Essays on Trade and Capital Flows in Developing Countries

by

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Submitted to the Department of Economics
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Abstract

This thesis is a collection of essays on the effects of trade and capital flows in developing countries.

Chapter 1 starts with the observation that institutions - contract enforcement, property rights, investor protection, and the like - have received a great deal of attention in recent years. I propose a simple model of international trade in which institutional differences are modeled within the Grossman-Hart-Moore framework of contract incompleteness. I show that doing so yields several surprising conclusions. Institutional differences imply, among other things, that the less developed country may not gain from trade, and factor prices may actually diverge as a result of trade. Then I test empirically whether institutions act as a source of trade, using data on 1998 US imports disaggregated by country and industry. The empirical results provide evidence of "institutional content of trade:" institutional differences are an important determinant of trade flows.

Chapter 2 focuses instead on capital flows. Recent empirical evidence demonstrates that in developing countries, financial liberalization is associated with an increase in consumption volatility. In this chapter I seek to rationalize the evidence by linking it to two important features of developing countries. First, domestic financial markets are underdeveloped. Second, access to international markets is not available to all members of society. I show that in this environment, opening up to international markets reduces the amount of risk sharing attained at home and can raise the volatility of consumption.

Chapter 3, joint work with Quy-Toan Do, discusses the effect of international trade on financial development. In our model, a country's financial development arises endogenously as an outcome of domestic demand for external finance. If poor countries import financially dependent goods rather than produce them domestically, financially intensive sectors shrink in the poor country, demand for external finance decreases and the domestic financial system deteriorates. We test our model using data on financial development for a sample of 77 countries. We find that trade openness is associated with faster financial development in wealthier countries, and with slower financial development in poorer ones.

Thesis Supervisor: Daron Acemoglu
Title: Charles P. Kindleberger Professor of Applied Economics
To my mother
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Contents

1 Institutional Quality and International Trade
   1.1 Introduction ........................................... 7
   1.2 The Basic Model ....................................... 11
       1.2.1 Case I: The Ricardian View of Institutions. .................. 11
       1.2.2 Case II: The Grossman-Hart-Moore View of Institutions. ....... 16
       1.2.3 Equilibrium Outside of the FPE Set ....................... 24
       1.2.4 Factor Prices and Factor Movements ..................... 25
   1.3 Institutional Choice ................................... 27
   1.4 Empirical Evidence ..................................... 31
       1.4.1 Specification ...................................... 32
       1.4.2 Data Sources and Variable Definitions ................... 35
       1.4.3 Results and Robustness ............................. 37
   1.5 Conclusion ............................................ 41
   1.6 Appendix ............................................... 42
   1.7 Bibliography .......................................... 44

2 Financial Liberalization and Consumption Volatility in Developing Countries 55
   2.1 Introduction ........................................... 56
   2.2 An Example ............................................. 61
   2.3 The Model .............................................. 63
       2.3.1 The Environment ................................... 63
       2.3.2 Recursive Solution: the General Case ................... 65
3 Trade and Financial Development\textsuperscript{1}  \hspace{1cm} 85
\hspace{1cm}
3.1 Introduction  \hspace{1cm} 85
3.2 The Model  \hspace{1cm} 89
\hspace{1cm}
3.2.1 The Environment  \hspace{1cm} 89
3.2.2 Closed Economy Equilibrium  \hspace{1cm} 91
3.2.3 Trade Equilibrium  \hspace{1cm} 94
3.2.4 Equilibrium with Factor Mobility  \hspace{1cm} 98
3.3 Empirical Evidence  \hspace{1cm} 99
3.4 Conclusion  \hspace{1cm} 103
3.5 Appendix  \hspace{1cm} 105
3.6 Bibliography  \hspace{1cm} 107

\hspace{1cm}
\textsuperscript{1}This Chapter is joint work with Quy-Toan Do
Chapter 1

Institutional Quality and International Trade

Summary 1 Institutions – quality of contract enforcement, property rights, shareholder protection, and the like – have received a great deal of attention in recent years. Yet trade theory has not considered the implications of institutional differences, beyond treating them simply as different technologies or taxes. The purpose of this chapter is twofold. First, I propose a simple model of international trade in which institutional differences are modeled within the Grossman-Hart-Moore framework of contract incompleteness. I show that doing so reverses many of the conclusions obtained by equating institutions with productivity. Institutional differences imply, among other things, that the less developed country may not gain from trade, and factor prices may actually diverge as a result of trade. Second, I test empirically whether institutions act as a source of trade, using data on 1998 US imports disaggregated by country and industry. The empirical results provide evidence of “institutional content of trade”: institutional differences are an important determinant of trade flows.

1.1 Introduction

What are the sources of trade between the developed world (the North) and developing countries (the South)? How are the gains distributed? How does trade affect factor prices? These questions are especially important to the South. In recent decades it has witnessed a considerable
expansion of trade with the North, but, with a few exceptions, has seen almost no narrowing of the North-South income or wage gap (Husted and Melvin, 2001). An important feature of the North-South trade is that it occurs between strikingly dissimilar countries. This paper attempts to explore the consequences of one important source of dissimilarity: institutions.

The notion of institutions has received a great deal of attention in recent literature. The term typically refers to a wide range of social structures affecting economic outcomes: contract enforcement, property rights, investor protection, the political system, and the like. Empirical evidence, in particular the series of papers by La Porta, Lopez-de-Silanes, Shleifer and Vishny (e.g. 1997, 1998), and Acemoglu, Johnson and Robinson (e.g. 2001, 2002), suggests two important facts. First, institutions matter a great deal for economic performance. Second, the North has much better institutions than the South.

Given the emerging consensus on the primary importance of institutions, it is natural to think that institutional differences could be a source of North-South trade. What are the features of this trade? In answering this question, the key issue is how we should model institutional differences between countries in a trade framework. This paper presents two different approaches, and takes a stand on which one is more appropriate.

The starting point of the analysis is the assumption that some sectors rely on institutions more than others. Dependence on institutions — enforcement of contracts and property rights — is a technological feature of the production process in some industries. This would be the case, for example, if production could not rely on spot markets for inputs, and instead required establishing complex relationships between the factors.

Better institutions in the North then immediately suggest a pattern of comparative advantage. The simplest way of formalizing this would be to model institutions as differences in productivity. We refer to this as the Ricardian view, and present it as a benchmark. Better institutions in the North imply that the North is relatively more productive in the institutionally dependent sectors. The implications are straightforward. First, there will be gains from trade. Second, the South stands to gain more from trade, because it stops producing the institutionally dependent goods, and thus no longer suffers the cost of its weak institutions.

The paper goes on to argue that we have more appropriate tools for modeling institutions. The most significant consequence of poor institutions is not lower productivity, as in the Ri-
cardian view. Contract enforcement, property rights, investor protection, and the like, matter because they allow agents to overcome frictions that arise when two parties with competing interests enter into a production relationship.\footnote{Indeed, there is both macro-level (e.g. Blanchard and Kremer, 1997, Claessens and Laeven, 2003), and micro-level evidence (e.g. McMillan and Woodruff, 1999, Johnson, McMillan, and Woodruff, 2002a, 2002b) that institutional arrangements do influence agents' behavior in important ways.} Thus, if we want to know how differences in institutions affect trade outcomes, we should use a theoretical framework in which they govern relationships between factors rather than manifest themselves in productivity.

To make explicit the role of institutions in alleviating distortions, we adopt a commonly used source of frictions for which quality of contract enforcement and property rights is likely to be especially important. Namely, we take the Grossman-Hart-Moore view of contract incompleteness and parameterize institutional quality in the way suggested in Caballero and Hammour (1998).

When we incorporate institutional differences into the basic Heckscher-Ohlin model of trade, we reach strikingly different conclusions than those obtained under Ricardian view. Under the Grossman-Hart-Moore view, the North gains more than the South, in fact the South may lose from trade. Factor rewards can actually diverge. In the North, labor stands to gain the most from trade. In the South, capital gains the most, while labor is likely to suffer losses.

What is the intuition for these results? Institutions play two key roles in our model. First, contracting imperfections lead to factor market distortions that are not captured by the Ricardian view. Imperfect institutions mean that even under perfect intersectoral mobility, factor rewards differ across industries. One of the factors – labor in our model – is compensated more in the institutionally dependent sector. These are the “good jobs,” in which workers earn rents. Second, institutional differences are a source of comparative advantage: because Northern institutions are better, only the North will produce the institutionally dependent good under trade. After trade opening, the good jobs disappear in the South, and wages decrease as a result. By contrast, the high-paying sector in the North expands to accommodate the entire world demand, resulting in gains from trade over and above those implied by conventional factor-abundance differences. The bottom line is that North’s superior institutions allow it to specialize in the
more desirable industries.\textsuperscript{2,3}

While it is reasonable to think of institutions as fixed in the short run, in the long run they may adapt to changing economic conditions. An extension of the model endogenizes institutions to explore the effects of trade opening on institutional quality. The main conclusion is that trade makes bad institutions more costly, and thus opening to trade will lead to institutional improvement. Countries will compete to capture the advantageous sectors, resulting in a "race to the top" in institutional quality.

The central implication of the model is that institutional differences across countries are an important determinant of trade patterns. We test this prediction with data on US imports disaggregated by 4-digit SIC industry and country, and using a factor content of trade methodology developed by Romalis (2002). Romalis tests whether countries that are abundant in a factor of production capture larger US import shares in industries relatively intensive in that factor. This paper takes the factor content specification and augments it with variation in industry institutional dependence and country institutional quality to test whether countries with better institutions capture higher US import shares in more institutionally dependent sectors. The main finding is that institutional differences are in fact a significant determinant of trade flows.

The Grossman-Hart-Moore framework has recently been used in international trade literature by Grossman and Helpman (2002b, 2002c, 2003) and Antras (2003a, 2003b). This paper is methodologically related to this literature, but differs from it in two important ways. First, existing contributions typically model the differences between North and South not in terms of institutions, but in terms of technology or factor endowments. As such, these models do not address the consequences of institutional differences acting as a source of comparative advantage. The second difference is in focus. The existing models apply contract incompleteness primarily

\textsuperscript{2}The underlying mechanism, which is that a reallocation of industries between countries resulting from trade will affect welfare through reallocation of rents, is more general. It could also be modeled within the efficiency wage dual labor markets framework of Bulow and Summers (1986), or in a two-sector matching model of Acemoglu (2001). In the context of the interaction between globalization and European labor market institutions, a similar argument has been made by Allais (1994).

\textsuperscript{3}This paper is not the first to suggest that when a developed and a developing country open to trade, the North ends up with more desirable sectors. In the Young (1991) model, the South may lose because of decreased learning-by-doing. Galor and Mountford (2003) argue that the 19th century trade opening delayed demographic transition in developing countries, further increasing the South's relative abundance in unskilled labor.
to analysis of boundaries of multinational firms. This paper derives the welfare implications of trade in the presence of institutional differences, as well as how institutions will in turn be affected by trade.

The rest of the paper is organized as follows. Section 2 presents a model of international trade. This is done in two parts. As a benchmark, institutions are modeled as Ricardian technology differences across countries, and the main conclusions obtained from that approach are drawn. We then present our preferred way of modeling institutional differences, and show that doing so reverses most of the conclusions obtained under the Ricardian view. In particular, we contrast the predictions of the model regarding welfare, factor reward changes, and effects international factor mobility with the predictions of standard models. Section 3 presents an extension of the model to a setting in which institutions are endogenously determined. Section 4 describes in detail the empirical strategy and results. Section 5 concludes.

1.2 The Basic Model

1.2.1 Case I: The Ricardian View of Institutions.

It is useful to start with the standard Heckscher-Ohlin paradigm of trade. Consider an economy with two factors, $K$ and $L$, and three goods. Two of the goods are produced using only one factor, and thus we call them the $K$-good and the $L$-good. The mixed good, $M$, is produced with both factors.

Agents have identical Cobb-Douglas utility functions in the consumption of the three goods,

$$U(C_K, C_L, C_M) = C_K^\alpha C_L^\beta C_M^\gamma,$$  \hspace{1cm} (1.1)

where $\alpha$, $\beta$, and $\gamma$ are positive and $\alpha + \beta + \gamma = 1$. Given the goods prices $p_K$, $p_L$, and $p_M$, we let the numeraire be the ideal price index associated with Cobb–Douglas utility:

$$P \equiv \left(\frac{p_K}{\alpha}\right)^\alpha \left(\frac{p_L}{\beta}\right)^\beta \left(\frac{p_M}{\gamma}\right)^\gamma = 1.$$
Consumer utility maximization then leads to the following first-order conditions:

\[ p_K = \alpha \frac{C_K^\alpha C_L^\beta C_M^\gamma}{C_K} \]  
(1.2)

\[ p_L = \beta \frac{C_K^\alpha C_L^\beta C_M^\gamma}{C_L} \]  
(1.3)

\[ p_M = \gamma \frac{C_K^\alpha C_L^\beta C_M^\gamma}{C_M} \]  
(1.4)

Production technology of the \(K\)-good and the \(L\)-good is linear in \(K\) and \(L\). Suppose one unit of capital produces \(a\) units of the \(K\)-good, and one unit of labor produces \(b\) units of the \(L\)-good. Then profit maximization in the two industries implies that

\[ p_K a = r \]  
(1.5)

\[ p_L b = w, \]  
(1.6)

where \(r\) and \(w\) are the returns to capital and labor respectively.

The \(M\)-good is produced with a Leontief technology which combines one unit of \(L\) and \(x\) units of \(K\) to produce \(y\) units of the \(M\)-good. This paper takes the view that institutions matter because they facilitate transactions between distinct self-interested economic parties. The \(M\)-good is the only one which requires joining of two distinct factors of production, and thus it is natural to think of the \(M\)-good as being institutionally dependent. Under the Ricardian view, imperfect institutions would be thought of as a productivity loss in the \(M\)-good sector. Suppose in fact that once a production unit has been formed and production had taken place, a fraction \(\tau\) of the output is lost due to imperfect institutions. The parameter \(\tau\) is meant to capture institutional quality, and thus it is natural to think of better institutions as lower values of \(\tau\). Profit maximization in the \(M\)-good industry then implies:

\[ p_M (1 - \tau) y = w + xr, \]  
(1.7)

which simply says that the price is equal to the unit cost.

The only remaining ingredient of the closed-economy equilibrium is market clearing. It is
useful to define the following notation. Let \( E \) be the share of labor force employed in the \( M \)-sector. This is convenient because the value of \( E \) completely characterizes the resource allocation in the economy. Given \( E \) and the relevant endowments \( K \) and \( L \), the production of the \( M \)-good is

\[
X_M = (1 - \tau) y_E L,
\]

the \( L \)-good:

\[
X_L = b(1 - E)L,
\]

and the \( K \)-good:

\[
X_K = a \left( \frac{K}{L} - xE \right) L.
\]

Goods market clearing then requires:

\[
C_K = a \left( \frac{K}{L} - xE \right) L; \quad (1.8)
\]

\[
C_L = b(1 - E)L; \quad (1.9)
\]

\[
C_M = (1 - \tau) y_E L. \quad (1.10)
\]

The equilibrium in an economy endowed with \( K \) units of capital and \( L \) units of labor is a set of prices and the resource allocation \( \{p_K, p_L, p_M, r, w, E\} \) characterized by equations (1.2) through (1.10).

The model is easily adapted to an international trade setting in the presence of both factor endowment and institutional differences. Suppose that there are two countries, North \( (N) \) and South \( (S) \), and transport costs between them are negligible. Let \( K^N, L^N, K^S, \) and \( L^S \) be the factor endowments in the two countries, and let

\[
\overline{K} = K^N + K^S
\]

and

\[
\overline{L} = L^N + L^S
\]
be the world quantities. To address the issue of trade in the presence of institutional differences, suppose that fractions $\tau^N$ and $\tau^S$ of the $M$-good produced in the North and the South, respectively, are lost due to institutional imperfections. In keeping with the notion that the South has inferior institutions, we assume $\tau^N < \tau^S$.

Without institutional differences ($\tau^N = \tau^S$), the model satisfies all the assumptions of the standard Heckscher-Ohlin factor proportions theory (see Helpman and Krugman, 1985, ch. 1). The unequal institutional quality introduces a Ricardian productivity difference in one sector, and thus the model can be analyzed as a special case of the Davis (1995) Heckscher-Ohlin-Ricardo model.

How can we determine the pattern of production and trade? A useful starting point of the analysis is the integrated equilibrium, which is the production pattern that results under perfect factor mobility. It is obtained by solving for the equilibrium of a closed economy endowed with the world quantities of the factors. From the integrated equilibrium production pattern we can construct a set of partitions of world factor endowments into countries called the Factor Price Equalization (FPE) Set. This is convenient because when country endowments belong to the FPE set, we can show that the integrated equilibrium world resource allocations and prices are replicated purely through trade.

Figure 1.1 illustrates the analysis. The sides of the box represent the world factor endowments. Any point in the diagram can represent a division of the world factor endowments into countries, where the North’s endowments are measured from $O^N$, and the South’s from $O^S$. We typically think of the North as being relatively capital-abundant. When that is the case, the world endowments will be given by a point above the diagonal, such as $A$. The vectors $\overline{V}(i) = [\overline{L}(i), \overline{K}(i)]$ denote the integrated equilibrium factor allocations in industry $i$.

The shaded area represents the FPE set. The key intuition in constructing this set is as follows: the FPE set is those country endowments for which the integrated equilibrium production pattern is replicated by trade in goods. Since the North has an absolute technical advantage in production of the $M$-good, in the integrated equilibrium only the Northern institutional setting will be used in that sector. Thus, country endowments can only belong to the FPE set if the entire integrated equilibrium production of the $M$-good can be accommodated in the North. This is the case, for example, at point $A$. 

14
Prices and the pattern of production and trade are easily obtained for a set of endowments within the FPE set. We know that the goods and factor prices are the same as in the integrated equilibrium, and that the entire integrated equilibrium production of the $M$-good is located in the North. Let $V^j(i) = [L^j(i), K^j(i)]$ be the trade equilibrium use of factors in industry $i$ and country $j$. The pattern of production is graphically illustrated in Figure 1.2 for the factor endowments at point $A$. While in autarky the $M$-good was produced in both countries, under trade the South stops producing $M$ altogether, and now its entire factor endowment is dedicated to production of the $K$-good and the $L$-good. In the North the amount of the labor force in the $M$-sector increases to accommodate the entire world demand.

Welfare Analysis

It is useful to establish an expression for gains from trade. To do this, let $\{p_K^N, p_L^N, p_M^N, r^N, w^N, E^N\}$ and $\{p_K^S, p_L^S, p_M^S, r^S, w^S, E^S\}$ denote the autarky equilibria in the North and South respectively, and let $\{p_K^T, p_L^T, p_M^T, r^T, w^T, E^T\}$ be the values that describe the trade equilibrium. The trade values are obtained by solving for the integrated equilibrium. $E^T$ is the fraction of the worldwide labor force employed in the $M$-sector, which we know from the discussion above is located entirely in the North.

The assumptions we made on the utility function imply that welfare is proportional to real income. Thus, in autarky, the welfare of $L$ and $K$ in country $i$ is simply $w^iL^i$ and $r^iK^i$, and the aggregate welfare is simply $w^iL^i + r^iK^i$. The gains from trade are thus expressed as the difference in factor rewards between trade and autarky.

To get an intuition about the distribution of gains from trade, it is useful to consider the simplest case. In order to focus solely on the effects of institutions, suppose North and South have the same $K^L$-ratio, and that after opening to trade we are in the FPE set (e.g., the endowments are given by a point such as $B$ on the diagonal in Figure 1.1). Because $\frac{K^N}{L^N} = \frac{K^S}{L^S} = \frac{\bar{K}}{\bar{L}}$, we know that $E^N = E^T$.\footnote{Under the assumptions we made, $E$, and the prices, are a function of the relevant $\frac{K}{L}$-ratio only, and not of levels of endowments. Thus, when $\frac{K^N}{L^N} = \frac{K^S}{L^S} = \frac{\bar{K}}{\bar{L}}$, the integrated economy is simply a scaled-up version of the North.} This delivers a significant simplification. Because only the Northern technology is used in the $M$-sector under trade, the goods and factor prices
under trade are the same as the Northern autarky prices: \( w^T = w^N \) and \( r^T = r^N \).

The fact that welfare in the North is unchanged implies that the gains from trade accrue entirely to the South. We can show that welfare of both factors unambiguously rises in the South as a result of trade: \( w^T > w^S \) and \( r^T > r^S \).

More generally, when factor proportions differ between the North and the South, there will be gains from trade to the North as well, and the standard results still obtain: if the North is capital abundant, capital in the North gains while labor loses. However, South will always benefit relatively more than the North. This is because in the North the gains are driven purely by factor proportions differences, while in the South the factor proportions-driven gains are augmented by an effective technology improvement, as the \( M \)-good is now produced with superior technology.

To summarize, as a result of trade opening the South loses all of its \( M \)-sector, but factor rewards increase, as it is able to take advantage of the superior Northern institutions purely through trade. All in all, this is a well-behaved setting that confirms the basic intuition a trade economist might have: if the South is institutionally inferior, it can only gain from trade with the North. The main conclusion, then, is that trade “bails out” the South: the institutionally weak country no longer bears any consequences of its weak institutions. The outcome is markedly different when we think of institutions as the quality of the contractual environment. This is the case we turn to next.

### 1.2.2 Case II: The Grossman-Hart-Moore View of Institutions.

The central point of this paper is that the Ricardian view fails to capture the essence of why institutions are important. Institutional arrangements matter because they help agents overcome transactional impediments that arise when economic relationships are formed. The consequence of these transactional impediments is not to lower productivity, but to create significant distortions.

#### Modeling Institutional Differences

To model a setting in which contract enforcement and property rights matter, we adopt the approach developed by Williamson (1985), Grossman and Hart (1986), and Hart and Moore
(1990) and assume that when two distinct parties invest in joint production, some fraction of their investment becomes specific to the production relationship. A consequence of this investment irreversibility is that it makes the parties more reluctant to enter, introducing inefficiency. One way to get around this problem is to write binding long-term contracts. This is exactly where institutions – contract enforcement and the like – matter a great deal.

It is important to note that this is a very general argument relevant in all kinds of relationships: within firms and at arm’s length, between producers within a supply chain, between managers and outside investors, between owners and employees, etc. Institutional quality determines the severity of transactional impediments that generally arise when two or more distinct parties form a production relationship. We focus on the archetypal case in which the parties to the production are K and L. In order to analyze the impact of institutions on trade outcomes, we start with the 2-factor, 3-good model employed in the previous subsection.

The modeling approach follows Caballero and Hammour (1998). In particular, we assume that a fraction \( \phi \) of capital’s investment in the \( M \)-good sector becomes specific to the relationship.\(^5\) The parameter \( \phi \) is meant to capture quality of contract enforcement and property rights, and its value will differ across countries. In principle, \( \phi \) is a consequence of both technological features of the production process and the institutional environment. This paper naturally favors the latter interpretation. Countries are assumed to have the same underlying production technology that requires \( K \) to make specific investments. What induces differences in \( \phi \) is the degree to which \( K \) can avoid specificity by writing enforceable contracts, a reflection of a country’s institutional quality.

We think of a better institutional environment as lower values of \( \phi \). In other words, if contracts and property rights are well-enforced, each agent will be able to recoup its \textit{ex ante} investment to a greater degree. In the limiting case when \( \phi = 0 \), institutions are perfect and we are back to the standard frictionless setting.

