consumption on permanent income  
• 2-stage LS                                                        | Yes          | • 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 |
• limited risk sharing in the short-term  
• evidence of risk sharing in the medium and long run |
|--------------------------|--------------------------|-------------|-----|----------------------------------------------------------|
| Islamaj (2008)           | WDI                      | • using available rule-based 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 | • 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 |
• 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 | • Volatility 5 years before and after equity market liberalization  
• Panel  
• Various indicators of financial liberalization | Yes | • Less volatility of consumption growth to GDP growth  
• Results are weaker for emerging markets |
• 9-year rolling window  
• Regressions for each sub-period  
• Effects of financial flows on risk sharing | Mixed | • 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>
<thead>
<tr>
<th>Indicator</th>
<th>Years</th>
<th>Coding</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMF AREAER</td>
<td>1966-95, All IMF members</td>
<td>0/1 dummy for controls on outflows</td>
<td>Extensive coverage</td>
<td>Only controls in outflows. Limited information about intensity. Based only on residents.</td>
</tr>
<tr>
<td>IMF</td>
<td>1996-present</td>
<td>Average of all 0/1 dummies in the new AREAER</td>
<td>Discriminates between outflows and inflows</td>
<td>Only available for 1996-2000</td>
</tr>
<tr>
<td>Brune et. al. (2001)</td>
<td>1973-1999, 173 countries</td>
<td>Sum of 0/1 AREAER dummies over 5 categories</td>
<td>Extensive coverage Discriminates btw outflows and inflows</td>
<td>Not publicly available Still limited</td>
</tr>
<tr>
<td>Quinn</td>
<td>1958- for 22 developed and only 1958, 1973, 1982 and 1988 for 42 developing countries</td>
<td>Using info on AREAER regarding capital account receipts and payments. Assigns values btw 0 and 2 in increments of 0.5</td>
<td>Takes into account intensity of restrictions Discriminates btw inflows and outflows</td>
<td>Limited public availability. Limited disaggregation.</td>
</tr>
<tr>
<td>Miniane</td>
<td>1983-2004, 34 countries</td>
<td>Average of AREAER dummies over 13 categories of capital account transactions</td>
<td>Substantial disaggregation</td>
<td>Limited country coverage No distinction btw controls on inflows and outflows.</td>
</tr>
<tr>
<td>Bekar, Harvey and Lundblad</td>
<td>95 countries, 43 success stories</td>
<td>Dates of stock market liberalization</td>
<td>Extra information</td>
<td>Equity liberalization may be a small subset of financial globalization.</td>
</tr>
<tr>
<td>Chinn-Ito</td>
<td>1970-2006, 163 countries</td>
<td>Calculate the first standardized principal component of the 4 major categories of AREAER For capital account restrictions use a 5-year window</td>
<td>Extensive coverage More information on current account, multiple exchange rates, and the requirement of the surrender of export proceeds</td>
<td>No distinction between restrictions on inflows and outflows.</td>
</tr>
<tr>
<td>Kaminsky and Schmukler</td>
<td>1973-2002, 28 countries Available monthly</td>
<td>3 degrees of intensity of liberalization for capital account, domestic financial system and stock markets</td>
<td>More information on intensity Not based only on capital accounts Discriminates btw inflows and outflows</td>
<td>Limited country average Limited degree of intensity</td>
</tr>
<tr>
<td>Abiad and Mody</td>
<td>1973-1996, 35 countries</td>
<td>4 degrees of liberalization (0-3) over 6 policy dimensions: credit control, interest rates, entry in banking sector, operational restrictions, privatization and international financial transactions</td>
<td>More dimensions Degree of intensity More country coverage than other studies of the same spirit</td>
<td>Still limited country coverage No distinction between inflows and outflows.</td>
</tr>
<tr>
<td>Edwards</td>
<td>1970-2000, 72 countries</td>
<td>0-100, combining Quinn, Mody &amp; Murshid and country-specific data</td>
<td>Large coverage Degree of intensity</td>
<td>Some data is imputed</td>
</tr>
</tbody>
</table>
Table 5: Net Effect of Liberalization and Cross-country Productivity Correlations, eqn (5).

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

Note: This Table shows the net effect of financial liberalization and cross-country productivity correlations on $\beta_1$ and $\beta_2$ 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 $\tau$ is calculated for the median productivity correlation with rest of the world $\rho=0.09$, whereas the effect of a change in $\rho$ corresponds to low $\tau$ for reasons explained in the text.