What are the consequences of imperfect institutions? Recall that one unit of \( L \) and \( x \) units of \( K \) are required to produce \( y \) units of \( M \). After the production unit is formed, \( K \) can only

\(^5\) Generally, specificity is relevant for \( L \) as well. That is, fractions \( \phi^L \) of \( L \) and \( \phi^K \) of \( K \) become specific to the production unit. All that matters for the results, however, is the “net effective specificity” which in our case would be \( \phi^K r x - \phi^{\phi} w \) (see more on this in Caballero and Hammour 1998). All the results in this paper hold except for the knife-edge case in which the parameter values are such that the net effective specificity is zero. Thus, we sacrificed \( \phi^K \) for expositional simplicity, and set \( \phi^K = \phi \).
recover a fraction \((1 - \phi)\) of the investment. In order to induce \(K\) to form the production unit, it must be compensated with a share of the surplus, which is given by the revenue minus the *ex post* opportunity costs of the factors:

\[
s = p_My - w - r(1 - \phi)x
\]

We adopt the assumption that *ex post* the parties reach a Nash bargaining solution and each receive one half of the surplus. Thus, \(K\) will only enter the \(M\)-good production if its individual rationality constraint

\[
r(1 - \phi)x + \frac{1}{2}s \geq rx
\]

is satisfied. This can be rearranged to yield:

\[
p_My \geq w + (1 + \phi)rx. \tag{1.11}
\]

This approach to modeling institutions is easily embedded in the general equilibrium model of the previous subsection, where \(p_M, w, r,\) and the size of the \(M\)-sector \(E\) are endogenously determined. Notice that in general equilibrium, condition (1.11) can be interpreted as a joint restriction on \(w, r,\) and \(p_M,\) and will hold with equality. Writing it in this form shows that it parallels the condition that unit price equals the unit cost, (1.7).

The rest of the model is unchanged. The closed economy equilibrium is characterized by equations (1.2) through (1.6), (1.11), and (1.8) through (1.10).

Institutional imperfections modeled here have two key consequences. First, in general equilibrium one of the factors \(- L\) in our case \(-\) is segmented: its rewards differ across sectors. Equation (1.11) makes it possible to calculate the reward to a unit of labor employed in the \(M\)-sector:

\[
w + \frac{1}{2}[p_My - w - (1 - \phi)rx] = w + \phi rx. \tag{1.12}
\]

It is clear from this expression that \(L\) earns rents in the \(M\)-sector, of size \(\phi rx\).

Second, contracting imperfections imply that the outcome is inefficient. There is underinvestment in the \(M\)-good production, and \(w\) and \(r\) are lower than in the efficient case. This is
intuitive. Imperfect institutions imply that it is harder to induce capital to enter the $M$-sector. Compared to the frictionless case, $w$ and $r$ must be pushed down, and $p_M$ pushed up to satisfy the individual rationality condition for capital. This is achieved by reducing the size of the $M$-sector, which simultaneously pushes the factors into the $K$- and the $L$-sectors, lowering $w$ and $r$ and raising $p_M$. The effect is monotonic in $\phi$: higher values of $\phi$ lead to lower $E_i$, $w$, and $r$. Notice also that for a given level of $\phi$, increasing the size of the $M$-sector will raise both $w$ and $r$, thereby raising welfare of all factors employed in all sectors.

In the context of trade, we model better institutions in the North by assuming $\phi^N < \phi^S$: a lower fraction of $K$ becomes specific to the $M$-sector production unit in the North. This modeling assumption needs some justification, because it may seem counterfactual. After all, in this type of model the parameter $\phi$ is traditionally thought of as rigidity of labor market institutions or power of unions. Under this interpretation, the North would be expected to have a higher $\phi$, because it is typically believed that unions in the North are stronger. Latest empirical evidence suggests that this conventional wisdom is not correct, however. Botero et al. (2003) show that labor market regulations are actually more restrictive in the South than the North.

There is a more general objection, however. We are interested in the role of quality of contract enforcement and property rights, and not in labor market institutions. The interpretation of $\phi$ as a quality of contracting institutions is still appropriate, however. Quality of contracts and property rights will affect employment relationships in ways other than through labor laws. In addition, institutional frictions in other relationships will affect both the production allocation and rewards to labor. For instance, the principal lesson from the papers by La Porta et al. is that institutions matter because managers or inside capital expropriate outside investors. In the Appendix, we show that an extension of the model to a setting in which managers expropriate the outside capital ($K$) is straightforward and leaves all the results below unchanged. The basic model in this section can be thought of as a reduced form of a fuller model which includes managers, and in which the relevant difference between the North and the South is the degree to which the managers can expropriate the outside capital.
Trade

To find the pattern of trade, we can use logic very similar to the Davis (1995) model in the previous section. This is because institutional differences act much like a Ricardian comparative advantage. For a given set of factor prices $w$ and $r$, the North’s better institutions enable it to produce the $M$-good at a strictly lower price, because it is easier to satisfy $K$’s individual rationality condition (1.11) in the North.

Proceeding in similar steps, we can solve for the integrated equilibrium in which, not surprisingly, only the Northern institutional setting will be used in $M$-good production. There exists an FPE set, in which the integrated equilibrium prices and production patterns are replicated. This requires, just as above, the factor endowments to be such that the entire integrated equilibrium quantity of $M$ can be produced in the North.

Diagrammatically, the FPE set looks exactly the same as in the Ricardian view (Figure 1.1). We must use the term FPE with caution here. Factor rewards are equalized across countries in each sector, but they now differ across sectors. Thus, relative factor rewards across countries will be determined by which sectors operate in which countries. Nevertheless, the FPE set still has the useful feature that for appropriate factor endowments it allows us to analyze the trade outcomes by first constructing the integrated equilibrium.

The pattern of production and trade is similar to that in the previous section, and is depicted graphically in Figure 1.2. The South stops producing $M$ altogether, and in the North the size of the $M$-sector grows from $E^N L^N$ to $E^T L$ – the entire integrated equilibrium value of production.

Welfare Analysis

We again begin with the simplest case, in which the capital-labor ratios are the same across countries. As we saw above, when institutions are thought of in terms of productivity, all the gains from trade accrue to the South. The North’s welfare is unchanged. We can now contrast this with the welfare implications that result under the Grossman-Hart-Moore view.

Once again it is true that $E$ is a function of the capital-labor ratio only. Because in the

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6 Though the approach to solving the model is similar to Case I, note that thinking of institutions in the contract incompleteness sense requires relaxing a different assumption in the standard Heckscher-Ohlin paradigm. In this case, we keep the common technology assumption, and focus instead on contracting problems. In particular, we must abandon the perfect competition in the factor markets assumption.
trade equilibrium only the Northern $M$-sector is active, we can use the same argument as before to show that from \( \frac{K_N}{L_N} = \frac{K}{L} \), it follows that the trade equilibrium inherits the autarky prices and relative resource allocation of the North ($E^N = E^T$). We can use this to express the gains from trade in a simple form.

Northern "base wage" is equal to the pre-trade value: \( w^N = w^T \) (also \( r^N = r^T \): the total reward to capital is unchanged after trade). But the total rewards to labor are the sum of what labor gets in the $L$-good production and the $M$-good production:

\[
W^T_N = w^T L^N + \phi^N x r^T E^N L,
\]

compared to the autarky value of

\[
W^A_N = w^T L^N + \phi^N x r^T E^N L^N.
\]

It is clear from these expressions that as \( L > L^N \), the North gains from trade purely because of the shift towards the high-paying $M$-sector jobs. In contrast to the previous case, the North gains from trade even if the underlying factor rewards are unchanged (that is, even if trade does not bring any conventional comparative advantage driven gains).

The situation in the South is very different. Before trade, the total rewards to labor were:

\[
W^A_S = w^S L^S + \phi^S x r^S E^S L^S,
\]

and \( r^S K^S \) to capital. In autarky, some of the labor force was in the high-paying $M$-sector. After trade, the $M$-sector disappears, and the South inherits the base factor prices of the North. The total income is now

\[
W^T_S = w^T L^S,
\]

for labor and \( r^T K^S \) for capital.

Now we can see the forces that determine gains from trade. Capital wins unambiguously, because \( r^T > r^S \). Labor experiences conflicting effects: on one hand, the base wage goes up: \( w^T > w^S \). This is the standard comparative advantage effect. But on the other hand, all the high-paying jobs are gone. This is the loss of $M$-sector effect driven by institutional weaknesses.
Thus, labor's gains from trade,

\[ W^T_S - W^A_S = [(w^T - w^S) - \phi^S x r^S E^S] L^S \]

could be negative.\(^7\) For some parameter values, it is even possible that the country as a whole loses by opening up to trade. That is, labor experiences a net loss that is greater than the gain experienced by capital.

Another result concerns factor price convergence. Under the Ricardian view, factor rewards converged perfectly by virtue of being in the Factor Price Equalization Set. In the present case, we once again observe conflicting effects. Rewards to capital are equalized. Trade affects relative rewards to labor in two ways. First, in the South the base wage \( w \) is pulled up to the level of the North, a force towards convergence. On the other hand, however, a higher share of the Northern labor force is employed in the high-paying \( M \)-sector, while in the South it goes to zero. Comparing the mean wages under autarky and trade, we can say unambiguously that the average wage goes up in the North, while it may go up or down in the South. The same forces that erode the gains from trade in the South can also produce factor price divergence resulting from trade.

It is worth emphasizing the intuition for these results. Imperfect institutions have two key consequences in our model. The first is in the international goods market: institutional differences affect country production patterns like a Ricardian productivity difference. Thus, the institutionally dependent good is only produced in the institutionally superior country.

The second is in the labor market: in equilibrium \( L \) is segmented, with workers in the institutionally dependent sector earning rents. Thus, a country is no longer indifferent as to which sectors are active under trade. Superior institutions allow the North to capture the more desirable sector, which disappears in the South. This is the effect not accounted for under the

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\(^7\)This expression relies on the implicit assumption that even though workers are strictly better off in the \( M \)-sector, they do not expend real resources competing for these jobs. Allowing for this possibility does not qualitatively alter the results in this section, provided that the \( M \)-sector rents are not dissipated completely. Complete rent dissipation occurs when the total expenditure by competing agents is equal to the total size of the \( M \)-sector rents. It can be ruled out by some relatively innocuous assumptions. For example, rents are not completely dissipated when agents are risk averse, or when agents differ in how much they value being in the \( M \)-sector. The latter could occur, for instance, if joining the \( M \)-sector is associated with dislocation (moving to the city), and agents differ in their disutility from it. For a detailed discussion of conditions under which complete rent dissipation breaks down, see Hillman (1989, pp. 58-72).
Ricardian view.

The results may still appear puzzling. After all, the world as a whole experiences an institutional improvement as a result of trade opening. This institutional improvement is relevant only to the South, because the North's institutions are the same as they were in autarky. Shouldn't the South then be the principal beneficiary of trade opening?

To resolve the seeming paradox, it is useful to contrast the trade outcome with a hypothetical case of institutional improvement in a closed economy. Recall that imperfect institutions imply that $E$, $w$ and $r$ are all lower than the efficient values. In autarky, improving institutions has two effects on welfare. First, it raises the opportunity costs of the factors, $w$ and $r$. Second, it allows a higher share of $L$ to move to the high-paying $M$-sector.

When the institutional improvement is due to trade, as is the case in the South, the first effect is still present, but the second effect goes in the opposite direction. In fact, the worldwide efficiency gain is achieved precisely by moving the $M$-sector out of the South. Which effect dominates is determined by parameter values. It is useful to consider two extreme examples.

First, suppose that the countries are very similar, with the North's institutions being better by an exceedingly small $\varepsilon$: $\phi^S = \phi^N + \varepsilon$. As a result of trade opening, the worldwide institutional improvement has been negligible, and thus for the South the first effect is nearly zero. The second effect is still very strong, as even a small difference in institutions implies that the high-paying sector moves out entirely. The South is sure to lose in this case.

On the other hand, suppose that the North achieved perfect institutions: $\phi^N = 0$. Under trade, there is no longer market segmentation, and the first-best levels of factor prices are achieved in all countries and sectors. In this case, the first effect dominates. Opening to trade with the North implies that the South reaches the first-best level of aggregate welfare, entirely escaping the costs of its weak institutions.\(^8\)

Once again, the analysis readily incorporates factor endowment differences between countries. In the traditional setting, capital in the North gains, while labor loses from trade. The effect of institutional differences is superimposed on that. Thus, the factor proportions-driven loss to labor is offset by the increase in the size of the high-paying $M$-sector. In the South, the

\(^8\)Note that while the aggregate welfare is at the first-best level, $L$ may still lose from opening to trade, as it can no longer earn rents in the $M$-sector.
relatively abundant labor's gains are eroded by the loss of the \( M \)-sector.

Finally, it is also useful to look at how institutional quality affects welfare under trade. In this example, since South loses all of its \( M \)-sector, its institutional quality ceases to matter. Better Northern institutions can be shown to increase total welfare in both countries. Keeping in mind that superior institutions mean lower \( \phi^N \), we observe that better institutions in the North increase rewards to both factors in the South:

\[
\frac{dw^T}{d\phi^N} < 0 \quad \text{and} \quad \frac{dr^T}{d\phi^N} < 0.
\]

In the North, return to capital increases, but the effect on rewards to labor \( W^T_N \) is ambiguous: the base wage \( w^T \) increases, as does \( E^T \), but per unit rents are lower because of lower \( \phi \). This is intuitive: there is some benefit to \( L \) of having a higher \( \phi \), because it raises the rents component of labor's income.

To summarize, all of the main results that we obtained when considering the Ricardian view are reversed. When institutional differences are a source of trade, the North is certain to gain, while the South may lose. Rewards to labor may actually diverge as a result of trade. In the previous case we saw that the South stands to benefit the most because it is in effect "bailed out" by trade. In this case the situation is quite the opposite: if anything, it's the North that gets bailed out. In autarky, expansion of the high-paying \( M \)-sector in the North was limited by the size of the Northern market. After trade, that sector can expand because of the larger market it now serves.

1.2.3 Equilibrium Outside of the FPE Set

The simple structure of the model makes it easy to analyze equilibria that result when factor endowments lie outside of the FPE set. The key simplifying feature is that two of the goods are produced with only one of the factors. Thus, the rewards that factors can earn in the \( L \)- and \( K \)-sectors, \( w \) and \( r \), are equalized under trade for any set of endowments:

\[
w^T_N = b p^T_L = w^T_S
\]

\[
r^T_N = a p^T_K = r^T_S,
\]
Outside of the FPE set there are several cases to consider. First, when the relative factor endowments are such that the North can produce a quantity of the \( M \)-good sufficiently close to the integrated equilibrium quantity, the South does not produce the \( M \)-good. This is because as long as \( \phi^N < \phi^S \), and the individual rationality condition for \( K \) in the North holds with equality:

\[
p^T_{M}y = u^T + (1 + \phi^N)x^T
\]

the South cannot produce \( M \):

\[
p^T_{M}y < u^T + (1 + \phi^S)x^T.
\]

Such a case is illustrated in Figure 1.3 for a set of endowments at the point \( C \). In this case the North produces only \( K \) and \( M \), and the entire labor force is employed in the \( M \)-sector, earning rents. The production of the \( M \)-good is lower here than under FPE, and thus its relative price is higher. Nevertheless, the South cannot start its own \( M \)-sector industry, and its entire endowment is dedicated to producing the \( K \)- and \( L \)-goods.

More generally, if factor endowments are sufficiently dissimilar, or the North is sufficiently small relative to the South, some production of the \( M \)-good is possible in the South under trade. Outside of FPE, the most important effect of the model is still present. Compared to autarky, the high-paying \( M \)-sector shrinks in the South and increases in the North under trade, with the implications for gains from trade that are much the same as in FPE.

### 1.2.4 Factor Prices and Factor Movements

How will factor rewards change as a result of trade opening between a developed country and a developing one? The answer depends on what we think is the difference between the two countries. The most common way of thinking about this issue is to presume that the developed country is relatively capital abundant. This paper has suggested another way, which seems to be at least as relevant empirically: the developed country has better institutions, which allow the factors to be allocated more efficiently.

We can thus compare predictions of our model regarding factor price changes to those derived in the standard factor-abundance model of trade between a poor and a rich country.
(see, for example, Dixit and Norman (1980)). Since capital is thought to be relatively scarce in the South, the conventional models predict that returns to capital decrease and returns to labor increase when it opens up to trade with the capital-abundant North. In the North it is the opposite: wages go down but return to capital goes up.

These predictions are in sharp contrast with the prediction of this model. Here, Southern capital benefits from opening to trade, whereas labor might lose. On the other hand, the return to capital in the North remains unchanged, whereas rewards to labor increase. These predictions are obtained in the case we considered above where institutional differences were the only source of trade. The model readily incorporates factor proportions differences, and they will still affect factor price changes in the usual way. This example does illustrate, however, that institutional differences could be an important countervailing force to the standard relative factor abundance driven price changes that result from trade.

We can also note here the prediction of this model regarding factor movements. We observe an enormous immigration pressure facing the North from the South, and yet tend to think of capital as a relatively mobile factor. Still, capital does not flow en masse from the North to the South, as Lucas (1990) observed. These two facts are not easily rationalized within the basic Heckscher-Ohlin framework. If labor wants to move to the North simply because the world economy is outside of FPE, why doesn’t the mobile factor – capital – move to the South to equalize factor rewards? The present framework offers institutions as one plausible explanation of these two facts together.

In our model, returns to capital are equalized in all sectors and countries. Thus, it is indifferent as to where it wants to enter production. Labor, however, would much prefer to be in the North. Notice that the source of the migration pressure is not relative factor endowment differences, or differences in productivity. What matters is that once in the North, workers have a chance of joining the high-paying $M$-sector. In the presence of institutional differences, movements of capital – or labor for that matter – cannot equalize factor rewards, as would be the case in a conventional factor proportions model of trade with factor mobility. This is

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It is important to note that this is a direct consequence of assuming that contract incompleteness matters for capital and not for labor ($\phi^k > 0$, $\phi^l = 0$). Naturally, results are reversed, and more in line with the standard theory if one makes the opposite assumption. We hold the view that the assumption we made is more relevant empirically.

26
because, as we saw above, rewards to labor will be different even when countries' endowments are identical.

1.3 Institutional Choice

Until now, this paper analyzed the impact of institutional quality on trade outcomes. This section asks the opposite question: how does opening to trade affect institutional quality? The framework above does not allow us to address this, as it treats institutional quality as exogenous. This section adopts a simple political economy model of institutional choice, and analyzes outcomes before and after trade.\textsuperscript{10}

We first consider autarky outcome in the two-factor, three-good model developed in the previous section. To analyze institutional choice, we adopt the political economy of special interest groups framework of Grossman and Helpman (2001, ch. 7-8). Suppose there is one policymaker and one interest group representing $L$ – the factor which earns rents when institutions are imperfect.\textsuperscript{11}

The policymaker receives a nonnegative contribution of size $c$ from the interest group, and sets institutional quality $\phi$ to maximize its political objective function $G(\phi, c)$. We adopt the standard assumption that the policymaker maximizes a weighted sum of the aggregate welfare in the economy, $S(\phi)$, and the political contribution:

$$G(\phi, c) = \lambda S(\phi) + (1 - \lambda)c,$$

where $\lambda \in [0, 1]$. In this formulation, $\lambda$ can be thought of as parameterizing corruption, and shows the extent to which the policymaker is captive to the interest group. At one extreme, when $\lambda = 1$, the policymaker is the benevolent social planner. At the other, when $\lambda = 0$, it cares only about its political contributions, and in effect sets the policy to serve exclusively the

\textsuperscript{10}Empirical work (e.g. Acemoglu, Johnson, and Robinson) provides evidence that institutions are quite slow to change. Thus, this section should be interpreted as modeling the long-run effects.

\textsuperscript{11}Strictly speaking, of course, only labor employed in the $M$-sector earns rents, thus in some sense it would be most natural to take only this subset of the labor force to be the interest group. The problem with this choice is that the fraction of the labor force employed in the $M$-sector is itself a function of institutions in our model, so the boundaries of the interest group change with the policy choice. To avoid this problem, we assume that the interest group represents the entire labor force, and choose to ignore disagreements between its different subsets.
special interest.

The interest group influences the policymaker by making its contribution contingent on the government's choice of $\phi$. In particular, the interest group confronts the government with a contribution schedule, $c = C(\phi)$, which specifies the contribution the policymaker will receive for each level of $\phi$ that it might set. The objective function of the interest group is simply $L$'s total welfare, $S_L(\phi)$, net of the contribution:

$$V(\phi, c) = S_L(\phi) - c.$$ 

The order of events can be thought of as follows: first, the interest group makes its contribution schedule known to the policymaker. Then the policymaker sets institutional quality $\phi$. Given this $\phi$, agents make their production and consumption decisions.

The last step is simply the equilibrium outcome of the model in the preceding section. Thus, under the assumptions we put on preferences, we know that aggregate welfare equals aggregate real income:

$$S(\phi) = r(\phi)K + [w(\phi) + \phi xr(\phi)E(\phi)]L.$$ 

$S(\phi)$ is maximized when institutions are perfect ($\phi = 0$), and decreases as institutions deteriorate ($\frac{dS}{d\phi} < 0$). This is intuitive because imperfect institutions introduce a distortion in an otherwise frictionless setting. The reward to capital, $r(\phi)$, decreases unambiguously in $\phi$, as does $w(\phi)$.

Imperfect institutions can arise because the agents extracting rents can lobby the policymaker. The interest group's objective function is labor's real income net of the contribution:

$$V(\phi, c) = [w(\phi) + \phi xr(\phi)E(\phi)]L - c.$$ 

This makes it apparent why $L$ will lobby for positive $\phi$: imperfect institutions allow it to earn rents equal to $\phi xr(\phi)E(\phi)L$.

The labor interest group bribes the policymaker to increase $\phi$ above the socially optimal value of zero. The contribution must be large enough to compensate the government for the disutility it suffers from the resulting decrease in aggregate welfare. It is possible to show that
in this setting the equilibrium institutional quality \( \phi^* \) is the one that maximizes a weighted sum of all agents' welfare levels, with higher weight given to those belonging to the interest group:\(^{12}\)

\[
\phi^* = \arg \max_{\phi \in [0,1]} \left\{ \left[ u(\phi) + \phi x r(\phi) E(\phi) \right] L + \lambda r(\phi) K \right\}.
\]  

(1.13)

This formulation highlights the redistributive nature of bad institutions: \( \phi \) is chosen to maximize a weighted sum of welfare levels of all agents, but the agents belonging to the interest group receive a higher weight. Aggregate welfare decreases as a result.

This setting lets us consider proximate determinants of institutional quality. *Ceteris paribus*, better equilibrium institutions will result for 1) low corruption (higher values of \( \lambda \)); 2) higher capital-labor ratios. This is intuitive. As discussed above, the interest group must bribe the policymaker enough to compensate for the loss of aggregate welfare. Higher bribes will be required when the policymaker places a low value on campaign contributions. In the extreme case when \( \lambda = 1 \), there is no way for the interest group to induce a departure from perfect institutions.

The capital-labor ratio works in a similar way. Recall that the loss of aggregate welfare from imperfect institutions arises because \( r(\phi) \) decreases in \( \phi \).\(^{13}\) This effect will be more important...
in a relatively capital-abundant country. In effect, a higher capital-labor ratio leads to a higher “natural” weight given to capital, which is unambiguously hurt by higher \( \phi \).

To summarize, in autarky imperfect institutions can arise as an equilibrium outcome of the political process when the parties extracting rents are allowed to lobby the policymaker. Countries with high corruption and low capital-labor ratios are expected to exhibit inferior institutional quality. This analysis is clearly incomplete, because corruption and the capital-labor ratio are surely affected by institutions. However, it does capture the notion that in autarky equilibrium institutions are a function of the characteristics of the economy.

We can now contrast these conclusions to the outcome under trade. When there are two countries that trade with each other, the interest group in each country must take into account institutional quality of the trading partner as well. The optimal institutional quality becomes a best-response function:

\[
\phi^i(\phi^{-i}) = \arg\max_{\phi^i \in [0,1]} \{ w(\phi^i, \phi^{-i})L^i + \phi^i r(\phi^i, \phi^{-i})E^i(\phi^i, \phi^{-i})L + \lambda r(\phi^i, \phi^{-i})K^i \},
\]

\( i = N, S \).

Recalling our analysis of the trade equilibrium, it is easy to see that the unique equilibrium in this game is that of perfect institutional quality in both countries: \( \phi^N = \phi^S = 0 \). This is driven by the fact that the \( M \)-sector can only be located in the institutionally superior country, and only the superior country’s institutions matter in determining the factor prices. If ever \( \phi^i \geq \phi^{-i} \geq 0 \) with at least one strict inequality, all parties in country \( i \) benefit from improving institutions to a level just below \( \phi^{-i} \). Not only do \( w(\phi^i, \phi^{-i}) \) and \( r(\phi^i, \phi^{-i}) \) increase as a result, but country \( i \) also captures the worldwide rents associated with locating the \( M \)-sector at home.

The mechanisms that made it possible to observe imperfect equilibrium institutions in autarky no longer work in the presence of a trade partner. Notice that the only reason \( L \) lobbies to increase \( \phi \) above the socially optimal level of zero is because it can earn rents in the \( M \)-sector. But under trade, \( L \) will only capture those rents so long as it is the institutionally superior country. In the institutionally inferior country, \( L \) will actually have an incentive to lobby for institutional improvement, up to a point at which it has at least slightly better institutions than

\[\text{into the } K \text{-sector, thereby reducing its opportunity cost } r. \text{ The higher the value of } \phi, \text{ the lower } r \text{ must be to satisfy the constraint.}\]
its trade partner. When both countries are determining their institutions this way, they are forced to choose the best available quality of institutions. In effect, competition to capture the rent-bearing $M$-sector results in a “race to the top” in institutional quality between countries.

An important feature of this result is that country characteristics no longer matter. The South can be entirely corrupt ($\lambda = 0$), so that the policymaker is completely captive to the special interest group. In autarky, it can have very bad institutions. Nevertheless, trade will force institutional improvement even in the most corrupt country. This is because in a country that has inferior institutions, under trade all groups prefer to improve them, so it no longer matters what weight each group receives. The institutional choice framework therefore provides a scenario in which trade does bail out the South: over time, it forces the less developed country to improve institutions.

It is worth emphasizing that this analysis provides a counterexample to most of the existing arguments about the effect of trade on institutions. It is typically thought that trade leads to a deterioration of institutions in developing countries through a “race to the bottom” effect (see Bagwell and Staiger 2001). Thus, to gain competitiveness, a developing country sacrifices its environmental or labor standards. Here we presented a simple argument to the contrary. In our framework, trade is precisely the mechanism which propels institutional improvement in all trading partners. This result is consistent with the empirical evidence presented by Rodrik, Subramanian and Trebbi (2002), who show that trade has a positive effect on institutional quality in a sample of countries.

This analysis is clearly subject to important caveats. There is a strong degree of history dependence in institutions. Trade barriers, both in the form of transport costs and tariffs, are coming down slowly. In fact, rather improving institutions, a corrupt policymaker may opt to erect trade barriers instead, an option not considered here. This simple framework, however, does capture the key idea that bad institutions are more costly in an open world.

1.4 Empirical Evidence

The basic two-country model we described in the previous sections illustrates the consequences of institutional comparative advantage. When countries open to trade, the institutionally su-
prior country will export the institutionally dependent good. This section aims to test this prediction. The empirical strategy, based on Romalis (2002), exploits variation in institutional quality across countries and dependence on institutions across industries. We use data on US imports disaggregated by industry and country to provide evidence that countries with better institutions capture larger import shares in more institutionally dependent industries.

1.4.1 Specification

Because of its simplicity, the basic model we developed above delivers the extreme prediction that the institutionally inferior country does not produce or export the institutionally dependent good, $M$. It is also not useful to talk about import shares in a two-country model. This section outlines an extension of the basic model to derive the predicted relationship between import shares, industry-level institutional dependence, and country-level institutional quality. Estimation of this relationship serves as a test of the model.

We modify the basic model in three ways. First, we now suppose there are $J$ countries. Second, each country produces its own unique variety of the $M$-good. We adopt the Armington assumption: varieties of the $M$-good produced in each country are imperfect substitutes. In particular, while the preferences across the $K$-, $L$-, and $M$-goods are still given by equation (1.1), now $C_M$ is interpreted as a CES aggregate of the $M$-good varieties from each country:

$$C_M = \left[ \sum_{j=1}^{J} C_{Mj}^{\sigma \frac{\sigma-1}{\sigma-1}} \right]^{\frac{\sigma-1}{\sigma}}.$$

We assume that $\sigma > 1$, that is, the varieties from different countries are gross substitutes. In any country $l$, demand for country $k$’s variety of the $M$-good is given by:\(^{14}\)

$$C_{Mk}^l = \frac{p_{Mk}^{-\sigma}}{\sum_{j=1}^{J} p_{Mj}^{-\sigma}} C_M^l.$$

The total value of country $i$'s $M$-sector imports from all countries is:

$$I_M^i = \sum_{j=1, j\neq i}^J p_{Mj} C_{Mj}^i$$

The share of country $k$'s imports in the $M$-sector is then:

$$s_{Mk}^i = \frac{C_{Mk}^i}{I_M^i} = \frac{p_{Mk}^{1-\sigma}}{\sum_{j=1, j\neq i}^J p_{Mj}^{1-\sigma}}.$$  \hspace{1cm} (1.14)

The third modification of the model is motivated by our objective to exploit cross-industry differences in institutional dependence. In our empirical estimation, we will proxy for institutional dependence with measures of product complexity based on intermediate good use. Intuitively, institutions are more important to industries that require joining of a relatively large number of parties to production, simply because there are more relationships that are potentially distorted due to imperfect institutions.

To illustrate the link between product complexity and institutional dependence, we modify the production technology of the $M$-good to include multiple intermediates, in the spirit of Blanchard and Kremer (1997). In particular, suppose that in addition to $K$ and $L$, production of the $M$-good requires the use of $(n - 1)$ intermediates, organized along a chain of production. For simplicity, we assume that each intermediate good producer’s outside option is zero. The producer of the first intermediate joins with $x$ units of $K$ to produce one unit of intermediate 1, and because of contracting imperfections, a share $\phi$ of $K$’s investment becomes specific to the relationship. Once that unit is produced, the first producer joins with a second intermediate producer, and again a fraction $\phi$ of the value of the first intermediate good becomes specific to producer 2, and so on. The $(n - 1)$-th intermediate producer joins with $L$ to produce the final $M$-good, again becoming partly specific to the relationship. In each case, we make our usual assumption that the surplus is divided equally between the parties.

What is the $M$-good price at which production is feasible in this industry? We can solve for it by working backwards from the final goods production stage and using the same reasoning.

33
we applied in the no-intermediates case of the basic model. The key is that each time a party to production makes a specific investment, its participation constraint must be satisfied. In equilibrium, if production takes place, $p_M$ must satisfy:

$$p_M y = w + (1 + \phi)^n r x,$$

(1.15)

an analog to equation (1.11). This equation shows that if relationships between parties joining for production are subject to frictions ($\phi > 0$), the price of the final good will be increasing in the product complexity, $n$. This means that for a given level of institutional quality, the amount of $M$-good produced in equilibrium will be lower the higher is the $M$-good’s complexity. Also, for a given level of $M$-good’s product complexity, a country with better institutions (lower $\phi$) will enjoy a higher level of $M$-good production.

Combining equations (1.14) and (1.15), suppose that country $k$ has a level of institutional quality $\phi^k$. Plugging $p_{Mk}$ into equation (1.14), taking logs, and making a further simplifying assumption that $w$ is close to zero,$^{15}$ we get the following approximate relationship between country $k$’s share of imports to country $l$:

$$\ln(s^I_{Mk}) \approx (1 - \sigma)n \ln(1 + \phi^k) + D_{lk}.$$

(1.16)

Using the assumption that $\sigma > 1$, we can thus establish that countries with inferior institutions (higher $\phi$) will have lower import shares in the institutionally intensive sector ($M$). Furthermore, this effect will be stronger the more institutionally intensive is the $M$-sector (higher $n$). The last term, $D_{lk}$, summarizes the features of the trading countries, as well as characteristics of the $M$-sector, such as factor intensity.

Our empirical analysis aims to test this prediction using import data for the US. Of course, any empirical test of the impact of institutions on trade patterns must control for other determinants of trade. Romalis (2002) developed a simple empirical model which shows that factor endowments of skilled labor, unskilled labor, and capital are important in explaining US import patterns across countries and industries. We augment his model to include institutional

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$^{15}$Alternatively, we could assume that the labor intensity in the $M$-sector production is very low.
intensity. Specifically, we estimate:

\[ \text{rel}\_\text{share}_{ic} = \alpha + \beta_1 \text{inst}\_\text{dep}_i \ast \text{inst}_c + \beta_2 \text{skint3}_i \ast \text{skill}_c + \beta_3 \text{capint3}_i \ast \text{capital}_c + \gamma_c + \delta_i + \epsilon_{ic}, \]

where \( i \) indexes industries and \( c \) countries. In particular, \( \text{rel}\_\text{share}_{ic} \) is country \( c \)'s US import share in sector \( i \), normalized as we will explain below. Industry-level variables \( \text{capint3}_i \) and \( \text{skint3}_i \) are measures of capital and skill intensity, and country-level variables \( \text{capital}_c \) and \( \text{skill}_c \) measure capital and skill abundance. To these we add an industry-level measure of institutional dependence (\( \text{inst}\_\text{dep}_i \)), and a country-level measure of institutional quality (\( \text{inst}_c \)). Motivated by equation (1.16), we are most interested in the coefficient on the institutions interaction term, \( \beta_1 \). A positive estimate of \( \beta_1 \) would provide evidence consistent with the predictions of the model: countries with better institutions capture higher trade shares in institutionally intensive sectors. Our estimation includes a full set of both country and industry dummies.

### 1.4.2 Data Sources and Variable Definitions

We use data on the 1998 US imports classified by 4-digit SIC industry and country of origin, available on the National Bureau of Economic Research website. Overall, there is trade data for 177 countries and 389 industries. The left hand side variable that we use, \( \text{rel}\_\text{share}_{ic} \), is country \( c \)'s trade share in sector \( i \), divided by the average share of country \( i \) in US imports. This is done to make the coefficient comparable across countries and is meant to account for country size and the closeness of its trade relationship to the United States.\(^{16}\)

Our empirical strategy requires a variable that captures industry-level institutional dependence. There is no well-accepted industry-level index of institutional dependence, and, indeed, the very notion is much more vague than, for example, capital intensity. Consistent with the model outlined in the previous subsection, we proxy for \( \text{inst}\_\text{dep}_i \) with a measure of product complexity. In particular, we use the Herfindahl index of intermediate input use, computed from the US Input-Output Use Table for 1992.\(^{17}\)

\(^{16}\)A log-transformation cannot be used because many of the import shares are 0. Dropping all observations in which import shares are zero and estimating a specification with \( \log(\text{rel}\_\text{share}_{ic}) \) as the dependent variable improves both the fit of the regression and the significance of the coefficient of interest.

\(^{17}\)We use this and other measures intermediate input use concentration following the work of Cowan and Neut (2002). We are grateful to Kevin Cowan for sharing the Stata code that generates these measures.
The Herfindahl index has been used to measure product complexity and proxy for institutional dependence in the literature (e.g. Blanchard and Kremer 1997, Cowan and Neut 2002). The rationale for using it rather than simply the number of intermediates employed in production is the following. If intermediate input use is dominated by one or two inputs (high concentration), and all the other intermediates are used very little, then what really matters to the final good producer is the relationship it has with the largest one or two suppliers. The scope for and importance of expropriation by suppliers of minor inputs is probably much smaller than by important suppliers. Thus, simply taking the number of intermediates may give excessive weight to insignificant input suppliers and overestimate the effective reliance on institutions. Because the Herfindahl index increases with concentration, we multiply it by -1 in order to have a measure that increases in institutional intensity.

We control for factor intensity differences in production coupled with factor endowment differences across countries. In particular, we take as a baseline a three-factor model, with unskilled labor, skilled labor and capital. Capital intensity (capint3) of an industry is measured as one minus the share of total compensation in value added. Skilled labor intensity (skint3) is then the ratio of nonproduction workers to total employment multiplied by the total share of labor in value added, \((1 - \text{capint3})\). Unskilled labor is the third factor.\(^{18}\) These are calculated using the US Manufacturing database maintained by the National Bureau of Economic Research and US Census Bureau’s Center for Economic Studies for 1992. While all industry-level measures are calculated using US data, the estimated coefficients are interpretable as long as there are no factor intensity or institutional intensity reversals.

Country-level measures of skilled labor and capital abundance are adopted from Hall and Jones (1999), and are available for 123 countries. Finally, to measure institutional quality we use the index developed by Kaufmann, Kraay and Zoido-Lobaton (2002), which is a composite indicator of protection of property rights and strength of the rule of law for the 1990’s. The index ranges between -2.5 (lowest institutional quality) and 2.5. The final sample contains 117 countries and 389 industries.

Table 1.1 lists some of the least and most institutionally intensive sectors. Industry-level

\(^{18}\) A measure of unskilled labor intensity is not included in the regression because by construction it is spanned by the constant term, \(\text{capint3}\), and \(\text{skint3}\).
variables are summarized in Table 1.2. Institutional dependence is slightly negatively correlated with capital intensity (correlation coefficient of -0.131), and positively, but not strongly, correlated with skill intensity (correlation of 0.277). Summary statistics for country-level variables are given in Table 1.3. The countries for which all the necessary data are available are listed in Table 1.4.

### 1.4.3 Results and Robustness

The baseline results are presented in Table 1.5. Column (1) is the closest to the basic Romalis (2002) three-factor specification, and does not include industry dummies. The coefficient on the interaction term is of the expected sign and highly significant. The effect is quantitatively important as well. In a country that moves from the 25th to the 75th percentile in institutional quality, the predicted relative import share in the good occupying the 25th percentile in institutional intensity decreases by 0.09, and the predicted relative import share in the good corresponding to the 75th percentile in institutional intensity increases by 0.18. The effect is quantitatively similar to the analogous effects in capital and skill intensity and abundance. The model is robust to inclusion of industry dummy variables, which is done in column (2) of Table 1.5. The coefficient on the interaction term is very similar to the base specification, and its significance is unchanged.

To ensure that we are really picking up the effect of institutions on trade, we now conduct a number of robustness checks. One obvious concern is whether the result is sensitive to our choice of institutional dependence variable. To address this, we use a set of alternative measures of institutional dependence. We start with two alternative indices of intermediate use concentration, the share of 20 largest intermediates in total intermediate good expenditure, and the Gini coefficient of intermediate good use. These work in a manner similar to the Herfindahl index, assigning a high institutional intensity to industries with dispersed and even intermediate use pattern, and low institutional intensity to industries in which intermediate use is concentrated. Next, we use a simpler measure, which is the number of intermediates used in production. As we discussed above, when some intermediates are insignificant, this measure will show a sector to be institutionally intensive even when effective contract intensity is low. All three of these measures are calculated using the 1992 US Input-Output Use Table. To
use a completely different measure, we also calculate the ratio of investment to output. This proxies for institutional dependence if the holdup problem increases with the size of investment. Industries whose technology requires a higher investment to produce will have to rely on contract and property rights enforcement to a greater extent. This measure is calculated using the US Manufacturing database maintained by the National Bureau of Economic Research and US Census Bureau's Center for Economic Studies for 1992. Correlations between the Herfindahl index and the alternative indices of institutional intensity are presented in Table 1.6. Table 1.7 presents the results of using the alternative measures of institutional intensity. Regardless of the measure of institutional intensity used, we find a positive and statistically significant relationship between institutional intensity and trade shares.

Another concern might be that the institutional quality measure is a proxy for some other feature of countries with good institutions. For instance, perhaps the more institutionally intensive goods require higher endowments of skilled labor or capital. To address this issue, Table 1.8 presents results for several alternative specifications. To aid comparison, Column (1) reproduces the baseline result, Column (2) of Table 1.5. We then run our basic specification with a full set of interaction terms. Thus, for example, the Herfindahl index is interacted not only with institutional quality, but with skill and capital abundance as well. The results are presented in column (2) of Table 1.8. While the coefficient on the Herfindahl index and institutional quality interaction term is virtually unchanged and still highly significant, the other two interaction terms involving the Herfindahl index are not significant. This suggests that institutional quality is relatively more important to production of complex goods than skill and capital abundance. It is also interesting to note that while the conclusions about the "institutional content of trade" are unchanged with the inclusion of cross-interaction terms, the significance of factor content of trade is eroded. In particular, while in the base specification exports of skill intensive goods were significantly correlated with country skill abundance, the interaction term of skill intensity and institutional quality seems to pick up all the significance. This suggests that institutional quality is relatively more important than skill abundance in generating exports of skill intensive goods.

To test robustness further, we expand the number of factors of production by including raw materials as one of the factors. The raw material intensity (matint4) is measured as the value
of raw material inputs divided by the sum of raw materials and value added. Consequently, the skill and capital intensity in the four factor model are $\text{capint}4 = \text{capint}3(1 - \text{matint}4)$ and $\text{skint}4 = \text{skint}3(1 - \text{matint}4)$, respectively.\(^{19}\) Raw materials abundance is proxied by the total land area divided by the total population, sourced from the World Bank World Development Indicators CD-ROM. Column (3) in Table 1.8 presents the results of estimating a four-factor model. Once again, the coefficient on the institutional intensity interaction term is very similar, and just as significant as in the three-factor specification. Finally, we estimate the four-factor model with all the cross-interactions, and present the results in Column (4) of Table 1.8. The coefficient on the institutional interaction term is slightly lower, but still significant, with a p-value of 6.5%.

Recent evidence suggests that countries with more developed financial markets tend to produce and export goods that rely more heavily on external finance (e.g. Beck, 2003). To control for financial comparative advantage, we construct a measure of industry financial dependence based on Compustat firm-level data, and following the methodology of Rajan and Zingales (1998). In particular, for each firm and each year, we define financial dependence as capital expenditure minus cash flow, divided by capital expenditure. We then average this measure for each firm over the period 1989-1998, and take the median across firms in each sector to create a sector-level index of financial dependence.\(^{20}\) We proxy for country-level financial development with the ratio of private credit by deposit money banks and other financial institutions to GDP for the period 1980-1995, sourced from Beck et al. (2000). Due to limited data availability, the resulting sample includes only 276 industries and 95 countries. Column (5) of Table 1.8 reports the results of controlling for financial comparative advantage alongside institutions in our base specification. We confirm that differences in financial development are a relevant determinant of trade patterns. Our conclusions regarding institutional comparative advantage are unchanged, as the coefficient of interest is similar in magnitude to the baseline estimate and still highly significant. Institutions affect trade patterns in ways that cannot be accounted for exclusively by differences in financial development.

\(^{19}\)Once again, the fourth factor, unskilled labor intensity, is implicit.

\(^{20}\)The number of firms available in each 4-digit SIC sector is generally small, often just 1 or 2 firms. To create meaningful averages, we compute them at 3-digit SIC level. We then drop all observations which were created by averaging less than 10 firms. We are very grateful to Claudio Raddatz for providing us with the necessary firm-level data and helpful advice.
We also attempt to instrument for institutional quality by using the settler mortality variable introduced by Acemoglu, Johnson and Robinson (2001). Because that variable is country-level, we instrument for the interaction term $\text{inst}_{int_i} \times \text{inst}_c$ by the interaction $\text{inst}_{int_i} \times \text{settler}_c$. Because the settler mortality variable is available for only 80 countries, we are left with a smaller sample. The results are presented in the last column of Table 1.8. The coefficient of interest does not change drastically, but is not significant at conventional levels, with a $p$-value of 23%.

As another robustness check, we see whether the results are driven by certain parts of the sample. Column (1) of Table 1.9 presents estimation results on a subsample that excludes the North, defined as industrial countries with per capita PPP-adjusted GDP of at least 50% of the US level. The list of countries belonging to the North is provided in Table 1.4. It is clear from Column (1) that the results are not driven simply by the North-South differences in import patterns. The coefficient of interest is actually greater in magnitude than in the full sample, and highly significant. Notice also that the coefficients on skill and capital interactions lose significance in the South-only sample, reinforcing the relative importance of institutions. We also perform estimation on the subsample that excludes Sub-Saharan Africa, and present the results in Column (2) of Table 1.9. The coefficient of interest is slightly lower than in the full sample, and still highly significant. The results are similarly unchanged when the South-East Asian economies are removed from the sample, as evidenced by Column (3). To check whether the results are driven by outlier industries, in Column (4) of Table 1.9 we estimate our base specification excluding the 10 most institutionally intensive industries.\footnote{Virtually the same results are obtained if we drop the 20 most institutionally intensive sectors, as well as the 10 or 20 least institutionally intensive sectors.}

Finally, we attempt to disentangle the effects of institutional differences from other country characteristics, such as productivity, that could be proxied for by per capita income. Unfortunately, institutional quality and income are so highly correlated (correlation coefficient of 0.82), that the results are at best only suggestive. Column (1) of Table 1.10 presents the outcome of using the log of per capita PPP-adjusted GDP in place of institutional quality. Clearly, countries with higher per capita income capture higher import shares in institutionally intensive
sectors. Whether that is due to institutional differences per se, or some other factor associated with higher per capita incomes cannot be definitively established, as Column (2) shows. Indeed, when both per capita incomes and institutional quality are included in the regression, their coefficients are roughly halved, and neither is significant.\textsuperscript{22}

In columns (3) and (4) we repeat the exercise for the subsample that includes only the South. To the extent that there are major differences in institutions, incomes, and trade flows, the bulk of those will be between the North and the South, rather than within those groups. Focusing on the South may help disentangle the effects of institutions from the rest more successfully. Indeed, in the South subsample, the correlation between institutional quality and income is 0.68, slightly lower than in the sample of all countries. The South subsample provides some evidence that institutions are the most important factor. Column (4) shows that the effect of institutions is both larger in magnitude and relatively more significant than the effect of per capita income. The effect of institutions is borderline significant for the South subsample, with a \( p \)-value of under 12\%, even when per capita GDP is included as one of the controls.