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

<table>
<thead>
<tr>
<th></th>
<th>Miniane</th>
<th>Chinn-Ito</th>
<th>Capital Account</th>
<th>Current Account</th>
<th>Kaminsky &amp; Shmukler</th>
<th>Abiad &amp; Mody</th>
<th>Edwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\partial \beta_1 / \partial \tau$</td>
<td>$0.26$</td>
<td>$0.18$</td>
<td>$0.15$</td>
<td>$0.10$</td>
<td>$0.20$</td>
<td>$0.05$</td>
<td>$0.27$</td>
</tr>
<tr>
<td></td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.018]**</td>
<td>[0.000]**</td>
</tr>
<tr>
<td>$\partial \beta_2 / \partial \tau$</td>
<td>$-0.45$</td>
<td>$-0.16$</td>
<td>$-0.19$</td>
<td>$-0.12$</td>
<td>$-0.18$</td>
<td>$0.03$</td>
<td>$-0.18$</td>
</tr>
<tr>
<td></td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.2526]</td>
<td>[0.000]**</td>
</tr>
<tr>
<td>$\partial \beta_1 / \partial \rho$</td>
<td>$-0.01$</td>
<td>$0.01$</td>
<td>$0.09$</td>
<td>$0.03$</td>
<td>$0.01$</td>
<td>$0.0314$</td>
<td>$-0.03$</td>
</tr>
<tr>
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<td>[0.212]</td>
<td>[0.070]**</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.185]</td>
<td>[0.044]**</td>
<td>[0.000]**</td>
</tr>
<tr>
<td>$\partial \beta_2 / \partial \rho$</td>
<td>$0.04$</td>
<td>$-0.04$</td>
<td>$-0.18$</td>
<td>$-0.08$</td>
<td>$-0.05$</td>
<td>$-0.16$</td>
<td>$0.00$</td>
</tr>
<tr>
<td></td>
<td>[0.259]</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.000]**</td>
<td>[0.044]**</td>
<td>[0.000]**</td>
<td>[0.773]</td>
</tr>
</tbody>
</table>

Note: This Table shows the net effect of financial liberalization and cross-country productivity correlations on $\beta_1$ and $\beta_2$ 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 $\tau$ is calculated for the median productivity correlation with rest of the world $\rho=0.09$, whereas the effect of a change in $\rho$ corresponds to low $\tau$ for reasons explained in the text.
Table 7: Effects of Liberalization and Cross-country Productivity Correlations, eqn (6).

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

Note: This Table shows the net effect of financial liberalization and cross-country productivity correlations on $\beta_1$ and $\beta_2$ 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 $\tau$ is calculated for the median productivity correlation with rest of the world $\rho$=0.09, whereas the effect of a change in $\rho$ corresponds to low $\tau$ for reasons explained in the text.

Table 8. Effects of Financial Liberalization for Low and High Levels of Liberalization

<table>
<thead>
<tr>
<th></th>
<th>Miniane</th>
<th>Chinn-Ito</th>
<th>Kaminsky &amp; Shmukler</th>
<th>Abiad &amp; Mody</th>
<th>Edwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\delta \beta_1 / \delta \tau$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>0.22</td>
<td>0.14</td>
<td>0.11</td>
<td>0.03</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>[0.000]***</td>
<td>[0.000]***</td>
<td>[0.000]***</td>
<td>[0.422]</td>
<td>[0.000]***</td>
</tr>
<tr>
<td>High</td>
<td>0.35</td>
<td>0.18</td>
<td>0.44</td>
<td>0.01</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>[0.000]***</td>
<td>[0.000]***</td>
<td>[0.000]***</td>
<td>[0.797]</td>
<td>[0.000]***</td>
</tr>
<tr>
<td>$\delta \beta_2 / \delta \tau$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>-0.35</td>
<td>-0.13</td>
<td>-0.10</td>
<td>0.05</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>[0.000]***</td>
<td>[0.000]***</td>
<td>[0.005]***</td>
<td>[0.198]</td>
<td>[0.182]</td>
</tr>
<tr>
<td>High</td>
<td>-0.67</td>
<td>-0.14</td>
<td>-0.26</td>
<td>0.064</td>
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</tr>
<tr>
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<td>[0.000]***</td>
<td>[0.0137]**</td>
<td>[0.265]</td>
<td>[0.000]***</td>
</tr>
</tbody>
</table>

Note: This Table shows the net effect of financial liberalization and cross-country productivity correlations on $\beta_1$ and $\beta_2$ 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.
Figure 1: Financial Liberalization and Correlation between Own Consumption and Income:

\[ \mu = 2, A = 1, \sigma = 0.1 \text{ (HP 04)} \]

Figure 2: Financial Liberalization Correlation between Own Consumption and ROW Income

\[ \mu = 2, A = 1, \sigma = 0.1 \text{ (HP 04)} \]

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 \( \sigma=0.1 \).
Figure 3: Mapping Financial Liberalization Indicators into the Model

1 to A?  B to 0?  B to A?

Note: This Figure is used to explain the mapping of a financial liberalization indicator in our model.

Figure 4: Distribution of Constructed Liberalization Measures