1.5 Conclusion

Recent literature has greatly improved our understanding of the role of institutions in countries' economic performance. Given the emerging consensus regarding their primary importance, a natural question to ask is how do institutional differences affect trade outcomes. This paper presented two simple ways of formalizing institutional differences in a trade framework. Under the well familiar Ricardian view, the South stands to gain the most from international trade, as it no longer bears the cost of its bad institutions. Under the Grossman-Hart-Moore view, the conclusions are reversed, and quite surprising. The North gains the most from trade, while the South may lose. When institutions are a source of trade, labor in the North and capital

\textsuperscript{22}The exercise is complicated by the fact that per capita incomes are also highly correlated with the other country characteristics we use as controls. Indeed, the correlations between per capita incomes and capital and skill abundance are 0.90 and 0.83, respectively, higher than with institutional quality. We tried to allow per capita incomes to explain import shares through all the channels available to us, that is, we included interactions of per capita incomes with the other factors for which we have data. When we do this, the direct effect of institutional quality increases in magnitude, though still falls short of becoming statistically significant. By contrast, the point estimate on the interaction term of per capita GDP and institutional intensity becomes lower in magnitude, and remains insignificant.
in the South are the factors that gain the most. Labor in the South is likely to lose; in fact, wages can diverge as a result of trade. Institutions are quite slow to change, so these results are appropriate in the short run. A different conclusion emerges when we endogenize institutions, something that is meant to capture long-run effects. In autarky, there may be reasons why bad institutions persist indefinitely. International trade, however, leads to a "race to the top" in institutional quality. Countries improve institutions as they compete to capture a share of the advantageous sectors.

So which view of institutions is more relevant in practice? We made a case that the Grossman-Hart-Moore view better captures the role of contracting imperfections between private parties that enter production relationships. A broader view of institutions may include, for instance, government expropriation and political instability, for which the Ricardian view is perhaps more accurate. Industries could also differ in the kinds of institutions they require. This paper argued that interactions between institutions and trade are important, and are likely to be quite nuanced. What kinds of effects prevail in which circumstances remains an open question.

1.6 Appendix

Suppose that production of the $M$-good requires joining outside capital $K$, labor $L$, and an entrepreneur. The joining is organized the following way. First, entrepreneurs raise $K$, and establish a company. Then, the company hires workers.

Sticking to the Grossman-Hart-Moore framework, suppose that in establishing a company, a fraction $\psi_K$ of $K$ becomes specific to the relationship. The parameter $\psi_K$ is meant to capture institutional quality in the La Porta et al. sense. Suppose also that when the company hires a worker, a fraction $\psi_C$ of its value becomes specific as well. This parameter can be thought of as capturing the conditions in the labor market as well as technological features of the production process. In both relationships, we assume once again that the \textit{ex post} surplus is split equally between the parties.

Suppose that the entrepreneur's outside option is fixed at zero. Because $K$ becomes partly specific to the entrepreneur, its participation constraint will hold with equality. Given its \textit{ex}
ante opportunity cost $r$, it will pin down the required return that the company must earn on each unit of $K, R$:

$$(1 - \psi_K)rx + \frac{1}{2}[Rx - (1 - \psi_K)rx] = rx,$$

or,

$$R = (1 + \psi_K)r.$$

Since the company becomes partly specific to $L$, its participation constraint will provide a joint restriction on $w, r$, and $p_M$ that is analogous to equation (1.11):

$$p_My = w + (1 + \psi_C)Rx = w + (1 + \psi_C)(1 + \psi_K)rx.$$

The reward to labor in the $M$-sector is then:

$$w + \psi_C(1 + \psi_K)rx,$$

which corresponds to equation (1.12). Both of the key consequences of the baseline model -- that workers earn rents in the $M$-sector and that the outcome is inefficient -- are unchanged. In this sense, the baseline model without entrepreneurs can be thought of as a reduced form of a fuller model outlined here. It may seem that as long as we are assuming $\psi_C > 0$, extending the model in this way is simply semantics. We would argue that the assumption of positive $\psi_C$ is plausible, and lets us gain a key insight.

Institutional quality in the capital markets, $\psi_K$, has a first order effect on worker compensation by both changing the size of the $M$-sector and the size of workers' rents (equation A1). The fuller model also lets us isolate better what we believe is the relevant difference between the North and the South. In particular, the assumption we made above that $\phi^N < \phi^S$ can be interpreted as a combination of $\psi_C^N = \psi_C^S$ and $\psi_K^N < \psi_K^S$. More generally, this parameterization opens the door to a more nuanced analysis. For example, if $\psi_C$ is thought of as power of unions, the decision of where to locate production will be determined by the interaction of that and the contracting environment. If $\psi_C^N > \psi_C^S$, but $\psi_K^N < \psi_K^S$, which way the comparative advantage in the $M$-sector goes is inconclusive.


45


Figure 1.1: The World Economy and the Factor Price Equalization Set

Figure 1.2: The Pattern of Production
Figure 1.3: Production Pattern Outside of FPE

Table 1.1: Sectors with Highest and Lowest Institutional Intensity

<table>
<thead>
<tr>
<th>Rank</th>
<th>Least Institutionally Intensive Industries</th>
<th>Most Institutionally Intensive Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Meat packing plants</td>
<td>Aircraft parts and equipment, n.e.c.</td>
</tr>
<tr>
<td>2</td>
<td>Soybean oil mills</td>
<td>Mineral wool</td>
</tr>
<tr>
<td>3</td>
<td>Poultry slaughtering and processing</td>
<td>Surgical appliances and supplies</td>
</tr>
<tr>
<td>4</td>
<td>Special product sawmills, n.e.c.</td>
<td>Packaging machinery</td>
</tr>
<tr>
<td>5</td>
<td>Creamery butter</td>
<td>Current-carrying wiring devices</td>
</tr>
<tr>
<td>6</td>
<td>Fluid milk</td>
<td>Small arms ammunition</td>
</tr>
<tr>
<td>7</td>
<td>Tire cord and fabrics</td>
<td>Gray and ductile iron foundries</td>
</tr>
<tr>
<td>8</td>
<td>Malt</td>
<td>Mobile homes</td>
</tr>
<tr>
<td>9</td>
<td>Setup paperboard boxes</td>
<td>Small arms</td>
</tr>
<tr>
<td>10</td>
<td>Stationery products</td>
<td>General industrial machinery, n.e.c.</td>
</tr>
</tbody>
</table>

Table 1.2: Industry-Level Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
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</thead>
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<tr>
<td>capital intensity</td>
<td>0.61</td>
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<td>0.18</td>
<td>0.95</td>
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<tr>
<td>skill intensity</td>
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<td>0.06</td>
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<td>herfindahl index of intermediate use</td>
<td>0.13</td>
<td>0.09</td>
<td>0.04</td>
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Table 1.3: Country-Level Summary Statistics

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<th>Max</th>
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</thead>
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<td>Institutional quality</td>
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<td>0.940</td>
<td>-2.166</td>
<td>1.909</td>
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<td>log of physical capital per worker</td>
<td>9.241</td>
<td>1.586</td>
<td>5.763</td>
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<td>log of human capital per worker</td>
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Table 1.5: Baseline Specification

Dep. Var: Normalized Share of a Country’s Imports in Total Imports

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<td>(0.68)***</td>
<td>(0.64)***</td>
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<tr>
<td>herfindahl index</td>
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<td>(0.69)***</td>
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<tr>
<td>(skill intensity)*(skill endow)</td>
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<tr>
<td>(2.05)***</td>
<td>(2.18)***</td>
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<td>skill intensity</td>
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<tr>
<td>(1.76)***</td>
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<tr>
<td>(capital intensity)*(cap. endow)</td>
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<td>0.49</td>
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<tr>
<td>(0.30)*</td>
<td>(0.28)*</td>
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Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; Herfindahl index of intermediate good use measures institutional intensity; inst is an index of institutional quality from Kaufmann, Kraay and Zoido-Lobaton (2002); capital intensity=1-(total compensation)/(value added); skill intensity=[(nonproduction workers)/(total employment)]*(1-capital intensity); skill endow. and cap. endow are natural logs of human and physical capital per worker, respectively, obtained from Hall and Jones (1999). Variable definitions and sources described in detail in the text.
Table 1.6: Correlation Coefficients between Alternative Institutional Intensity Indices

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<th>no. of int.</th>
<th>inv/out</th>
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<td>herf</td>
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Table 1.7: Alternative Measures of Institutional Intensity

Dep. Var: Normalized Share of a Country's Imports in Total Imports

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<td>(share of 20 largest intern.)*inst</td>
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<td></td>
<td>(0.57)***</td>
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<tr>
<td>(gini coefficient)*inst</td>
<td>21.05</td>
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<tr>
<td></td>
<td>(3.09)***</td>
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<tr>
<td>(number of intermediates/1000)*inst</td>
<td>2.73</td>
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<tr>
<td></td>
<td>(1.62)*</td>
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<tr>
<td>(investment/output)*inst</td>
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<td>4.02</td>
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<td></td>
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<td>(1.53)***</td>
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<tr>
<td>(skill intensity)*(skill endow)</td>
<td>8.02</td>
<td>8.11</td>
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<tr>
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<td>(2.20)***</td>
<td>(2.22)***</td>
<td>(2.12)***</td>
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<tr>
<td>(capital intensity)*(cap. endow)</td>
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<td>0.52</td>
<td>0.43</td>
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<td>(0.28)*</td>
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Country Dummies
Industry Dummies
Observations
Industries
Countries

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; Gini coefficient of intermediate good use, share of 20 largest intermediates, number of intermediates/1000, and investment/output ratio are measures of institutional intensity; inst is an index of institutional quality from Kaufmann, Kraay and Zoido-Lobaton (2002); capital intensity=1-(total compensation)/(value added); skill intensity=|(nonproduction workers)/(total employment)|*(1-capital intensity); skill endow. and cap. endow are natural logs of human and physical capital per worker, respectively, obtained from Hall and Jones (1999). Variable definitions and sources described in detail in the text.
### Table 1.8: Alternative Specifications

Dep. Var: Normalized Share of a Country's Imports in Total Imports

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<td>(herfindahl index)*inst</td>
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<td>2.21</td>
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<td>(0.64)**</td>
<td>(0.95)**</td>
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<td>(skill intensity)*(skill endow)</td>
<td>11.54</td>
<td>2.21</td>
<td>17.33</td>
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<td>(capital intensity)*(cap. endow)</td>
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<td>(raw mat. intensity)*(raw endow)</td>
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<td>(herfindahl index)*(cap. endow)</td>
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<td>(0.58)</td>
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<td>(skill intensity)*inst</td>
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<td>(0.92)**</td>
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<td>(raw mat. intensity)*inst</td>
<td>0.11</td>
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<td>(0.77)</td>
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Country Dummies | yes | yes | yes | yes | yes | yes |
Industry Dummies | yes | yes | yes | yes | yes | yes |
Observations | 31568 31568 31568 31568 20008 18385 |
Industries | 389 389 389 389 276 389 |
Estimation | OLS OLS OLS OLS OLS IV |
Countries | 117 117 117 117 95 80 |

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; Herfindahl index of intermediate good use measures institutional intensity; inst is an index of institutional quality from Kaufmann, Kraay and Zoido-Lobaton (2002). In a 3-factor model, capital intensity=1-(total compensation)/(value added); skill intensity=([nonproduction workers]/(total employment))*(1-capital intensity). In a 4-factor model, raw material intensity=(value of raw material inputs)/(value of raw material inputs+value added); capital intensity=([1-(total compensation)]/(value added))*(1-raw material intensity) skill intensity=([nonproduction workers]/(total employment))*(1-capital intensity)*(1-raw material intensity). skill endow. and cap. endow are natural logs of human and physical capital per worker, respectively, obtained from Hall and Jones (1999). Financial dependence is a measure of dependence on external finance calculated from firm-level Compustat data following the methodology of Rajan and Zingales (1998). Financial development is the ratio of private credit to GDP obtained from Beck et al. (2000). In Column (6), (herfindahl index)*inst is instrumented with (herfindahl index)*(log of settler mortality). Variable definitions and sources described in detail in the text.
### Table 1.9: Alternative Samples

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<td>(0.27)**</td>
<td>(0.30)*</td>
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Country Dummies: yes
Industry Dummies: yes
Observations: 22912
Specification: South only
Industries: 389
Countries: 94

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; Herfindahl index of intermediate good use measures institutional intensity; inst is an index of institutional quality from Kaufmann, Kraay and Zoido-Lobaton (2002); capital intensity=1-(total compensation)/(value added); skill intensity=[(nonproduction workers)/(total employment)]*(1-capital intensity); skill endow. and cap. endow are natural logs of human and physical capital per worker, respectively, obtained from Hall and Jones (1999). Variable definitions and sources described in detail in the text.

### Table 1.10: Institutions vs. Per Capita Incomes

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<td>2.30</td>
<td>1.46</td>
</tr>
<tr>
<td></td>
<td>(1.25)</td>
<td>(2.25)**</td>
<td>(2.23)**</td>
<td>(3.28)</td>
</tr>
<tr>
<td>(skill intensity)*(skill endow)</td>
<td>11.53</td>
<td>11.34</td>
<td>2.52</td>
<td>2.15</td>
</tr>
<tr>
<td></td>
<td>(2.25)**</td>
<td>(2.23)**</td>
<td>(3.28)</td>
<td>(3.27)</td>
</tr>
<tr>
<td>(capital intensity)*(cap. endow)</td>
<td>0.55</td>
<td>0.53</td>
<td>0.50</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>(0.28)**</td>
<td>(0.28)*</td>
<td>(0.41)</td>
<td>(0.41)</td>
</tr>
</tbody>
</table>

Specification: ALL
Country Dummies: yes
Industry Dummies: yes
Observations: 31366
Industries: 389
Countries: 115

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; GDPPC is log of PPP-adjusted per capita GDP in 1995; Herfindahl index of intermediate good use measures institutional intensity; inst is an index of institutional quality from Kaufmann, Kraay and Zoido-Lobaton (2002). Capital intensity=1-(total compensation)/(value added); skill intensity=[(nonproduction workers)/(total employment)]*(1-capital intensity). Skill endow. and cap. endow are natural logs of human and physical capital per worker, respectively, obtained from Hall and Jones (1999). Variable definitions and sources described in detail in the text.
Chapter 2

Financial Liberalization and Consumption Volatility in Developing Countries

Summary 2 One of the chief benefits of financial liberalization proposed by theoretical literature is that it should allow countries to better smooth consumption through international risk sharing. Recent empirical evidence does not support this prediction. In developing countries, financial liberalization seems to be associated with an increase in consumption volatility. In this chapter I seek to rationalize the evidence by linking it to two important features of developing countries. First, domestic financial markets are underdeveloped. I model this by adopting the Kocherlakota (1996) framework of risk sharing subject to limited commitment. Second, access to international markets is not available to all members of society. I show that when risks are idiosyncratic, that is, insurable within the domestic economy, opening up to international markets reduces the amount of risk sharing attained at home and raises the volatility of consumption. When risk is aggregate to the economy, the underdeveloped financial system prevents the pooling of aggregate risk across agents for the purposes of insurance in the international markets. Thus, while the volatility of consumption coming from aggregate risk decreases with financial liberalization, it does so by much less than would be predicted by a representative agent model.
2.1 Introduction

How does international financial integration help developing countries? Two main potential benefits are the more efficient allocation of capital across country borders, and improved risk sharing opportunities. For risk sharing in particular, international financial integration should lead to a decrease in consumption volatility relative to output volatility. The last few decades indeed saw ever-increasing capital flows across national borders. What did we learn about the effects of international financial integration on the volatility of consumption?

The latest empirical evidence suggests that the outcomes are quite different from those predicted by the conventional risk sharing models. Kose, Prasad and Terrones (2003) examine the volatility of consumption relative to income for a broad sample of developing countries. The results are quite puzzling. Consumption volatility relative to income volatility has actually increased between the 80’s and the 90’s for the more financially integrated developing countries. The period in question is precisely the time of increased cross-border capital flows that should have afforded those countries an opportunity to smooth consumption in the face of income shocks. The authors point out that these results cannot be explained away by some countries experiencing crises, because they look at consumption volatility relative to that of income. The regression analysis corroborates these results. Financial openness, measured by the gross capital flows relative to GDP, is associated with an increase in the ratio of consumption volatility to income volatility, up to a certain level of financial openness. Beyond that level, financial integration does seem to lower consumption volatility.

The main purpose of this paper is to propose an explanation for the perplexing empirical evidence. We explore the effects of financial liberalization on developing countries in light of two important features of these countries. First, domestic institutions and financial markets are underdeveloped. Second, not all agents have access to the international financial markets. In this framework, we reach three main results. When risks are purely idiosyncratic, that is, perfectly insurable within the domestic economy, opening up to international markets reduces the amount of risk sharing attained at home and raises the volatility of consumption. When risk is purely aggregate to the economy, the underdeveloped financial system prevents the pooling of aggregate risk across agents for the purposes of insurance in the international markets. Thus, while the volatility of consumption decreases with opening in this case, it does so by much
less than in a frictionless model. Finally, the gains from financial integration are unevenly distributed. Agents that have direct access to international markets benefit disproportionately, while those that do not may actually experience an increase in their consumption volatility and a decline in welfare.

This paper represents a very different treatment of the relationship between financial integration and consumption volatility. In thinking about this relationship, our intuitions are typically shaped by representative agent models such as Obstfeld (1994) or Obstfeld and Rogoff (2000). By construction, these models can only tell us about the role of financial integration in sharing aggregate country risk. The representative agent models make two implicit assumptions. First, to the extent there is idiosyncratic risk among agents within a country, these agents reach the first best level of risk sharing, and only aggregate risk remains to be insured abroad. Second, the aggregate country risk is perfectly pooled across agents, or, alternatively, all agents have equal access to the international markets.

To help rationalize the disconcerting empirical evidence, this paper focuses on precisely the aspects missing from the traditional analysis. We move away from the representative agent framework. In our model, agents are heterogeneous both in their income process, and in whether or not they have access to the international financial markets. Of course, this approach is only fruitful when the within-country risk sharing arrangement is subject to frictions, but we believe that these frictions are important, especially in the less developed countries.

The basic model is a version of the Kocherlakota (1996), or Kehoe and Levine (2001) framework of risk sharing subject to limited commitment. In the model there are two groups of people whose income processes may differ. They enter into a risk sharing relationship, subject to the constraint that participation by each agent must be voluntary in all dates and states. We view this constraint as a consequence of poor contract enforcement and an underdeveloped financial system. Agents cannot successfully commit their future income flows to the risk sharing relationship.

The voluntary participation constraint means that the first best level of risk sharing is not necessarily achieved. Agents with high current income realizations will be tempted to walk away from the risk sharing arrangement and enjoy the high current consumption. If the agent does walk away, however, the risk sharing arrangement is severed forever. Naturally, each
agent's outside option will be key in determining the extent to which voluntary participation is sustainable. If the outside option is very good, the risk sharing relationship may not be viable, because the agent will choose to walk away the first time her current income shock is high. Since financial opening will affect some agents' outside option, it will have an important effect on the state of domestic risk sharing.

We model financial opening as allowing only one group of agents access to international markets. We call these agents the upper, or middle, class. The assumption that only some groups will have access to foreign markets seems plausible for developing countries. For simplicity, we will think of the foreign markets as providing an exogenous amount of insurance, and do not model them explicitly. When the upper class gains access to the international markets, it chooses the amount of its participation in the domestic and foreign markets optimally. Thus, we extend the basic Kocherlakota framework to endogenize the extent of participation in the domestic risk sharing arrangement by one of the groups.

What effects will financial liberalization have in this economy? We consider two polar cases. First, suppose that the groups face purely idiosyncratic risks, and aggregate country risk is absent. In the frictionless benchmark, there is no insurance role for the international markets. When domestic risk sharing is subject to frictions, however, access to international markets has important consequences through its effect on agents' outside options. As the upper class experiences a dramatic increase in their outside option, the extent of risk sharing attainable in the domestic relationship is reduced. Furthermore, the less attractive the domestic risk sharing relationship becomes, the more likely it is that the upper class will reduce its participation in it, and insure abroad instead. When they do so, the agents left behind in the domestic risk sharing relationship experience an increase in consumption volatility, because the income from the upper class is no longer available to insure them. Thus, when access to international financial markets is quite uneven in the economy, some groups' participation in these markets actually lowers the extent of risk sharing available at home. As a result, the members of society unable to take advantage of international financial integration will be adversely affected, and their consumption volatility will increase.

The second polar case we consider is that of only aggregate uncertainty. All agents in the economy face the same income process, but they are nonetheless heterogeneous in whether or
not they have access to international markets. In the frictionless benchmark, it is not important
which of the agents have access to international markets, because the aggregate income risk
would be pooled and insured abroad optimally by the agents able to do so. In our framework,
the voluntary participation constraint in the domestic markets prevents this from occurring.
The upper class will certainly insure its income shocks abroad. However, there are limits to how
much of the lower class's income it can insure. We show that in this framework, even aggregate
country risk is not fully eliminated.

It is also clear that the benefits from financial integration are unevenly distributed between
the groups, with the upper class enjoying them fully, while the lower class benefits less. Fur-
thermore, when idiosyncratic risks predominate in the economy, agents that do not have access
to international markets may actually lose from financial liberalization, as their opportunities
for insuring income risk decrease.

A large literature studies the relationship between financial and trade integration and output
volatility. Since integration affects agents' investment and asset allocation decisions, it naturally
changes the volatility of output. A number of very different models, such as Baxter and Crucini
(1995), and Acemoglu and Zilibotti (1997) show that output volatility may increase due to
financial integration. An important strand of the literature analyzes the role of speculative
capital flows in precipitating financial crises in emerging markets, with important consequences
for real output volatility. Kaminsky and Reinhart (1999) argue that emerging market crises
are frequently “twin crises,” in which a balance of payments crisis is combined with a banking
crisis. In this framework, foreign capital inflows prone to “sudden stops” a la Calvo (1998)
exacerbate distortions in the domestic banking system and increase the likelihood of crises.

This paper addresses a different question. Suppose that international financial integration
does increase output volatility in emerging markets – as indeed appears to be the case (see Kose,
Prasad and Terrones, 2003). A representative agent model in which agents can use international
markets to insure against output risk would still imply that consumption volatility, and certainly
the ratio of consumption volatility to income volatility, should decline under quite general
conditions.¹ Here, we provide a framework which shows that domestic frictions and uneven

¹An important exception is an economy which is subject primarily to shocks to trend growth. See Aguiar and
access to international markets can prevent this from happening, and indeed consumption volatility can increase with financial liberalization in some cases. The argument does not rely on a rise in output volatility resulting from liberalization.

The contribution most closely related to ours is Attanasio and Rios-Rull (2000b). These authors build a model of a village economy in which agents face both aggregate and idiosyncratic risks. Local arrangements subject to limited commitment help agents partly insure against idiosyncratic risks. The authors consider the consequences of an outside program that insures the villagers against the aggregate risk. They find that because aggregate insurance raises the agents' outside option, arrangements to share idiosyncratic risks deteriorate. The authors use this framework to caution against undesirable consequences of international aid programs to poor village economies in less developed countries. While the model in our paper is methodologically related to this contribution, we address a different issue, and suggest a different mechanism. In our model, agents use international markets to smooth both idiosyncratic and aggregate income shocks. Consumption volatility increases because of uneven access to foreign markets, and is related explicitly to participation in international financial markets. The framework we use thus allows us address the distributional aspects of financial integration in developing countries. In addition, the Attanasio and Rios-Rull mechanism does not generate an increase in aggregate consumption volatility obtained in our model.

The rest of the paper is organized as follows. Section 2 presents a sketch of the argument for how incomplete participation in international markets can increase consumption volatility if risks are not shared efficiently within the economy. Agents' behavior looks clearly suboptimal in this example. Section 3 presents the model of risk sharing, in which the perverse effects sketched out in the simple example arise as a consequence of frictions in the domestic risk sharing system, namely limited commitment. In particular, we analyze the cases of purely idiosyncratic risk and purely aggregate risk, to show that domestic frictions can prevent this economy from taking full advantage of international consumption insurance opportunities and, in some cases, aggregate consumption volatility can actually go up. Section 4 concludes.
2.2 An Example

Suppose there is an endowment economy populated by two types of agents, $A$ and $B$. The agents' endowments in each period are comprised of an aggregate component common to both groups, and an idiosyncratic component, which is perfectly negatively correlated across groups. Suppose for simplicity that the aggregate shock takes on values of $\eta$ and $-\eta$ with equal probability. Type $A$ gets an idiosyncratic shock of size $\omega$ with probability $\frac{1}{2}$, and $-\omega$ with probability $\frac{1}{2}$, independent of the aggregate shock in that period. Type $B$'s idiosyncratic shock is the opposite of $A$'s in each case. There are then four equiprobable states of nature, for which agent endowments $(e^A, e^B)$ are given in Table 2.1.

<table>
<thead>
<tr>
<th>$(e^A, e^B)$</th>
<th>Aggregate State</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>$(1 + \eta + \omega, 1 + \eta - \omega)$</td>
<td>$(1 - \eta + \omega, 1 - \eta - \omega)$</td>
</tr>
<tr>
<td>Idiosyncratic State</td>
<td>$(1 + \eta - \omega, 1 + \eta + \omega)$</td>
<td>$(1 - \eta - \omega, 1 - \eta + \omega)$</td>
</tr>
</tbody>
</table>

Table 2.1: Agents' endowment values by state.

In this endowment economy with no aggregate saving, the variance of aggregate output is $Var(Y) = 4\eta^2$. In the closed economy, variance of aggregate consumption is $Var(C) = 4\eta^2$ as well. Assuming agents are perfectly able to share idiosyncratic risk, the average per capita consumption variance is $Var(c) = \eta^2$.

Suppose now that this economy opens up to international markets, but not all agents have access. In particular, assume that only type $A$ can insure abroad, and for simplicity suppose she insures perfectly her income process, both the aggregate and idiosyncratic components. Now $A$'s consumption is constant, but none of $B$'s risks are insured. Consumption values of agents $(e^A, e^B)$ are given in Table 2.2.

<table>
<thead>
<tr>
<th>$(e^A, e^B)$</th>
<th>Aggregate State</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>$(1, 1 + \eta - \omega)$</td>
<td>$(1, 1 - \eta - \omega)$</td>
</tr>
<tr>
<td>Idiosyncratic State</td>
<td>$(1, 1 + \eta + \omega)$</td>
<td>$(1, 1 - \eta + \omega)$</td>
</tr>
</tbody>
</table>

Table 2.2: Agents' consumption values by state, after opening.
While in this economy the variance of aggregate endowment is still $\text{Var}(Y) = 4\eta^2$, aggregate consumption now has variance $\text{Var}(C) = \eta^2 + \omega^2$. The average per capita consumption variance is $\text{Var}(c) = \frac{1}{2}(\eta^2 + \omega^2)$.

Three conclusions from this simple example are worth highlighting. First, the volatility of aggregate consumption does not decrease unambiguously. It is true that type $A$'s newfound ability to insure herself against aggregate risks acts to decrease consumption variance. But $A$'s decision to participate in the foreign markets deprives type $B$ of the ability to insure her idiosyncratic risks. Thus, if risks that are insurable within the economy are important relative to aggregate country risk, aggregate consumption volatility may go up as a result of type $A$'s departure.

Second, the aggregate country risk is not eliminated entirely in this economy. While type $A$ can insure herself against those risks, type $B$, which does not have access to international markets, is still subject to aggregate shocks. Thus, when access to international markets is uneven in this way, the economy may not be able to take full advantage of aggregate insurance they provide.

Finally, the gains from this type of liberalization are unevenly distributed. In particular, while $A$ gains from accessing the international markets, $B$'s consumption volatility increases due to reduced risk sharing opportunities at home.

This example is clearly oversimplified. In particular, the agents' behavior following opening up to international markets looks far from optimal. Two key questions arise. First, why would type $A$ insure her idiosyncratic risk abroad when she can do so at home? Second, why can't type $A$ efficiently pool the entire aggregate risk of this economy, and use her access to foreign insurance technology to insure type $B$'s aggregate risk as well? In a frictionless benchmark that we should keep in mind, agents insure each other perfectly against idiosyncratic risk before and after financial liberalization, and access to foreign insurance even by a subset of agents will eliminate all aggregate risk as well. In the next section we build a model to show that frictions in the domestic risk sharing system lead to outcomes illustrated in this simple reduced-form example.
2.3 The Model

2.3.1 The Environment

The basic model is a simple version of Kocherlakota (1996), or Kehoe and Levine (2001). There is an endowment economy populated by two kinds of infinitely lived agents, A and B, with identical period utility $u(c_t)$, and discount rate $\beta < 1$. Each group has mass 1. Agents in each group maximize lifetime expected utility:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$$

(2.1)

There are $S$ states of nature, denoted by $s = 1, ..., S$, with state $s$ occurring with probability $p_s$. Agents' stochastic endowments are $e_s^A$ and $e_s^B$ in each $s = 1, ..., S$. We make the simplifying assumption that the two groups face an identical endowment process. Aggregate endowment in this economy is $Y_s = e_s^A + e_s^B$ in each state $s$.

We assume that endowments are perishable, and so there is no aggregate saving in the economy. When each agent simply consumes her endowment in every period, the lifetime expected utility is given by:

$$v_{aut} \equiv E \sum_{t=0}^{\infty} \beta^t u(e_t) = \frac{1}{1 - \beta} \sum_{s=1}^{S} p_s u(e_s).$$

(Here, the subscript "aut" stands for personal "autarky").

We model uneven access to international markets by assuming that only agents of type $A$ can use these markets to insure. Suppose that the foreign insurance provides $\phi_s$ to type $A$ in state $s$, $s = 1, ..., S$, for each unit of endowment that the type $A$ commits to the international markets. To make the problem interesting, suppose that accessing the international markets has a cost $\pi$. Thus, if the type $A$ chooses to insure $\psi$ units of her endowment abroad, she will be able to consume

$$y_s^A = e_s^A + \phi_s \psi - \pi \psi$$

in state $s$, $s = 1, ..., S$. We make the assumption that the transfers are a pure insurance, that is, $E(\phi_s) = 0$. Note that this requires agent $A$ to transfer income to international markets in
some states ($\phi_s < 0$ for those $s$).

The trade-off is clear. If there is no type $B$, the optimal foreign market participation will weigh the benefits of insurance against the costs of buying it, $\pi$. When insurance is costless, the agent insures completely. Access to costly international markets will now determine the outside option of the type $A$ agent. Let $\psi_{aut}$ denote the optimal portfolio of international insurance type $A$ would choose in the absence of $B$: 

$$\psi_{aut} = \arg \max_\psi \left\{ \frac{1}{1 - \beta} \sum_{s=1}^{S} p_s u(y^A_s) \right\}$$

s.t.

$$y^A_s = e^A_s + \phi_s \psi - \pi \psi, \quad \forall s = 1, ..., S$$

$$\psi \geq 0.$$ 

We introduce the last constraint because of the positive cost of purchasing insurance, $\pi$. Allowing agents to buy negative amounts may in this formulation lead them to do so for values of $\pi$ high enough, as it can raise their average consumption. We let $\psi^A_{aut}$ be the lifetime expected utility type $A$ gets from optimally participating only in the international markets.

Besides the foreign markets, type $A$ can also enter into a risk sharing relationship with type $B$. Domestic risk sharing is subject to limited commitment. Agents can walk away from the relationship at any point. If this happens, the domestic risk sharing relationship breaks down forever. We view limited commitment as a consequence of institutional imperfections in the domestic markets, such as poor contract enforcement. The main problem is that these agents cannot sign a binding contract committing their future income flows to the relationship. The voluntary participation constraint must hold in all dates and states, and will limit the amount of risk sharing attainable in this economy.

In general, the evolution of risk sharing and consumption in this economy is history-dependent. Denote by $s^t = \{s_0, ..., s_t\}$ the history of the states of nature through period $t$. Agents enter the risk sharing arrangement by specifying consumption allocations ($c^A(s^t)$, $c^B(s^t)$) and foreign market participation by type $A$, $\psi(s^t)$ for each period, and each possible history $s^t$, 

64
subject to the participation constraint of each agent in each date and for all histories,

$$\mathbb{E}_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} u(c^A_{\tau}, s^\tau) \geq \mathbb{E}_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} \gamma u(y^A_{\tau}, s^\tau) = \gamma \left( u(y^A_t, s^t) + \beta v^A_{aut} \right), \quad \forall t, s^t, \quad (2.2)$$

$$\mathbb{E}_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} u(c^B_{\tau}, s^\tau) \geq \mathbb{E}_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} \gamma u(c^B_{\tau}, s^\tau) = \gamma \left( u(c^B_t, s^t) + \beta v^B_{aut} \right), \quad \forall t, s^t, \quad (2.3)$$

and the aggregate resource constraint in the economy,

$$c^A_t + c^B_t = y^A_t + e^B_t, \quad \forall t. \quad (2.4)$$

The participation constraints state that any risk sharing arrangement must give each agent a lifetime expected utility that is at least as great as the lifetime utility the agent would get by reneging on the arrangement and consuming her endowment from that period on. The formulation is flexible and incorporates the possibility of a punishment, by introducing a parameter $\gamma$. When there is no enforcement at all, $\gamma = 1$, and we are in a world of no commitment. When $\gamma < 1$, there is some punishment that can be inflicted in case an agent reneges, and thus a wider range of risk sharing relationships are sustainable. We think of the parameter $\gamma$ as reflecting the quality of a country's institutions, with lower values reflecting better institutional quality.

It is easy to establish the first best benchmark. An allocation $(c^A(s^t), c^B(s^t), \psi(s^t))$ is first best if the ratio of marginal utilities $u'(c^A_t)/u'(c^B_t)$ is constant across time and states, and the economy consumes its full endowment every period, $c^A_t + c^B_t = y^A_t + e^B_t$, $\forall t$.

2.3.3 Recursive Solution: the General Case

How can we determine how much risk sharing and foreign market participation takes place in this economy? While for the most part we will be comparing steady states, it is useful to write down the general formulation, in order to highlight the most important features of the optimal contract in the presence of a varying outside option for $A$. Type $A$ simultaneously chooses the extent of her participation in the foreign markets and the amount of risk sharing that is taking place in the domestic relationship.

The recursive representation of the problem above can be obtained by introducing a state variable, $v$, which represents the expected lifetime utility promised to one of the agents, and
giving a recursive structure to the participation constraints. In particular, let \( v \) be the utility promised to agent B, and \( P^A(v) \) be the lifetime utility that A can attain. \( P^A(v) \) is given by the following Bellman equation:\(^2\)

\[
P^A(v) = \max_{\psi, \{c_s^B, w_s\}_{s=1}^S} \sum_{s=1}^S p_s \left[ u(Y_s + \phi_s \psi - \pi \psi - c_s^B) + \beta P^A(w_s) \right] \tag{P}
\]

s.t.

\[
\sum_{s=1}^S p_s \left[ u(c_s^B) + \beta w_s \right] \geq v \tag{PK}
\]

\[
u(c_s^B) + \beta w_s \geq \gamma \left[ u(e_s^B) + \beta v_{aut} \right] \quad \forall s = 1, \ldots, S \tag{PC^B}
\]

\[
u(Y_s + \phi_s \psi - \pi \psi - c_s^B) + \beta P^A(w_s) \geq \gamma \left[ u(e_s^A + \phi_s \psi - \pi \psi) + \beta v_{aut}^A \right] \quad \forall s = 1, \ldots, S \tag{PC^A}
\]

\[
\psi \geq 0 \tag{INS}
\]

\[
c_s^B \in [0, Y_s + \phi_s \psi - \pi \psi] \tag{c_s^B}
\]

\[
w_s \in [v_{aut}, v_{max}] \tag{w_s}
\]

Equation (\( P \)) is the Bellman equation for the value function of type A. The way the program has been set up, type A chooses foreign market participation \( \psi \), consumption levels \( c_s^B \), and the expected lifetime utility levels she promises to type B in each state, \( w_s^B \), to maximize lifetime utility subject to the constraints. In particular, (\( PK \)) is the "promise-keeping constraint," which ensures that type B does get the expected utility she has been promised in the previous period. The following \( S \) constraints, (\( PC^B \)), are the participation constraints of type B. These are recursive representations of the general participation constraint, (2.3), for each state of nature. Intuitively, the risk sharing contract \( (c_s^B, w_s^B) \) offered to agent B in each state \( s \) should be such that the agent is willing to stay in the risk sharing relationship given the outside option of consuming her endowment from that period on. The parameter \( \gamma \leq 1 \) is meant to measure the quality of domestic institutions. (\( PC^A \)) are the participation constraints of type A. The condition (\( INS \)) prevents type A from taking on negative amounts of foreign insurance. The last two constraints restrict the policy functions to the feasible set. Compared to the canonical version of the model, type A's option to insure in the foreign markets introduces another control

variable, the optimal foreign market participation $\psi$.

Let $\mu$ be the multiplier on the promise-keeping constraint $(PK)$, $p_s \lambda_s$ the multipliers on each of the participation constraints for $B$, $(PC^B)$, $p_s \theta_s$ the multipliers on each of the participation constraints for $A$, $(PC^A)$, and $\delta$ be the multiplier on the $\psi$-nonnegativity constraint $(INS)$. Then the first-order conditions with respect to $c_s$, $w_s$, $s = 1, \ldots, S$, and $\psi$ are:

\begin{align}
- (1 + \theta_s)u'(Y_s + \phi_s \psi - \pi \psi - c^B_s) + (\mu + \lambda_s)u'(c^B_s) &= 0 \quad \forall s = 1, \ldots, S \\
(1 + \theta_s)P^A(w_s) + (\mu + \lambda_s) &= 0 \quad \forall s = 1, \ldots, S \\
\sum_{s=1}^{S} p_s (\phi_s - \pi) u'(Y_s + \phi_s \psi - \pi \psi - c^B_s) + \\
\sum_{s=1}^{S} p_s \theta_s (\phi_s - \pi) &\left[u'(Y_s + \phi_s \psi - \pi \psi - c^B_s) - \gamma u'(c^A_s + \phi_s \psi - \pi \psi)\right] + \\
+ \delta &= 0.
\end{align}

By the envelope theorem,

$P'(v) = -\mu$.

The first two first order conditions can be combined to yield the optimal relationship between consumption given to $B$ and promised utility, in each state:

\begin{equation}
- \frac{u'(Y_s + \phi_s \psi - \pi \psi - c^B_s)}{u'(c^B_s)} = P'(w_s)
\end{equation}

Following the discussion in Ljungqvist and Sargent (2000), we observe that there are three kinds of states. If in state $s$ neither $(PC^A)$ nor $(PC^B)$ bind, $\lambda_s = \theta_s = 0$, $w_s = v$, $P^A(w_s) = P^A(v)$, and the values of consumption are solved from equation (2.8). In states where $(PC^B)$ binds, $\lambda_s > 0$, $w_s > v$, $P^A(w_s) < P^A(v)$. Agent $B$'s promised utility increases, and $A$'s lifetime utility decreases as a result. In this state, $c^B_s$ and $w^B_s$ can be obtained by solving (2.8), and $(PC^B)$ holding with equality, for a given equilibrium value of $\psi$. The opposite is true for states in which $(PC^A)$ binds. In those states, $w_s < v$, and $P^A(w_s) > P^A(v)$.

The optimal participation in foreign markets, $\psi$, is determined by equation (2.7). Though
it is a complicated expression, it contains three distinct parts from which we can glean some intuition for what drives the choice of \( \psi \). The first term is the "optimal portfolio" term. It would be present whether or not participation constraints for \( A \) bind. The second term comes from the effect of portfolio choice on \( A \)'s participation constraints. In particular, if in any state \( s \) \( A \)'s participation constraint binds (i.e. \( \theta_s > 0 \)), agent \( A \) will take into account the effect of foreign insurance on her participation constraint in that state. Note that we cannot tell in the general case whether raising \( \psi \) relaxes or tightens the constraint, thus the effect of the presence of these constraints on the equilibrium amount of foreign participation is ambiguous. The third term simply comes from the non-negativity constraint we imposed on the foreign market participation.

Kocherlakota (1996, Propositions 4.1 and 4.2) shows that starting from an initial value of \( \nu_0 \) for which non-trivial risk sharing is possible, the relationship converges to a steady state, in which the first best level of risk sharing may or may not be attained. Unfortunately, an analytic solution to the Bellman equation in (P) is not known even in the canonical version of the model which does not include endogenous foreign market participation.

In order to get an intuition about how the equilibrium amount of risk sharing responds to changing opportunities to participate in foreign markets, we will assume functional forms and solve for the value and policy functions numerically. In all cases we consider, a straightforward value function iteration mechanism described in Judd (1998, ch. 12) is sufficient to generate a solution.

We approach the problem by considering the two extreme cases, those of purely idiosyncratic and purely aggregate risk. Looking at simple versions of this problem lets us gain a fair bit more intuition about the effect of financial liberalization in this environment. It also allows us to reduce the number of states to the minimum possible value of 2, thereby significantly reducing the dimensionality of the policy function. We then discuss what kind of interactions we would expect to take place between aggregate and idiosyncratic risk when they are both present.
2.3.3 Case I: Purely Idiosyncratic Risk

We now consider the first of the two polar cases. For simplicity, suppose there are two states of nature, \( s = 1, 2 \) and the states have equal probability of \( \frac{1}{2} \). When there is no aggregate risk, agents’ incomes are perfectly negatively correlated. In particular, we assume that in \( s = 1 \), group A’s per capita income endowment is \( e_1^A = 1 + \varepsilon \), and group B’s per capita endowment is \( e_1^B = 1 - \varepsilon \). In \( s = 2 \), the per capita endowments are reversed. The total endowment in the economy equals 2 in every period.

The foreign insurance provides \(-\phi^f\) to type A in \( s = 1 \), and \( \phi^f \) in \( s = 2 \), for each unit of endowment that the type A commits to the international markets. If the type A chooses to insure a share \( \psi \) of her endowment risk abroad, she will be able to consume

\[ y_1^A = 1 + \varepsilon - \phi^f \psi - \pi \psi \]

in \( s = 1 \), and

\[ y_2^A = 1 - \varepsilon + \phi^f \psi - \pi \psi \]

in \( s = 2 \).

It is useful to restate the recursive formulation for this special case, writing out participation
constraints state by state:

\[
P^A(v) = \max_{\psi, (c^B_s, w^B_s)_{s=1,2}} \left\{ \frac{1}{2} \sum_{s=1}^{2} \left[ u(2 + \phi_s \psi - \pi \psi - c^B_s) + \beta P^A(w^B_s) \right] \right\} \quad (P')
\]

s.t.

\[
\frac{1}{2} \left[ u(c^B_1) + \beta w^B_1 + u(c^B_2) + \beta w^B_2 \right] \geq v \quad (PK')
\]

\[
u(c^B_1) + \beta w^B_1 \geq \gamma [u(1 - \varepsilon) + \beta v_{aut}] \quad (PC^B_1')
\]

\[
u(c^B_2) + \beta w^B_2 \geq \gamma [u(1 + \varepsilon) + \beta v_{aut}] \quad (PC^B_2')
\]

\[
u(2 - \phi^f \psi - \pi \psi - c^B_1) + \beta P^A(w^B_1) \geq \gamma \left[ u(1 + \varepsilon - \phi^f \psi - \pi \psi) + \beta v_{aut}^A \right] \quad (PC^A_1')
\]

\[
u(2 + \phi^f \psi - \pi \psi - c^B_2) + \beta P^A(w^B_2) \geq \gamma \left[ u(1 - \varepsilon + \phi^f \psi - \pi \psi) + \beta v_{aut}^A \right] \quad (PC^A_2')
\]

\[
\psi \geq 0 \quad (INS')
\]

\[
c^B_s \in [0, Y_s + \phi_s \psi - \pi \psi]
\]

\[
w_s \in [v_{aut}, v_{max}]
\]

This formulation is quite general and includes a number of important special cases. The closed economy case is replicated when \( \pi \) is prohibitively high, so that even without type \( B \), type \( A \) would not want to access the international markets (\( v_{aut} = 0 \)). Then, \( v_{aut}^A = v_{aut} \), and the domestic risk sharing relationship is intact. Another important special case is that of frictionless domestic markets given by \( \gamma = -\infty \): the participation constraints never bind, and the first best outcome is achieved. At another extreme, suppose that there is no commitment, \( \gamma = 1 \), and international markets are costless (\( \pi = 0 \)). Then, we know that \( v_{aut} = \frac{\psi}{\phi^f} \) (without \( B \), type \( A \) opts for full insurance). Under these circumstances, domestic risk sharing relationship will most likely break down completely, because the type \( B \) agents would not be able to provide type \( A \) with favorable enough terms of domestic insurance without violating their own participation constraint. If domestic risk sharing breaks down, type \( B \) is completely uninsured. The discussion of the extreme cases provides an illustration that domestic risk sharing is likely to suffer the most when the cost of accessing foreign markets is low, and domestic institutions are poor. Even before going to a numerical solution, we can make two important remarks on the features of this problem.
**Remark 1:** If the first best is reached in this risk sharing contract, it necessarily means that there is no foreign market participation, \( \psi = 0 \), irrespective of the value of \( \pi \). Due to the absence of aggregate uncertainty, the first best level of risk sharing implies that all agents’ consumption is constant across time and states: agents are perfectly insured. Since risks are perfectly insurable within the economy, in the frictionless setting there is no role for international markets in smoothing consumption risk.

Participation in international markets reduces welfare in two ways, vis-a-vis the first best benchmark. First, it costs \( \pi \), and thus reduces the aggregate endowment in both states. Second, and most importantly, because the agents’ endowments are negatively correlated, type A’s participation in the foreign markets actually lowers her ability to insure type B. In particular, whereas in the closed economy A had at her disposal \( \varepsilon \) in \( s = 1 \), with which to insure B’s negative income shock of \( -\varepsilon \), now in \( s = 1 \) agent A has only \( \varepsilon - \phi A \psi - \pi \psi \).

The feature that the first best benchmark is the same for each \( \pi \) is also convenient because as we consider the effects of financial liberalization on domestic risk sharing, we can judge the changing amount of domestic risk sharing against a constant benchmark.

**Remark 2:** When in equilibrium the amount of foreign participation is \( \psi = 0 \) and the first best level of risk sharing is not achieved, lowering barriers to international markets, \( \pi \), actually decreases type A’s welfare \( P^A(v) \), for each \( v \). This is a consequence of the envelope theorem. Evaluated at an optimum value of \( \psi = 0 \), 
\[
\frac{dP^A(v)}{d\pi} = -\sum_{s=1}^{S} p_s \theta_s \gamma \frac{d\pi^A}{d\pi} < 0.
\]

How can lowering the international barriers type A faces make A worse off? International markets play two roles in our framework. First, insuring abroad may improve A's lifetime utility by smoothing some of A’s consumption risk. Second, ability to access international markets raises A’s outside option, irrespective of whether A actually participates in the international markets or not. The second effect is detrimental to A’s ability to insure domestically. Thus, if there are parameter values under which A chooses not to insure abroad at all (\( \psi = 0 \)), only the second effect remains. By raising A’s outside option, the presence of foreign markets actually decreases the amount of risk sharing attainable in the domestic relationship, lowering A’s utility for a given \( v \).

The pure idiosyncratic risk economy in this subsection provides the most drastic illustration
of the perverse effects on international markets on domestic risk sharing. Though in the first best world international markets have no role, in the limited commitment framework their mere presence has a negative effect. The Remark above focuses on A's participation constraints, but B's constraints matter as well. Since A's insurance in foreign markets decreases aggregate welfare, type B has an incentive to induce A to lower her foreign market participation. The ability of type B to offer A better domestic risk sharing terms is limited, however, by type B's own participation constraints. There is only a limited amount of utility that B can give up before they start to bind.

We now provide a numerical illustration of the effect of financial opening on agents' welfare and consumption volatility. To do this, we assume a functional form for the utility function that is quadratic:

\[ u(c) = 4c - \frac{1}{2}c^2. \]

The parameter values we pick are the following: \( \epsilon = 1, \phi^f = 1, \beta = 0.8, \gamma = 1. \) Under these parameter values, \( v_{aut} = 15. \) We then find \( P^A(v) \) for various values of \( \pi, \) barriers to international insurance markets. We can think of \( P^A(v) \) as a Pareto frontier, as it gives the highest level of A's lifetime utility for each level of B's lifetime utility, \( v. \) \( P^A(v) \) is obtained by value function iteration (Judd, 1998, ch. 12). Results are presented in Figure 2.1. The first best level of risk sharing is not achieved in this economy, thus one of the participation constraints binds at each \( t. \) The closed-economy Pareto frontier is symmetric around the 45-degree line, that is, if \( P^A(v_1) = v_2, \) then \( P^A(v_2) = v_1. \)

As we lower \( \pi, \) we see that the frontier shifts unevenly inward. In particular, two key observations can be made from this Figure. First, the Pareto frontier is no longer symmetric. The pairs \( (v, P^A(v)) \) of sustainable lifetime utilities become skewed in favor of A: if \( P^A(v_1) = v_2, \) then \( P^A(v_2) > v_1. \) Second, the range of values of \( v \) for which non-trivial domestic risk sharing is sustainable shrinks as we lower international barriers. This is intuitive: the higher A's outside option becomes, the lower is the maximum value of B's lifetime utility \( v \) for which A is willing to participate in the domestic risk sharing relationship. We also see that for each \( v, \) the lifetime utility of A, \( P^A(v), \) decreases in \( \pi \) in this example, as long as \( \pi \) is high enough to sustain domestic risk sharing – an illustration of Remark 2.

While finding the value function \( P^A(v) \) is informative about the combinations of the two
agents’ lifetime utilities that are sustainable in the economy, it does not tell us much directly about the amount of risk sharing and foreign market participation that occurs as \( \pi \) changes. We can perform comparative statics by finding steady state levels of risk sharing and foreign market participation for different values of \( \pi \).

In a steady state, income transfers, and thus consumption, are constant over time in each state, though not necessarily constant across states (see Kehoe and Levine, 2001, Proposition 5). It is straightforward to show that in a steady state expected lifetime utility, denoted by \( \overline{v}_i \), \( i = A, B \), is constant for each agent as well. We can fully characterize the symmetric steady state by consumption values of each agent in each state, \( \{\overline{z}_1^A, \overline{z}_2^A, \overline{z}_1^B, \overline{z}_2^B\} \). We label steady state values by an overbar.

The key limitation to the extent of risk sharing that takes place in this economy is the voluntary participation constraint that must be satisfied for each agent in each state and each period. In practice, risk sharing takes place by transferring income from the group that has a high current income realization to the other group. Naturally, then, the only relevant participation constraints will be those in which the current realization of income is high for that particular group.

There are two possibilities. If in steady state, the participation constraint of the agent that is experiencing a high income shock does not bind,

\[
u(\overline{z}_1^A) + \beta \overline{v}^A > \gamma (u(1 + \varepsilon) + \beta v_{aut}^A),
\]

\[
u(\overline{z}_2^B) + \beta \overline{v}^B > \gamma (u(1 + \varepsilon) + \beta v_{aut}),
\]

then the first best level of risk sharing is achieved, and each agent’s consumption is constant across time. Notice that in this type of steady state no participation in the international markets takes place.

If on the other hand in steady state the participation constraints bind, the steady state consumption values \( \{\overline{z}_1^A, \overline{z}_2^A, \overline{z}_1^B, \overline{z}_2^B\} \) are those that maximize \( \overline{v}^A \), subject to participation constraints holding with equality:

\[
u(\overline{z}_1^A) + \beta \overline{v}^A = \gamma \left( u(1 + \varepsilon - \phi \psi - \pi \psi) + \beta v_{aut}^A \right),
\]
\[ u(\tilde{a}_2^B) + \beta \tilde{v}^B = \gamma \left( u(1 + \varepsilon) + \beta v_{aut} \right). \]

We illustrate how the steady state amount of risk sharing changes as barriers to accessing the foreign markets, \( \pi \), are lowered. Here, we consider the same set of parameter values as we used to construct \( P^A(\nu) \) above. At these parameter values, the closed economy does not achieve perfect risk sharing, and the steady state is unique. The effects we discuss are much more general, however.

Figure 2.2 illustrates the patterns of consumption for the two types in the two states as a function of the cost of accessing international markets, \( \pi \). Thicker lines represent consumption values of type \( A \), and thinner lines of type \( B \). Without domestic or international risk sharing, each type would consume her endowment, which is equal to 2 in the high state, and 0 in the low state. Perfect risk sharing, on the other hand, implies that in a symmetric steady state consumption is equal to 1 for all agents in all states.

How does the option of accessing the international markets affect risk sharing at home? We can divide values of \( \pi \) into four intervals. First, when the cost of accessing the international markets is prohibitive, \( \pi > \pi_1 \), they to not raise type \( A \)'s outside option, \( \psi_{aut} = 0 \), and \( v_{aut}^A = v_{out} \). The foreign markets are too expensive, and even if left alone, type \( A \) would choose not to participate in them. In this case, risk sharing is the same as in the closed economy.

When \( \pi < \pi_1 \), the presence of foreign markets does raise type \( A \)'s outside option, because \( \psi_{out} > 0 \). When \( \pi_2 < \pi < \pi_1 \), the outside option of type \( A \) is rising, but foreign markets are costly enough that type \( B \) can induce \( A \) to stay entirely in the domestic risk sharing arrangement. Notice that as \( \pi \) decreases and the outside option of type \( A \) rises, the amount of risk sharing taking place decreases for both agents, but type \( A \)'s consumption is higher in both states than the corresponding consumption of type \( B \). This is because the rising outside option for \( A \) both reduces the amount of risk sharing available to agents and increases the transfer of utility that type \( B \) must make to keep type \( A \) at home. In this interval, type \( A \) does not participate in the foreign markets, \( \psi = 0 \). Thus, while there is less risk sharing at home, aggregate consumption is still flat.

When \( \pi \) falls below \( \pi_2 \), some foreign market participation starts to occur. As some of the type \( A \)'s consumption risk is now insured abroad, her consumption volatility starts decreasing. But this also means that there is less possibility of risk sharing at home, and consumption
volatility of type $B$ continues rising. This is precisely the effect illustrated in the simple example of the previous section. While participation in international markets can decrease consumption volatility of some agents, it can have adverse effects on consumption volatility of others. Type $A$’s rising participation in foreign markets implies that it is less able and willing to insure type $B$.

Finally, when $\pi \geq \pi_3$, international markets are so accessible, and thus type $A$’s outside option is so high, that type $B$ cannot offer good enough terms of insurance contract at home without violating her own participation constraint. Thus, all domestic risk sharing breaks down and type $A$ participates only in the international markets. The problem with this, of course, is that type $B$ is now completely uninsured. Aggregate consumption volatility is highest, and the type $B$ agents are least insured, when opening up to international markets implies a complete breakdown of domestic risk sharing.

2.3.4 Case II: Aggregate Risk

Suppose instead that all agents have identical endowments in each period. In particular, in $s = 1$, $e_1^A = e_1^B = 1 + \varepsilon$, and in $s = 2$, $e_2^A = e_2^B = 1 - \varepsilon$. Notice that when the economy is closed, there is no scope for risk sharing. When the economy is open, the first best allocation requires that type $A$ pools the entire country risk, and insures it optimally in the foreign markets, given the cost of access $\pi$. The international markets are modeled exactly the same as in the previous subsection, transferring $-\phi^f$ in $s = 1$ and $\phi^f$ in $s = 2$ for each unit of endowment insured abroad.

When the relationship between types $A$ and $B$ is subject to limited commitment, we can characterize it by setting up a program similar to that of the previous subsection, as a value
maximization of type $A$, $P^A(v)$, subject to constraints:

$$P^A(v) = \max_{\psi, \{c_s^B, w_s^B\}_{s=1,2}} \left\{ \sum_{s=1}^{2} \left[ u(Y_s + \phi_s \psi - \pi \psi - c_s^B) + \beta v^A_s w_s^B \right] \right\}$$

$$\text{s.t.}$$

$$\frac{1}{2} [u(c_1^B) + \beta w_1^B + u(c_2^B) + \beta w_2^B] \geq v$$

$$u(c_1^B) + \beta w_1^B \geq \gamma [u(1 + \varepsilon) + \beta v_{aut}],$$

$$u(c_2^B) + \beta w_2^B \geq \gamma [u(1 - \varepsilon) + \beta v_{aut}],$$

$$u(2 - \phi^I \psi - \pi \psi - c_1^B) + \beta v^A_1 w_1^B \geq \gamma \left[ u(1 + \varepsilon - \phi^I \psi - \pi \psi) + \beta v_{aut} \right],$$

$$u(2 + \phi^I \psi - \pi \psi - c_2^B) + \beta v^A_2 w_2^B \geq \gamma \left[ u(1 - \varepsilon + \phi^I \psi - \pi \psi) + \beta v_{aut} \right],$$

$$\psi \geq 0$$

$$c_s^B \in [0, Y_s + \phi_s \psi - \pi \psi]$$

$$w_s \in [v_{aut}, v_{max}]$$

Examining the constraints allows us to get a sense of what limits efficient risk pooling in this economy. The participation constraint of type $B$ in the high state ($PC^{B''}_1$) shows that rather than transferring income to type $A$ for the purposes of insurance in the international markets, type $B$ will be tempted to consume her current high endowment, an intuition identical to that of the previous subsection. When the economy is experiencing a negative aggregate shock, type $A$ is the only one that is insured from abroad. Efficient risk pooling would call on type $A$ to redistribute some of the positive income to type $B$, but that is limited by $A$'s participation constraint in this state of nature, ($PC^{A''}_2$). Notice also that engaging with type $B$ serves no insurance purpose for type $A$, thus to induce type $A$ to take on a risk pooling role, type $B$ must transfer income to type $A$. Type $B$'s ability to decrease her own utility in the risk pooling arrangement is itself limited by her voluntary participation constraint.

Once again we use a numerical example to provide an illustration. We could repeat the exercise in the previous section, and look at the response of risk pooling to changing values of $\pi$. However, when the economy is subject to aggregate risk, the first best frontier changes as we vary $\pi$, thus we don’t have a natural benchmark. Instead, we use this example to highlight
the importance of quality of contract enforcement, $\gamma$, in determining the amount of risk pooling achieved in this economy. For simplicity, we assume that there are no barriers to international markets, $\pi = 0$. The first best in this economy is achieved by sharing all of the aggregate risk in the international markets, and giving each agent constant consumption across time. Notice that the first best frontier in this economy is the same as in the idiosyncratic risk case of the previous subsection, but is achieved very differently, through full participation in international markets.

How do institutions affect the amount of risk sharing achieved in this economy? Figure 2.3 plots the first best frontier and the value functions, $P^A(v)$, for several values of $\gamma$. Several aspects of this figure are worth highlighting. First, better institutions imply that the economy is closer to the first best frontier. As institutions get worse, the frontier shifts inward. This implies both that $P^A(v)$ is lower for a given $v$, and that the range of $B$'s lifetime utilities, $v$, for which non-trivial risk sharing is attainable is narrower. For high enough $\gamma$ (in this example about 0.8875), no risk pooling is possible, and type $A$ insures in the international markets alone, leaving $B$ completely uninsured. Second, the figure illustrates the distributional consequences of uneven access to the international markets. When $A$ can insure abroad, she must be given lifetime utility at least as great as what she would get from perfect insurance abroad (17.5 in this case, given by a dashed line). This necessarily means that, as $B$ engages $A$ in an insurance relationship, $B$'s lifetime utility is smaller than $A$'s. It's important to note that this statement is true whether or not the economy achieves an allocation that is first best.

To give a sharper picture of the amount of insurance agents get in this arrangement as a function of $\gamma$, we can compare steady states in this economy in a manner similar to the previous subsection. Figure 2.4 plots the steady state values of consumption for different levels of institutional quality. There are several distinct insurance relationships that can arise, depending on the value of $\gamma$. Starting at the left-hand side of the graph, when $\gamma \leq \gamma_1$, institutions are strong enough that a risk pooling contract under which both agents are perfectly insured and receive equal lifetime utility is sustainable. As we move into the interval $\gamma \in (\gamma_1, \gamma_2)$, the risk pooling relationship can no longer sustain an equitable allocation. In this area, aggregate risk is still perfectly insured by the economy, and both agents are perfectly insured. But to induce $A$ to perform the risk pooling role, $B$ must give up utility. Thus, while both agents'
consumption is constant across time, A’s consumption is higher than B’s.\textsuperscript{3} As we move into the interval $\gamma \in (\gamma_2, \gamma_3)$, imperfect institutions prevent efficient foreign insurance, even in aggregate. Neither agent is now perfectly insured, but the risk pooling relationship still operates and $A$ provides positive insurance to $B$. As we lower institutional quality in this interval, agents are less and less well insured. Finally, when $\gamma > \gamma_3$, no risk pooling is sustainable in equilibrium. This means that $A$ leaves the domestic relationship entirely, and insures optimally (perfectly) abroad. It also means that $B$ is completely uninsured, and consumes her own endowment in each period.

To summarize, the first best outcome of efficient risk pooling may not be achieved in this economy. When risks are purely aggregate, clearly access to international markets improves the economy’s aggregate consumption volatility. Type $A$ certainly reaches the optimal level of insurance, given the cost of access $\pi$. The benefits of financial opening may not spread to those agents that do not have direct access to international markets.

\subsection{2.4 Conclusion}

The latest empirical evidence demonstrates that increasing international financial integration is actually associated with higher consumption volatility in developing countries. This finding is difficult to rationalize within the framework of representative agent models of risk sharing.

The main shortcoming of representative agent models is that they can only tell us about the role of international financial markets in sharing aggregate country risk. The canonical models also do not address the issue of how aggregate risk is pooled among agents for the purposes of international risk sharing. This paper shows that focusing on agent heterogeneity when domestic risk sharing and risk pooling are subject to frictions can help us rationalize the empirical evidence. In the model we presented, agents are heterogeneous in both their income process and in whether or not they have access to international markets. When we consider the consequences of agent heterogeneity in an economy with underdeveloped institutions and financial markets, we reach three main conclusions.

\textsuperscript{3}Generally, when the economy attains a first best allocation, as it does in this interval, the steady state is not unique. In constructing this Figure, we select for each $\gamma$ the steady state in which the two types’ consumption values are closest to each other – the most equitable steady state.
First, if income risks are idiosyncratic, financial opening will have first-order effects on the domestic financial markets. International markets can be used by agents to insure against not only aggregate but also idiosyncratic risks. When some agents participate in the international risk sharing markets, domestic risk sharing deteriorates, leading to an increase in consumption volatility. The mechanism we suggest here reproduces a positive relationship between capital flows and consumption volatility found in the data.

Second, when agents face only aggregate income risk, the underdeveloped financial system will prevent efficient pooling of risk across agents for the purposes of international insurance. Thus, for aggregate risk, the benefits of access to international markets are much lower in this framework than in the representative agent model.

Finally, considering agent heterogeneity allows us to highlight distributional consequences of financial liberalization. While agents with access to international markets benefit from expanded opportunities, those that do not have access benefit less, and in fact may experience an increase in consumption volatility and a reduction in welfare.

The simple framework we presented in this paper focuses narrowly on the opportunities for insuring income risk domestically and internationally. Clearly, financial liberalization has a variety of other effects on developing economies. Not the least important, for instance, is the role of capital flows in generating output growth through their ability to mobilize foreign savings for domestic investment. The effects we reveal here should nevertheless be taken into account in building a complete picture of financial liberalization in developing countries.

2.5 Bibliography


Figure 2.1: $P(v)$ for different values of $\pi$, with purely idiosyncratic risk
Figure 2.2: Steady state values of consumption as a function of access to foreign markets, purely idiosyncratic risk
Figure 2.3: $P(v)$ for different values of $\gamma$, with purely aggregate risk.
Figure 2.4: Steady state values of consumption as a function of domestic institutions, purely aggregate risk.
Chapter 3

Trade and Financial Development\textsuperscript{1}

Summary 3 The differences in financial development between advanced and developing countries are pronounced. It has been observed, both theoretically and empirically, that these differences in countries’ financial systems are a source of comparative advantage and trade. This chapter points out that to the extent a country’s financial development is endogenous, it will in turn be influenced by trade. We build a model in which a country’s financial development is an equilibrium outcome of the economy’s productive structure: in countries with large financially intensive sectors financial systems are more developed. When a wealthy and a poor country open to trade, the financially dependent sectors grow in the wealthy country, and so does the financial system. By contrast, as the financially intensive sectors shrink in the poor country, demand for external finance decreases and the domestic financial system deteriorates. We test our model using data on financial development for a sample of 77 countries. We find that the main predictions of the model are borne out in the data: trade openness is associated with faster financial development in wealthier countries, and with slower financial development in poorer ones.

3.1 Introduction

There are significant differences in financial development across countries. In 1995, the average ratio of private credit to GDP was 0.95 in OECD countries, and just 0.3 in developing countries.

\textsuperscript{1}This Chapter is joint work with Quy-Toan Do
(see Figure 3.1). At the same time, a significant and growing share of world’s GDP is now exported and imported across country borders (Maddison, 2001). Do these two broad features of today’s world economy interact in important ways?

When industries differ in their reliance on external finance, in the sense of, for example, Rajan and Zingales (1998), these differences would be expected to interact with cross-country variation in financial development to serve as a source of comparative advantage and trade. The notion of financial comparative advantage has been formalized theoretically by Kletzer and Bardhan (1987) and Baldwin (1989). The key insight is that countries endowed with better financial systems will produce and export financially dependent goods. Indeed, there is some recent empirical evidence that financial comparative advantage is relevant to trade patterns, e.g. Beck (2002, 2003), Becker and Greenberg (2003), Svaleryd and Vlachos (2004).

The framework in which differences in financial development are an exogenous determinant of trade is only appropriate if we believe that a country’s financial system is exogenously given. One may take this view, for instance, in light of the strand of literature originated by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998), which provides evidence that financial development is determined in part by the type of legal system an economy adopted at some point in its history. A country’s historical experience is clearly important. However, even within each legal system, countries differ a great deal in their degree of financial development. Along these lines, Rajan and Zingales (2003) document considerable variation in financial development over the past century, providing evidence that the historically inherited legal system is only one of many determinants of financial development. To the extent a country’s financial system is endogenous, we would expect it to be influenced by the economic conditions a country faces, and that includes trade.

This paper analyzes the effect of international trade on financial development. We build a model with two sectors, one of which is financially intensive. The size of the financial system, that is, the amount of borrowing and lending that occurs in the economy, is naturally a function of total output in the financially intensive sector. Furthermore, the quality of the financial system is a function of its size. In our framework, a larger financial sector leads to the greater ease with which entrepreneurs are able to fulfill the need for external finance. This is because when entrepreneurs start financially intensive projects and engage the country’s financial system,
they add liquidity. A deeper financial system makes projects less risky by reducing the number of states in which liquidity is lacking. Entrepreneurs that enter the financially dependent sector thus exert a positive externality on the other entrepreneurs.

We find plausible the positive feedback from the size of the financial system to its quality. Levine and Schmukler (2003) document that when some firms in emerging markets begin raising external finance abroad rather than at home, trading liquidity of the remaining domestic firms actually decreases, providing evidence that financial depth is positively related to market size. Furthermore, this type of effect is implicit is most studies of financial development quoted above. These studies typically use measures of financial system size, such as ratios of private credit to GDP or stock market capitalization to GDP, to proxy for financial system quality.

Opening to trade will affect demand for external finance, and thus financial depth, in the trading countries. In particular, when a wealthy country starts trading with a poor one, it will naturally increase production of the financially dependent good, and its financial system will deepen. In the poor country, on the other hand, the financially dependent sector will shrink, leading to a deterioration in the size of the country's financial system, as well as its quality.

The bottom line is that when a poor country no longer needs to produce the financially dependent good, demand for external finance will decrease as a result of trade, and the domestic financial system will suffer. This could induce losses from trade to the poor country, as could be expected given that the financially dependent industry exhibits external effects, and thus economy-wide increasing returns to scale (see Helpman and Krugman, 1985, ch. 3). Furthermore, the deterioration of the domestic financial system could be harmful to the poor country for reasons beyond gains from trade. Indeed, there is a great deal of empirical evidence that financial development is conducive to increasing growth and lowering volatility (Levine, 2003, Kose, Prasad and Terrones, 2003).

In illustrating the effect of trade on the financial system, we make a series of special assumptions. First, in modeling the market for external finance and the positive effect of financial system size on its quality, we abstract from the informational and enforcement frictions that are often invoked in this context. One can clearly adopt this approach as well, and think of the quality of the financial system in terms of how well it can overcome these distortions and achieve the efficient level of lending. A positive link between the size of the financial markets
and their ability to resolve such frictions has been modeled, for example, by Acemoglu and Zilibotti (1999).

On a related point, in our model countries will differ only in their levels of wealth, and wealth levels will determine the direction of financial comparative advantage. Differences in institutional quality, such as enforcement of contracts and property rights, are clearly important in driving the pattern of financial comparative advantage. Adding institutional differences to our framework will leave the main conclusions unchanged, and in fact reinforce the strength of financial comparative advantage as long as wealthier countries are also the ones with better institutions.

It is important to note that the effect of trade opening on financial development we illustrate here is one of many that could be relevant in practice. For instance, trade can increase uncertainty and income variability of agents within the economy (Newbery and Stiglitz, 1984). Financial system could then be expected to grow after trade opening, as agents’ demand for insurance increases. This type of mechanism is not inconsistent with the effect we are proposing. One important difference, however, is that our mechanism affects countries differentially, while the alternative one unambiguously implies an improvement of the financial system in all countries.

The model predicts that in wealthy countries, trade should be associated with faster financial development. By contrast, in poor countries, more trade should lead to slower financial development, as these countries import financially intensive goods rather than develop their own financial system. We use data on financial development for a sample of 77 countries compiled by Beck, Demirgüç-Kunt, and Levine (2000) to show that the pattern predicted by the model seems to find empirical support. While for developed countries, higher trade openness is associated with faster growth of the financial system, developing countries that traded more experienced slower growth in their financial systems.

The rest of the paper is organized as follows. Section 2 presents the basic model and shows that when the amount of lending and the quality of the financial system are equilibrium

---

Rodrik (1998) shows that more open countries have larger governments, which helps them deal with increased uncertainty that is associated with openness. Svaleryd and Vlachos (2002) provide empirical evidence that countries with better developed financial systems are more likely to be open to trade, and argue this is because a better financial system allows a country to better cope with increased uncertainty. Tangentially, these authors also provide some evidence that the financial system improves after trade opening.
outcomes, they will be influenced by trade. Section 3 discusses empirical evidence. Section 4 concludes.

3.2 The Model

3.2.1 The Environment

Consider an economy with 3 goods and 2 factors, labor (entrepreneurs) and wealth. There is a final consumption good, and agents’ utility is assumed to be linear this good. The final good will serve as the numeraire, and we normalize its price to 1. The time horizon consists of the interval $t \in [0, 1]$. At $t = 1$, the final good is produced with two intermediate goods 1 and 2 using a Cobb-Douglas production function:

$$\pi(K_1, K_2) = AK_1^\alpha K_2^{1-\alpha}. \quad (3.1)$$

If prices of intermediate goods are denoted by $p_1$ and $p_2$, profit maximization in the final goods sector at $t = 1$ requires that:

$$p_1 = \alpha A \left( \frac{K_2}{K_1} \right)^{1-\alpha}$$

and

$$p_2 = (1-\alpha) A \left( \frac{K_1}{K_2} \right)\alpha.$$

Intermediate good 1 is financially intensive, while intermediate good 2 does not rely on external finance. Entrepreneurs make the decision to enter either of the two intermediate goods sectors at $t = 0$. Production in the two sectors then occurs continuously in the interval $t \in [0, 1]$.

In particular, setting up a unit of production of intermediate good 2 requires no wealth and one unit of labor/entrepreneur. The project then produces a constant flow return $Rdt$, and thus the total output produced by one unit of labor in this sector is

$$\int_0^1 Rdt = R.$$

Setting up a production unit of intermediate good 1 requires one entrepreneur and $C$ units of wealth. Each entrepreneur then manages a flow of projects between dates $t = 0$ and $t = 1$. 

89
Between time \( t \) and \( t + dt \), entrepreneurs face a liquidity shock \( \tilde{L}_t dt \). At each date, we assume that \( L_t = -L \) with probability \( \frac{1}{2} \) and \( L_t = L \) with probability \( \frac{1}{2} \). Shocks are assumed to be identically and independently distributed, and cannot be saved.

If the liquidity shock is positive, or the liquidity need is fulfilled, then the project yields a flow of returns \( Rdt \); otherwise it returns 0 (see Figure 3.2). Denoting by \( R^i_t dt \) the realized flow of returns at date \( t \) for entrepreneur \( i \), the total output produced by entrepreneur \( i \) is then given by

\[
R^i = \int_0^1 R^i_t dt.
\]

Agents with a negative liquidity shock can borrow from those with a positive one at each \( t \in [0, 1] \). Let \( r_t \) denote the gross interest rate which prevails at time \( t \); a debt contracted at time \( t \) is a claim on time \( t = 1 \) returns and \( r_t \geq 0, \forall t \in [0, 1] \). How can we determine the total flow of production and the interest rate at each time \( t \)? Let there be \( \eta \) entrepreneurs in sector 1 in this economy. Denote aggregate liquidity in the economy by

\[
\Lambda_t = \sum_{i \in [0, \eta]} L^i_t.
\]

Entrepreneurs with excess liquidity lend to entrepreneurs with liquidity shortages at the instantaneous interest rate \( r_t \). In case of a positive aggregate liquidity shock (\( \Lambda_t \geq 0 \)), interest rate drops to zero and no projects are liquidated. If a negative aggregate shock hits the economy at time \( t \), then a fraction \( \gamma_t \) of projects are liquidated and interest rates rise so that lenders appropriate all surplus: \( r_t L dt = p_t R dt \). The aggregate production flow is then given by

\[
K_{1t} = \eta R (1 - \gamma_t) dt,
\]

and the aggregate production realized at \( t = 1 \) is:

\[
K_1 = \eta R [1 - \gamma(\eta)],
\]

where \( \gamma(\eta) \equiv \int_0^1 \gamma_t dt \).

We can think of the equilibrium value of \( \gamma(\eta) \) as capturing the quality of the financial system.
It reflects the fraction of time an agent is unable to fulfill the need for external finance. In this setting, \( \gamma(\eta) \) is a function of the number of entrepreneurs that access the financial system. The financial system benefits from having more entrepreneurs.

We now see that production in this sector is characterized by a positive externality. Each agent's decision to enter provides a benefit to the other agents, by reducing the number of states in which aggregate liquidity is lacking. But since in states with positive aggregate liquidity each agent borrows or lends at rate \( r_1 = 0 \), the agent does not internalize the positive effect she has on everyone else when making the entry decision. It is helpful to state the following Lemma.

**Lemma 1: The structure of liquidity externalities**

With \( \eta \) entrepreneurs in sector 1, aggregate supply of intermediate good 1 is given by

\[
K_1 = \eta R [1 - \gamma(\eta)], \tag{3.2}
\]

where \( \gamma(\eta) \) is a decreasing and convex function of \( \eta \) such that \( \lim_{\eta \to 0} \gamma(\eta) = \frac{1}{2} \) and \( \lim_{\eta \to \infty} \gamma(\eta) = 0 \).

**Proof:** see Appendix.

### 3.2.2 Closed Economy Equilibrium

We can now analyze the equilibrium in the closed economy. Suppose that a country's endowment of entrepreneurs is normalized to 1, and the total wealth in the economy is \( W \). We assume that the opportunity cost of wealth outside of production of intermediate good 1 is zero.\(^3\) Thus, there are two possibilities: if production in sector 1 requires the entire wealth in the economy, \( r > 0 \). If, on the other hand, sector 1 production uses less than the total wealth in equilibrium, \( r = 0 \).

At \( t = 0 \), agents make entry choices. The return earned by an entrepreneur in sector 2 is \( V_2 = p_2 R \). To enter sector 1, the entrepreneur must borrow \( C \) units of wealth at the prevailing

\(^3\)Alternatively, we could assume a lower bound on \( r \) that is higher than zero, which we could think of as a storage technology. None of the results would change, and the analysis would be identical as long as we did not allow stored wealth to fulfill a liquidity need at \( t \in (0, 1) \).
interest rate $r$. Then, the value of the project is:

$$V_1(\eta) = p_1 R [1 - \gamma(\eta)] - rC.$$  

In equilibrium, the entrepreneur project choice arbitrage condition must be satisfied: $V_1(\eta) = V_2$.

When $\eta$ entrepreneurs enter sector 1 in equilibrium, total production in sector 1 is given by (3.2), and in sector 2 by

$$K_2 = (1 - \eta)R.$$  

We can now state the equilibrium conditions in this economy:

**Proposition 1: Equilibrium in the closed economy**

The equilibrium of the economy is characterized by a vector of prices $(p_1, p_2, r)$ and a fraction $\eta$ of entrepreneurs in sector 1, such that the following conditions hold:

1. Intermediate good market clearing conditions:

   $$p_1 = \alpha A \left[ \frac{1 - \eta}{\eta [1 - \gamma(\eta)]} \right]^{1-\alpha},$$  
   $$p_2 = (1 - \alpha) A \left[ \frac{\eta [1 - \gamma(\eta)]}{1 - \eta} \right]^{\alpha},$$  

2. Project choice arbitrage condition:

   $$p_1 R [1 - \gamma(\eta)] - rC = p_2 R;$$  

3. Time $t = 0$ credit market clearing conditions:

   $$\eta C \leq W,$$

and

$$\eta C < W \Rightarrow r = 0.$$  

92
Corollary 1: In autarky, it must be that:

\[ r = 0 \implies \eta = \alpha. \]

**Proof:** see Appendix.

We can then determine the equilibrium industrial structure of the country, which fully characterizes the economy.

Corollary 2: In a closed economy, the equilibrium number of entrepreneurs who undertake the risky project is given by

\[ \eta = \min \left[ \alpha, \frac{W}{C} \right]. \]

Thus, in this economy there are two kinds of equilibria, depending on the value of the parameters and wealth endowment \( W \). Either the economy is not wealth constrained, and the share of entrepreneurs going to sector 1 is \( \alpha \), the value that would be unchanged even if wealth was infinite. Or the economy produces the highest quantity of intermediate 1 that its wealth would allow.

**The Social Planner Solution**

It may be instructive to set up the social planner’s problem, and show that in the decentralized equilibrium the size of sector 1 is too low. A social planner would maximize aggregate output. She would choose the number of entrepreneurs \( \eta^{SP} \) to work in sector 1 to maximize:

\[ \eta^{SP} = \arg \max_{\eta \in [0,1]} AR \{ \eta [1 - \gamma(\eta)] \}^\alpha (1 - \eta)^{1-\alpha}, \]

subject to

\[ \eta C \leq W. \]

When the economy is not wealth-constrained, the first-order condition can be written as

\[ \frac{\alpha}{\eta^{SP}} - \frac{\alpha'}{1 - \gamma(\eta^{SP})} \frac{1 - \alpha}{1 - \eta^{SP}} = \frac{1 - \alpha}{1 - \eta^{SP}}. \]  

(3.7)

Given that in the decentralized equilibrium, \( \eta^{DC} = \alpha \), and thus \( \frac{\alpha}{\eta^{DC}} = \frac{1 - \alpha}{1 - \eta^{DC}} \), the so-
cial planner's solution is not the same as that occurring in the decentralized equilibrium. In particular, since a larger financial sector implies that fewer projects are liquidated, the term \(-\alpha \frac{\gamma'(\eta^{SP})}{1-\gamma(\eta^{SP})}\) > 0. This in turn implies that \(\eta^{SP} > \alpha = \eta^{DC}\): the social planner solution has a larger financially intensive sector. This is because when entrepreneurs enter sector 1, they do not internalize the benefit they provide to all the other entrepreneurs through the improved financial system.

What about when the economy is wealth-constrained? Since the economy reaches the maximum attainable level of the financially intensive sector production, the social planner cannot improve upon the decentralized allocation, and thus the social planner solution coincides with the market equilibrium. We can calculate the marginal welfare gain from giving a wealth-constrained country one extra unit of wealth. In such a situation, an additional dollar given to the economy has a marginal impact on occupation choices equal to:

\[ d\eta = \frac{1}{C} dw. \]

Then, the welfare impact of an extra dollar can be measured by:

\[ \frac{d \ln \pi}{dw} \approx \frac{1}{C} \left[ \frac{\alpha}{\eta} - \frac{1-\alpha}{1-\eta} - \frac{\alpha \gamma'(\eta)}{1-\gamma(\eta)} \right], \]

which can be decomposed into an allocative effect, \(\frac{a}{C} \left( \frac{\alpha}{\eta} - \frac{1-\alpha}{1-\eta} \right)\), and a liquidity effect \(\frac{a}{C} \frac{-\gamma'(\eta)}{1-\gamma(\eta)}\).

A wealth-constrained country is not only subject to misallocation of tasks because it cannot implement the optimal number of projects of type 1, but is also subject to larger aggregate liquidity shocks that lower the return on each financially intensive project undertaken.

### 3.2.3 Trade Equilibrium

Suppose that there are two countries, North \((N)\) and South \((S)\). While the final consumption good is non-tradeable, intermediates 1 and 2 can be traded at no cost. Suppose for simplicity that both countries are endowed with one unit of labor, but that their wealth levels differ. In particular, suppose that \(W_N > W_S\). To fix ideas, we will also assume that \(W_N \geq \alpha C \geq W_S\): in autarky, the North is wealthy, while the South is wealth-constrained.

The difference in wealth endowments will drive the pattern of comparative advantage. While
both countries possess the same technology, the North will specialize in the production of the financially intensive intermediate.\textsuperscript{4} This is intuitive: to serve the world market of intermediate goods would require a country to expand its production of that good vis-a-vis autarky. Since the South is wealth-constrained, it cannot do so, while the North can. We now state the equilibrium conditions under trade.

**Proposition 2: Equilibrium with Trade**

The trade equilibrium is characterized by a vector of prices \((p_1, p_2, r_N, r_S)\), where \((r_N, r_S)\) are time \(t = 0\) interest rates in the North and the South, and \((\eta_N, \eta_S)\), the number of entrepreneurs undertaking risky projects in each country, that satisfy the following conditions:

1. Intermediate good market clearing conditions:

\[
\begin{align*}
p_1 &= \alpha A \left[ \frac{(1 - \eta_N) + (1 - \eta_S)}{\eta_N [1 - \gamma (\eta_N)] + \eta_S [1 - \gamma (\eta_S)]} \right]^{1-\alpha}, \\
p_2 &= (1 - \alpha) A \left[ \frac{\eta_N [1 - \gamma (\eta_N)] + \eta_S [1 - \gamma (\eta_S)]}{(1 - \eta_N) + (1 - \eta_S)} \right]^\alpha;
\end{align*}
\]

(3.8) \hspace{2cm} (3.9)

2. Project choice arbitrage condition for \(j = N, S\):

- \(i\) if in country \(j\) both sectors are open, then:

\[
p_1 R \left[ 1 - \gamma (\eta_j) \right] - r_j C = p_2 R;
\]

(3.10)

- \(ii\) if in the North only sector 1 is open:

\[
p_1 R \left[ 1 - \gamma (1) \right] - r_N C \geq p_2 R;
\]

(3.11)

- \(iii\) if in the South only sector 2 is open:

\[
p_1 R \left[ 1 - \gamma (0) \right] \leq p_2 R;
\]

(3.12)

\textsuperscript{4}We could introduce the North’s financial comparative advantage in other ways. For instance, we could assume that the North has better institutions, which allow it to achieve greater efficiency in the market for external finance. The quality of institutions is undoubtedly important, but for our purposes this alternative modeling approach will yield similar results.

95
3. Time $t = 0$ credit markets clearing condition for $j = N, S$:

$$\eta_j C \leq W_j,$$

and

$$\eta_j C < W_j \Rightarrow r_j = 0.$$

The pattern of production and trade can be determined from the equilibrium conditions. The key result for us is that the North expands production of the financially intensive good ($\eta_N$ increases compared to autarky), while in the South, the financially intensive sector contracts ($\eta_S$ falls, possibly to zero). Thus, the size of the financial system, that is, the amount of borrowing and lending that occurs in the economy, increases in the North and decreases in the South.

This is not without consequence for the quality of the financial system, given here by $\gamma(\eta)$. In particular, as $\eta_N$ increases, $\gamma(\eta_N)$ goes up as well. This means that the agents operating in sector 1 in the North are able to fulfill their external financing needs more often, lowering the fraction of periods during which they lose output due to unsatisfied liquidity needs.

In the South, as the share of agents employed in the financial sector contracts, production in the sector 1 experiences more periods in which some agents' external financing needs are not satisfied. Thus, the quality of the financial system deteriorates. For some parameter values, sector 1 disappears from the South entirely. This this case, an entrepreneur wishing to enter the sector experiences the most difficult conditions, with $\gamma$ at its highest value of $\gamma(0)$.

**Gains from Trade**

While the main purpose of the model we present here is to show that the financial outcomes – the size of the financial sector and its quality – are affected by trade, it may also be useful to analyze aggregate welfare implications of trade. We show that under some conditions, the South may lose from trade. The key insight is that when production is characterized by externalities, one of the countries may lose as a result of trade. When the sector which exhibits the externality shrinks, the remaining firms experience a *de facto* productivity decrease, and this effect can more than offset traditional comparative-advantage based gains. The mechanism is well known (see Helpman and Krugman, 1985, ch. 3).
Since we've assumed that utility is linear in the consumption of the final good, and set its price as the numeraire, aggregate welfare in these economies is proportional to the real output. Thus, if the autarky prices in the two countries are given by the country superscript \( p_1^N, p_2^N, p_1^S, p_2^S \), then the autarky welfare is proportional to

\[
\Omega_{aut}^N = p_1^N \left[ 1 - \gamma(\eta_{aut}^N) \right] \eta_{aut}^N + p_2^N \left( 1 - \eta_{aut}^N \right)
\]
in the North, and

\[
\Omega_{aut}^S = p_1^S \left[ 1 - \gamma(\eta_{aut}^S) \right] \eta_{aut}^S + p_2^S \left( 1 - \eta_{aut}^S \right)
\]
in the South.

Correspondingly, if trade prices are given by \( p_1^T \) and \( p_2^T \), welfare under trade is:

\[
\Omega_T^N = p_1^T \left[ 1 - \gamma(\eta_{T}^N) \right] \eta_{T}^N + p_2^T \left( 1 - \eta_{T}^N \right)
\]
in the North, and

\[
\Omega_T^S = p_1^T \left[ 1 - \gamma(\eta_{T}^S) \right] \eta_{T}^S + p_2^T \left( 1 - \eta_{T}^S \right)
\]
in the South, keeping in mind that \( \eta_{T}^N \) may be 1 and \( \eta_{T}^S \) may be 0: only one sector could be operating in some countries under trade.

As a result of trade, sector 1 expands in the North and shrinks in the South: \( \eta_{T}^N > \eta_{T}^N^{aut} \) and \( \eta_{T}^S < \eta_{T}^S^{aut} \). We can see that in the North there are standard comparative advantage-driven gains that come from reallocating resources to sector 1. Furthermore, as sector 1 grows in the North, the de facto productivity of Northern firms in this sector grows as well, \( 1 - \gamma(\eta_{T}^N) > 1 - \gamma(\eta_{T}^{aut}) \). Thus, the North experiences additional gains. As the size of the financial sector grows, the financial system improves, and thus less output is lost due to unfulfilled need for external finance.

In the South, we see that the standard comparative advantage-driven gains are offset by the deterioration of the financial system, and the resulting drop in productivity in the financially intensive sector. As the financial system shrinks, there are more and more unfulfilled needs for external finance, and thus the firms operating (or considering operating) in that sector face a low productivity. This lowers the opportunity cost of labor in the South, and thus in some cases
may even imply that the real price of intermediate 2, to which labor is reallocated after trade, is lower under trade than in autarky. In the Appendix, we provide a proof that the South may on aggregate lose from trade.

3.2.4 Equilibrium with Factor Mobility

The best decentralized equilibrium outcome is achieved in this model when factors are mobile. We state the equilibrium conditions here.

Proposition 3: Equilibrium in the integrated economy

The equilibrium of the integrated economy is characterized by a vector of prices \((p_1, p_2, r)\) and the number \(\eta\) of entrepreneurs investing in the risky project in the two countries combined, such that:

1. Intermediate good market clearing conditions:

\[
p_1 = \alpha A \left( \frac{2 - \eta}{\eta [1 - \gamma(\eta)]} \right)^{1-\alpha},
\]
\[
p_2 = (1-\alpha) A \left( \frac{\eta [1 - \gamma(\eta)]}{2 - \eta} \right)^{\alpha};
\]

2. Project choice arbitrage condition:

\[
p_1 R [1 - \gamma(\eta)] - rC = p_2 R;
\]

3. Time \(t = 0\) credit market clearing conditions:

\[
\eta C \leq (W_N + W_S),
\]

and

\[
\eta C < (W_N + W_S) \Rightarrow r = 0.
\]

We can make several observations about the integrated world and how it compares to the autarky allocation. The equilibrium size of the financial sector is \(\eta' = \min \left[ 2\alpha, \frac{W_N + W_S}{C} \right]\), which
is weakly greater than the combined size of the financial sector when the two countries are in autarky, and is strictly greater if in autarky one of the countries is wealth-constrained. Also, while the South may lose on aggregate in the trade equilibrium, it is clear that in the fully integrated equilibrium the South gains with certainty. This is because Southern entrepreneurs are able to enter the financially intensive sector which has access to the worldwide financial markets.

Though the integrated economy equilibrium is still suboptimal, it is nevertheless worth noticing through equation (3.7) that the market failure, measured by the term $-\alpha \frac{\gamma'(\eta)}{1-\gamma(\eta)}$ is smaller as $\eta$ gets larger. When wealth can move costlessly between the two countries, liquidity shocks that hit entrepreneurs are averaged out at the world level, which decreases the likelihood of a negative aggregate shock occurring. The poorer country benefits more from integration than the richer country.

3.3 Empirical Evidence

The model presented in the section above illustrates the main point of the paper: to the extent both the size and the quality of a country’s financial system are equilibrium outcomes of local demand and supply for external finance, they will be influenced by trade. Thus, the impact of trade is expected to be differential across countries. When trade leads to specialization in financially dependent goods, it will lead to growth of the financial system. Conversely, when trade leads a country to import the financially dependent goods rather than produce them domestically, the financial system will shrink after trade opening, ceteris paribus.

We test the predictions of our model using a dataset compiled by Beck, Demirguc-Kunt, and Levine (2000). It consists of measures of financial development plus a variety of other country-level variables, including trade openness, for 22 OECD countries and 55 developing countries. The dataset is also available as a panel, reporting data at 5-year intervals from 1965 to 1995. The list of countries is presented in Table 3.1.

The key question is how do we proxy for financial comparative advantage: which countries should we expect to export financially dependent goods? The model gives the answer in terms of per capita income: a richer country will specialize in the financially intensive good. Perhaps
at least as relevant empirically is the quality of institutions dimension: countries with better enforcement of contracts and property rights will be expected to export the financially dependent good under trade. In practice, of course, institutional quality and per capita incomes are extremely highly correlated \( (\rho \approx 0.85) \), and thus the two sources of financial comparative advantage will tend to reinforce each other. Thus, in the present empirical work we will take per capita incomes as a sufficient statistic for the degree of financial comparative advantage.

Thus, we attempt to show that trade led to faster financial development in richer countries, and slower financial development in poorer countries. As a first pass, we split the sample into OECD and non-OECD countries, and run the following basic specification in the two subsamples:

\[
\text{FinDev}_j = \alpha + \beta \times \text{Trade65}_j + \delta \times X_j + \varepsilon_j, \tag{3.16}
\]

where \( \text{FinDev}_j \) is the change in country \( j \)'s financial development over the period 1965-95, \( \text{Trade65}_j \) is a country's trade openness in 1965 and \( X_j \) is a set of controls. Financial development is measured by the ratio of private credit to GDP, while trade openness is measured by \((\text{Exports}+\text{Imports})/\text{GDP}\). The list of controls includes initial level of private credit to GDP, initial per capita GDP, a measure of human capital (average years of secondary schooling in the population), as well as legal origin dummies. Variable definitions and summary statistics are presented in Table 3.2.

The results are presented in Table 3.3. Column 1 estimates equation (3.16) for the OECD countries. In developed countries, trade openness has if anything a positive effect on subsequent financial development, though it is not statistically significant. The fact that the positive effect of trade on financial development is not strong in the OECD sample is not surprising, as a large share of OECD trade is with other OECD countries, and the financial comparative advantage is not likely to be especially important in this trade relative to other determinants, such as increasing returns. By contrast, in developing countries trade openness has a negative effect. Column 2 replicates the regression from Column 1 in the non-OECD sample. The coefficient

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5 As expected, the differences in per capita income across these two groups are pronounced. In the OECD sample, per capita GDP is $7354, while in the other sample, $1010.

6 The coefficient in the OECD sample is not significant, however, if outlier Japan is dropped from the sample, the coefficient increases by a factor of more than 1.5 and becomes significant at 2% level. Japan is indeed an exception, as it is relatively closed but experienced a very strong financial sector expansion in the last 30 years.
on the trade variable is negative and significant, with a $p$-value of 8%.

The key effect that our model illustrates is that trade affects financial development differently depending on how strong are the forces of financial comparative advantage, as proxied by per capita income. Thus, we augment the basic specification by including an interaction term between trade and per capita GDP:

$$\text{FinDev}_j = \alpha + \beta_1 \cdot \text{Trade65}_j + \beta_2 \cdot \text{Trade65}_j \cdot \text{Income65}_j + \delta \cdot \mathbf{X}_j + \varepsilon_j,$$  \hspace{1cm} (3.17)

This allows us to pool the sample and test for the differential impact of trade. While now we are agnostic about the sign of the main effect of trade, $\beta_1$, we are interested in whether the coefficient on the interaction term, $\beta_2$, is positive and significant. Column 3 presents the results of estimating equation (3.17). To ease interpretation of the interaction coefficient, all variables have been demeaned. The main effect of trade openness on financial development is positive but not significant in the full sample. The trade-income interaction term, by contrast, is positive and significant at 1% level. Column 4 presents a specification that includes a full set of GDP interaction terms, allowing the effect of other regressors on financial development to be affected differentially for rich and poor countries. The coefficients of interest are virtually unchanged in the more flexible specification.

The results show that trade affects financial development differentially based on a country's level of income. In particular, for a country at the mean of the per capita GDP distribution, the effect of trade on financial development is given by the coefficient on the main trade term, slightly positive in this sample, though not statistically different from zero at 0.3. A country which is in the 25th percentile of per capita income distribution is affected by trade negatively, with the derivative of financial development with respect to trade being -0.2. In a country in the 10th percentile of the per capita income distribution, that negative effect has magnitude of -0.7. By contrast, in a country that is in the 75th percentile of the income distribution, the effect of trade on financial development is positive, with the derivative being 0.96.

While the Ordinary Least Squares estimates suggest that the correlations present in the data support the main argument we are making in this paper, they do not let us argue that the relationship between trade openness and the pace of financial development is indeed causal. We
can address this issue by instrumenting for trade openness with a variable that does not directly affect financial development. Such a variable was constructed by Frankel and Romer (1999). Using on the gravity model of trade, these authors construct a predicted measure of trade openness based on geographical characteristics, such as land area, population, and distance to other countries. This instrument for trade openness has since been widely used in the literature.

Columns (5) and (6) of Table 3.3 replicate the pooled sample specifications of Columns (3) and (4), using as an instrument for trade openness the predicted trade openness constructed by Frankel and Romer, and as an instrument for the trade-income interaction term the interaction between the Frankel and Romer variable and income. The point estimates on the coefficients of interest are similar to the OLS coefficients, and significant.

To check the robustness of this result, it is important to establish that it is not driven by outliers. In presenting robustness checks, we report the instrumental variables estimates throughout. Using OLS estimates leaves all the conclusions unchanged, in fact the coefficients of interest are if anything more robust in the OLS estimation. Table 3.4 presents the results of reestimating the basic specification, first dropping outliers on trade, then on income. The two least open countries in the data set are United States and Japan. The two most open countries are the Gambia and Guyana. Results of dropping these in turn are presented in Columns (1) and (2) of Table 3.4. Though the significance level deteriorates somewhat, the point estimates are similar to the base specification and remain significant. We then drop outliers on income. The wealthiest countries in our sample are United States and Switzerland. The three poorest countries are Rwanda, India, and Pakistan. We present the results in Columns (3) and (4) of Table 3.4. We see that the results are not driven purely by income outliers. The coefficients change little and remain significant.

As another robustness check, Table 3.5 presents estimation results when alternative indicators of financial development are used. We use two alternative measures, the ratio of liquid liabilities (M2) to GDP, and claims of deposit money banks on nonfinancial domestic sectors as share of GDP. The former is broader than the main measure that we use, while the latter is an indicator of banking finance in particular. Table 3.5 shows that the effect we are highlighting is

\[7\] Since India and Pakistan's per capita incomes are virtually identical, we drop both of them in this robustness check.
not driven purely by our measure of financial development. The coefficient on the interaction
term of interest is significant and reveals a similar effect of trade on these alternative measures
of financial system growth. The point estimates indicate, however, that the effect of trade
on these indicators of financial development is appreciably negative only for countries in the
bottom quartile of the income distribution.

We can also use the panel dimension of the data to shed light on this relationship. In
particular, we test whether financial development over a five-year horizon is affected by trade
openness in the beginning of the period:

\[
FinDev_{jt} = \alpha + \beta_1 \cdot Trade_{jt-1} + \beta_2 \cdot Trade_{jt-1} \cdot Income_{jt-1} + \delta \cdot X_{jt-1} + \eta_j + \varepsilon_{jt},
\]

a full set of country dummies, thus controlling for any country characteristics that are not time-
varying. The results are presented in Table 3.6. Unfortunately, we cannot use the instrumental
variables approach here, as the trade openness instrument is not time-varying, and thus is
perfectly correlated with the country fixed effects. Column 1 contains the base specification.
The trade-income interaction term is positive and significant, in parallel to the cross-sectional
regression. We establish that this effect is not driven by our choice of financial development
variable in Columns 2 and 3. The interaction of interest remains significant when we use
alternative measures of financial development. In the last column, we include a full set of time
dummies. We see that our results are not driven purely by omitted time effects, in fact the
coefficient of interest is virtually unchanged.

3.4 Conclusion

It has been documented that the differences in financial development between developed and
developing countries are substantial, and that these differences are an important determinant
of trade patterns. Departing from the realization that financial development affects trade
patterns, this paper asks the opposite question: will openness to trade affect countries' financial
development?

We build a model in which each country's financial system is an endogenous outcome of
entrepreneurs' demand for external finance. In this world, when a poor and a rich country open to trade, the poorer country begins to import the financially dependent good, rather than produce it domestically. This in turn implies that demand for external finance decreases, and the domestic financial system deteriorates. This effect may or may not generate losses from trade to the poor country, but the deterioration of the financial system may be important for a wide variety of reasons that are beyond the scope of this model. Indeed, the importance of financial development to fostering long-run growth and reducing output volatility has received a great deal of attention in the literature.

In the model we presented, the comparative advantage that generates the key effect comes purely from differences in wealth between countries. However, in practice institutional quality — contract enforcement, property rights, investor protection, etc. — has been shown to be quite important to financial development (La Porta et al., 1997). Institutional differences will tend to reinforce the financial comparative advantage in favor of rich countries, and exacerbate the effects we highlight here.

We provide empirical evidence that trade openness affects countries' financial systems differentially. In richer countries trade promotes financial system growth, in poorer ones the effect is the opposite. While the results in this paper are suggestive, there are a number of important caveats. The empirical proxy of financial development we use is the ratio of total lending to GDP, which is a measure of the size of the financial system and not its quality. Thus, while the results are consistent with the model we presented in this paper, they do not allow us to conclude that the quality of the financial system is affected as well as its size.

The strength of financial comparative advantage was proxied crudely by the interaction of aggregate trade openness and per capita income. Perhaps the revealed financial comparative advantage can be measured more precisely by looking at industry-level import and export data and the implied "financial content of trade." Implementing more sophisticated empirical tests of the influence of trade on the financial system remains on the research agenda.
3.5 Appendix

Proof of Lemma 1:

\( \gamma^t \) is a random variable with the following probability distribution:

\[
\gamma^t = \begin{cases} 
0 & \text{with probability } \frac{1}{2^n} \sum_{k=0}^{\text{Int}\left(\frac{n+1}{2}\right)} \binom{n}{k} \\
1 - \frac{2k}{n} & \text{with probability } \frac{1}{2^n} \binom{n}{k} \text{ for } 0 \leq k \leq \text{Int}\left(\frac{n+1}{2}\right),
\end{cases}
\]

and this implies that

\[
E(\gamma^t) = \frac{1}{2^n} \left( \frac{\eta - 1}{\text{Int}\left(\frac{n+1}{2}\right)} \right) \equiv \gamma(\eta)
\]

and it is easy to check that \( \gamma(1) = 1/2 \) and \( \lim_{\eta \to \infty} \gamma(\eta) = 0 \). Furthermore the sequences \( \{2\eta[\gamma(2\eta + 2) - \gamma(2\eta)]\}_{\eta \geq 1} \) and \( \{(2\eta - 1)[\gamma(2\eta + 1) - \gamma(2\eta - 1)]\}_{\eta \geq 1} \) are positive and decreasing. In the rest of the paper, the notation \( \gamma'(\eta) \) will refer to \( \frac{1}{2} [\gamma(2k + 2) - \gamma(2k)] \) if \( \eta \) is of the form \( \eta = 2k \) for some \( k \geq 1 \) and \( \frac{1}{2} [\gamma(2k + 1) - \gamma(2k - 1)] \) if \( \eta \) is of the form \( \eta = 2k - 1 \) for some \( k \geq 1 \).

Q.E.D.

Proof of Corollary 1:

Rewriting the arbitrage condition (3.6) in terms of \( \eta \), the expression becomes:

\[
\alpha A \left[ \frac{1 - \eta}{\eta[1 - \gamma(\eta)]} \right]^{1-\alpha} R [1 - \gamma(\eta)] - rC = (1 - \alpha) A \left[ \frac{\eta [1 - \gamma(\eta)]}{1 - \eta} \right]^{\alpha} R,
\]

which can be simplified to

\[
\alpha AR \left( \frac{1 - \eta}{\eta} \right)^{1-\alpha} - \frac{r}{[1 - \gamma(\eta)]^\alpha} C = (1 - \alpha) AR \left( \frac{\eta}{1 - \eta} \right)^\alpha.
\]

When interest rates drop to zero, the arbitrage condition becomes

\[
\alpha AR \left( \frac{1 - \eta}{\eta} \right)^{1-\alpha} = (1 - \alpha) AR \left( \frac{\eta}{1 - \eta} \right)^\alpha,
\]

which implies that

\( \eta = \alpha \).
Q.E.D.

Proof that the South may on aggregate lose from trade

South's welfare in autarky is

\[
\Omega^S_{\text{aut}} = p^S_1 \left[ 1 - \gamma(\eta^S_{\text{aut}}) \right] \eta^S_{\text{aut}} + p^S_2 \left( 1 - \eta^S_{\text{aut}} \right)
\]

and under trade:

\[
\Omega^S_T = p^T_1 \left[ 1 - \gamma(\eta^S_T) \right] \eta^T_S + p^T_2 \left( 1 - \eta^T_S \right).
\]

Project choice arbitrage conditions in the South in autarky and trade imply the following inequalities:

\[
p^S_1 \left[ 1 - \gamma(\eta^S_{\text{aut}}) \right] \geq p^S_2
\]

and

\[
p^T_1 \left[ 1 - \gamma(\eta^S_T) \right] \leq p^T_2
\]

Together, these imply that

\[
\Omega^S_{\text{aut}} \geq p^S_2
\]

and observing that if \( p^T_1 \left[ 1 - \gamma(\eta^S_T) \right] < p^T_2 \) then \( \eta^S_T = 0 \), it is also true that:

\[
\Omega^S_T = p^T_2.
\]

Therefore, the South loses from trade if \( p^S_2 > p^T_2 \).

Writing out

\[
p^S_2 = (1 - \alpha) A \left[ \frac{\eta^S_{\text{aut}} \left[ 1 - \gamma(\eta^S_{\text{aut}}) \right]}{1 - \eta^S_{\text{aut}}} \right]^\alpha
\]

and

\[
p^T_2 = (1 - \alpha) A \left[ \frac{\eta^T_N \left[ 1 - \gamma(\eta^T_N) \right] + \eta^S_S \left[ 1 - \gamma(\eta^S_S) \right]}{(1 - \eta^N_N) + (1 - \eta^S_S)} \right]^\alpha
\]

we see that \( p^S_2 > p^T_2 \) if and only if \( \frac{\eta^S_{\text{aut}} \left[ 1 - \gamma(\eta^S_{\text{aut}}) \right]}{1 - \eta^S_{\text{aut}}} > \frac{\eta^T_N \left[ 1 - \gamma(\eta^T_N) \right] + \eta^S_S \left[ 1 - \gamma(\eta^S_S) \right]}{(1 - \eta^N_N) + (1 - \eta^S_S)} \). These ratios are proportional to \( \frac{p^S_2}{p^T_1} \) and \( \frac{p^T_1}{p^T_2} \), thus \( p^S_2 > p^T_2 \) if \( \frac{p^S_2}{p^T_1} > \frac{p^T_1}{p^T_2} \).
From project choice arbitrage conditions, we know that

\[ \frac{p^S_2}{p^S_1} = [1 - \gamma (\eta^S_{aut})] - r^S_A C \]

and if sector 1 operates in the South,

\[ \frac{p^T_2}{p^T_1} = 1 - \gamma (\eta^T_S). \]

Thus, when sector 1 operates in the South, the country loses from trade if:

\[ [1 - \gamma (\eta^S_{aut})] - r^S_A C > 1 - \gamma (\eta^T_S), \]

which will be true for small \( r^S_A \); the country is not too wealth-constrained in autarky.

This discussion is suggestive of the set of conditions under which the South is most likely to lose from trade. When the South is not too wealth-constrained in autarky, and still produces intermediate 1 under trade, the de facto productivity loss coming from the deterioration of the financial system is most severe. Note that this will happen if the North is wealth-constrained under trade: there is not enough wealth in the North to accommodate the entire world production of intermediate 1. This suggests that the South would gain relatively more from opening to trade with a country that is much wealthier rather than slightly more wealthy. Of course, the conditions for the South to lose from trade that are stated here are not necessary.

### 3.6 Bibliography


109
Figure 3.1: Financial Development Over Time in Developed and Developing Countries


Figure 3.2: Timing of the risky project

\[
\begin{align*}
  t & \quad \text{Liquidity shock: } L_t \\
  & \quad \text{Refunded} \quad R_t = R \\
  & \quad \text{Liquidated} \\
  t + dt & \quad R_t = 0
\end{align*}
\]

Figure 3.3: Timing of the static economy

\[
\begin{align*}
  t = 0 & \quad \text{occupation choice} \quad \text{Intermediate goods production} \\
  & \quad \text{Risky Project} \\
  t = 1 & \quad \text{final production} \\
  & \quad \text{Risk-free Project}
\end{align*}
\]
### Table 3.1: Country list

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* indicates countries included in the cross-sectional regression
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Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. FinDev is the log growth rate of the private credit by deposit money banks and other financial institutions as share of GDP, 1965-1995; Trade65 is the sum of imports and exports as a share of GDP in 1965. Income65 is the log of real per capita GDP in 1965; PrivateCredit65 is private credit by deposit money banks and other financial institutions as share of GDP in 1965; School65 is the average years of schooling in the population over 25. English, German, and French indicate legal origin dummies. In Columns (5) and (6) the instrument for trade openness is the predicted openness obtained by Frankel and Romer (1999), and the instrument for Trade65*Income65 variable is the interaction of the Frankel and Romer instrument and Income65. All variables have been demeaned.
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<td>(2.51)</td>
</tr>
<tr>
<td>German</td>
<td>-0.66</td>
<td>-1.00</td>
<td>-1.74</td>
<td>-1.49</td>
</tr>
<tr>
<td></td>
<td>(2.62)</td>
<td>(2.43)</td>
<td>(3.68)</td>
<td>(2.74)</td>
</tr>
<tr>
<td>Private Credit65*Income65</td>
<td>1.40</td>
<td>1.65</td>
<td>1.70</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>(0.52)**</td>
<td>(0.56)**</td>
<td>(0.55)**</td>
<td>(0.45)**</td>
</tr>
<tr>
<td>School65*Income65</td>
<td>0.24</td>
<td>0.23</td>
<td>0.22</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>(0.10)**</td>
<td>(0.11)**</td>
<td>(0.12)*</td>
<td>(0.14)</td>
</tr>
<tr>
<td>English*Income65</td>
<td>1.97</td>
<td>2.38</td>
<td>2.63</td>
<td>1.91</td>
</tr>
<tr>
<td></td>
<td>(1.48)</td>
<td>(1.63)</td>
<td>(1.82)</td>
<td>(1.48)</td>
</tr>
<tr>
<td>German*Income65</td>
<td>0.55</td>
<td>0.65</td>
<td>1.20</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td>(1.62)</td>
<td>(1.53)</td>
<td>(2.39)</td>
<td>(1.70)</td>
</tr>
<tr>
<td>French*Income65</td>
<td>1.87</td>
<td>2.25</td>
<td>2.50</td>
<td>1.96</td>
</tr>
<tr>
<td></td>
<td>(1.49)</td>
<td>(1.64)</td>
<td>(1.84)</td>
<td>(1.57)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample</th>
<th>Excl. 2 most open countries</th>
<th>Excl. 2 least open countries</th>
<th>Excl. 2 richest countries</th>
<th>Excl. 3 poorest countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>54</td>
</tr>
<tr>
<td>Estimation</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. FinDev is the log growth rate of the private credit by deposit money banks and other financial institutions as share of GDP, 1965-1995; Trade65 is the sum of imports and exports as a share of GDP in 1965. Income65 is the log of real per capita GDP in 1965. PrivateCredit65 is private credit by deposit money banks and other financial institutions as share of GDP in 1965; School65 is the average years of schooling in the population over 25. English, German, and French indicate legal origin dummies. The instrument for trade openness is the predicted openness obtained by Frankel and Romer (1999), and the instrument for Trade65*Income65 variable is the interaction of the Frankel and Romer instrument and Income65. All variables have been demeaned.
Table 3.5: Regression Results, Alternative Measures of Financial Development

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>M2/GDP</th>
<th>Deposit Money Bank Assets/GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Trade65</td>
<td>0.57</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>(0.28)**</td>
<td>(0.35)**</td>
</tr>
<tr>
<td>Trade65*Income65</td>
<td>0.33</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>(0.18)*</td>
<td>(0.22)**</td>
</tr>
<tr>
<td>Income65</td>
<td>-0.03</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.10)**</td>
</tr>
<tr>
<td>School65</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>(0.10)*</td>
<td>(0.10)**</td>
</tr>
<tr>
<td>English</td>
<td>0.11</td>
<td>-3.35</td>
</tr>
<tr>
<td></td>
<td>(0.26)</td>
<td>(1.49)**</td>
</tr>
<tr>
<td>French</td>
<td>0.17</td>
<td>-3.33</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(1.33)**</td>
</tr>
<tr>
<td>German</td>
<td>0.75</td>
<td>-1.56</td>
</tr>
<tr>
<td></td>
<td>(0.26)**</td>
<td>(1.45)***</td>
</tr>
<tr>
<td>M2/GDP65</td>
<td>-0.93</td>
<td>-1.03</td>
</tr>
<tr>
<td></td>
<td>(0.33)**</td>
<td>(0.42)**</td>
</tr>
<tr>
<td>M2/GDP65*Income65</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.25)*</td>
<td></td>
</tr>
<tr>
<td>BankAssets65</td>
<td>-1.47</td>
<td>-2.06</td>
</tr>
<tr>
<td></td>
<td>(0.38)**</td>
<td>(0.69)**</td>
</tr>
<tr>
<td>BankAssets65*Income65</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.60)</td>
<td></td>
</tr>
<tr>
<td>School65*Income65</td>
<td>-0.01</td>
<td>-0.16</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.10)</td>
</tr>
<tr>
<td>English*Income65</td>
<td>2.14</td>
<td>2.55</td>
</tr>
<tr>
<td></td>
<td>(0.82)**</td>
<td>(0.94)**</td>
</tr>
<tr>
<td>German*Income65</td>
<td>1.23</td>
<td>2.27</td>
</tr>
<tr>
<td></td>
<td>(0.93)</td>
<td>(1.40)</td>
</tr>
<tr>
<td>French*Income65</td>
<td>2.12</td>
<td>2.67</td>
</tr>
<tr>
<td></td>
<td>(0.90)**</td>
<td>(0.94)**</td>
</tr>
<tr>
<td>Observations</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>Estimation</td>
<td>IV</td>
<td>IV</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses; * significant at 10%, ** significant at 5%; *** significant at 1%. The dependent variable is the log growth rate, 1965-1995; Trade65 is the sum of imports and exports as a share of GDP in 1965. Income65 is the log of real per capita GDP in 1965; M2/GDP65 is liquid liabilities as share of GDP in 1965; BankAssets65 is claims of deposit money banks on nonfinancial domestic sectors as share of GDP in 1965; School65 is the average years of schooling in the population over 25. English, German, and French indicate legal origin dummies. The instrument for trade openness is the predicted openness obtained by Frankel and Romer (1999), and the instrument for Trade65*Income65 variable is the interaction of the Frankel and Romer instrument and Income65. All variables have been demeaned.
### Table 3.6: Panel Regression Results

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(1) Change in Private Credit/GDP</th>
<th>(2) Change in M2/GDP</th>
<th>(3) Change Bank Assets/GDP</th>
<th>(4) Change in Private Credit/GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade</td>
<td>-2.04</td>
<td>-1.00</td>
<td>-1.12</td>
<td>-2.01</td>
</tr>
<tr>
<td></td>
<td>(0.85)**</td>
<td>(0.49)**</td>
<td>(0.73)</td>
<td>(0.87)**</td>
</tr>
<tr>
<td>Trade*Income</td>
<td>0.32</td>
<td>0.16</td>
<td>0.18</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>(0.13)**</td>
<td>(0.07)**</td>
<td>(0.11)*</td>
<td>(0.13)**</td>
</tr>
<tr>
<td>Income</td>
<td>-0.25</td>
<td>0.02</td>
<td>-0.04</td>
<td>-0.21</td>
</tr>
<tr>
<td></td>
<td>(0.14)*</td>
<td>(0.09)</td>
<td>(0.12)</td>
<td>(0.16)</td>
</tr>
<tr>
<td>School</td>
<td>-0.40</td>
<td>-0.24</td>
<td>-0.55</td>
<td>-0.33</td>
</tr>
<tr>
<td></td>
<td>(0.39)</td>
<td>(0.22)</td>
<td>(0.31)*</td>
<td>(0.42)</td>
</tr>
<tr>
<td>School*Income</td>
<td>0.04</td>
<td>0.02</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.03)</td>
<td>(0.04)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>PrivateCredit</td>
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<td></td>
<td>-5.49</td>
</tr>
<tr>
<td></td>
<td>(1.27)***</td>
<td></td>
<td></td>
<td>(1.30)***</td>
</tr>
<tr>
<td>PrivateCredit*Income</td>
<td>0.52</td>
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<td></td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>(0.15)***</td>
<td></td>
<td></td>
<td>(0.15)***</td>
</tr>
<tr>
<td>M2/GDP</td>
<td></td>
<td>-2.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.72)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M2/GDP)*Income</td>
<td></td>
<td>0.21</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(0.09)**</td>
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</tr>
<tr>
<td>BankAssets</td>
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</tr>
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<td></td>
<td></td>
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<td>(1.02)***</td>
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<tr>
<td>BankAssets*Income</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(0.12)***</td>
<td></td>
<td></td>
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<td>347</td>
<td>347</td>
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</tr>
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<td>R-squared</td>
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<td>0.27</td>
<td>0.27</td>
<td>0.23</td>
</tr>
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</table>

Notes: Fixed effects estimates; * significant at 10%; ** significant at 5%; *** significant at 1%. The dependent variable is the log growth rate of a financial development indicator over the previous period. *Trade* is the sum of imports and exports as a share of GDP. *Income* is the log of real per capita GDP; *PrivateCredit* is private credit by deposit money banks and other financial institutions as share of GDP; *M2/GDP* is liquid liabilities as share of GDP; *BankAssets* is claims of deposit money banks on nonfinancial domestic sectors as share of GDP; *School* is the average years of schooling in the population over 25.