

# **Advances in Economics and Econometrics**

*Theory and Applications, Eighth  
World Congress, Volume III*

*Edited by*

**Mathias Dewatripont**

*Université Libre de Bruxelles  
and CEPR, London*

**Lars Peter Hansen**

*University of Chicago*

**Stephen J. Turnovsky**

*University of Washington*



**CAMBRIDGE**  
UNIVERSITY PRESS

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE  
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS  
The Edinburgh Building, Cambridge CB2 2RU, UK  
40 West 20th Street, New York, NY 10011-4211, USA  
477 Williamstown Road, Port Melbourne, VIC 3207, Australia  
Ruiz de Alarcón 13, 28014 Madrid, Spain  
Dock House, The Waterfront, Cape Town 8001, South Africa  
<http://www.cambridge.org>

© Mathias Dewatripont, Lars Peter Hansen, and Stephen J. Turnovsky 2003

This book is in copyright. Subject to statutory exception  
and to the provisions of relevant collective licensing agreements,  
no reproduction of any part may take place without  
the written permission of Cambridge University Press.

First published 2003

Printed in the United States of America

*Typeface* Times Roman 10/12 pt.    *System* L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> [TB]

*A catalog record for this book is available from the British Library.*

*Library of Congress Cataloging-in-Publication Data*

Advances in economics and econometrics : theory and applications : eighth world  
Congress / edited by Mathias Dewatripont, Lars Peter Hansen, Stephen J. Turnovsky.

p. cm. – (Econometric Society monographs ; 2003.)

ISBN 0-521-81872-9 (v.1) – ISBN 0-521-52411-3 (pb.) – ISBN 0-521-81873-7 (v.2) –  
ISBN 0-521-52412-1 (pb.) – ISBN 0-521-81874-5 (v.3) – ISBN 0-521-52413-X (pb.)

1. Econometrics – Congresses. 2. Economics – Congresses. I. Dewatripont, M.  
(Mathias) II. Hansen, Lars Peter. III. Turnovsky, Stephen J. IV. Econometric  
Society. World Congress (7th : 1995 : Tokyo, Japan) V. Series.

HB139 .A35 2003

330 – dc21

2002071258

ISBN 0 521 81874 5 hardback  
ISBN 0 521 52413 X paperback

# Contents

|                                                                                                                                                       |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <i>List of Contributors</i>                                                                                                                           | page ix |
| <i>Preface</i>                                                                                                                                        | xi      |
| 1. Contracting Constraints, Credit Markets, and Economic Development                                                                                  | 1       |
| ABHIJIT V. BANERJEE                                                                                                                                   |         |
| 2. Factor Models in Large Cross Sections of Time Series                                                                                               | 47      |
| LUCREZIA REICHLIN                                                                                                                                     |         |
| 3. Macroeconomic Forecasting Using Many Predictors                                                                                                    | 87      |
| MARK W. WATSON                                                                                                                                        |         |
| “Big Data” Dynamic Factor Models for Macroeconomic Measurement and Forecasting: A Discussion of the Papers by Lucrezia Reichlin and by Mark W. Watson | 115     |
| FRANCIS X. DIEBOLD                                                                                                                                    |         |
| 4. How Severe Is the Time-Inconsistency Problem in Monetary Policy?                                                                                   | 123     |
| STEFANIA ALBANESI, V. V. CHARI, AND LAWRENCE J. CHRISTIANO                                                                                            |         |
| 5. New Perspectives on Monetary Policy, Inflation, and the Business Cycle                                                                             | 151     |
| JORDI GALÍ                                                                                                                                            |         |
| Comments on Papers by Stefania Albanesi, V. V. Chari, and Lawrence J. Christiano and by Jordi Galí                                                    | 198     |
| CHRISTOPHER A. SIMS                                                                                                                                   |         |
| 6. Consumption Smoothing and Extended Families                                                                                                        | 209     |
| ORAZIO P. ATTANASIO AND JOSÉ-VÍCTOR RÍOS-RULL                                                                                                         |         |
| 7. Computational Methods for Dynamic Equilibria with Heterogeneous Agents                                                                             | 243     |
| KENNETH L. JUDD, FELIX KUBLER, AND KARL SCHMEDDERS                                                                                                    |         |
| <i>Index</i>                                                                                                                                          | 291     |

## Contributors

Stefania Albanesi  
Bocconi University and IGER

Orazio P. Attanasio  
University College London, IFS, NBER,  
and CEPR

Abhijit V. Banerjee  
Massachusetts Institute of Technology

V. V. Chari  
University of Minnesota and Federal  
Reserve Bank of Minneapolis

Lawrence J. Christiano  
Northwestern University and Federal  
Reserve Banks of Chicago and  
Cleveland

Francis X. Diebold  
University of Pennsylvania and NBER

Jordi Galí  
CREI and Universitat Pompeu Fabra

Kenneth L. Judd  
Stanford University

Felix Kubler  
Stanford University

Lucrezia Reichlin  
Université Libre de Bruxelles  
(ECARES) and CEPR

José-Víctor Ríos-Rull  
University of Pennsylvania, NBER,  
and CEPR

Karl Schmedders  
Northwestern University

Christopher A. Sims  
Princeton University

Mark W. Watson  
Princeton University

# **Contracting Constraints, Credit Markets, and Economic Development**

**Abhijit V. Banerjee**

## **1. INTRODUCTION**

Development economists are, perhaps by necessity, optimistic people. One does not become a development economist if one believes that the world's poorest are doing as well as they possibly could. Indeed, the premise of the entire field<sup>1</sup> is that there is talent in every people, if not every person, and if there is one central question, it has to be: What prevents people from making the best use of their natural talents?

There are at least five distinct answers to this question. The first, which is elaborated here, is the answer from contract theory: Talent is not an apple<sup>2</sup>; one cannot simply go to the market, sell one's talent, and expect to be paid the appropriate price. The second is coordination failure: Talent is talent only if it gets to work with the appropriate other inputs. Even Lennon needed Paul and George – had they decided to go to the City instead, he too might have found himself a different profession.<sup>3</sup> The third is political economy: Governments can and often do make it harder for people to do what they are best at doing.<sup>4</sup> The fourth is learning: People may not know what they ought to be doing, and even when they do the rest of the world may not appreciate them. For example, a growing body of evidence shows that farmers are often ignorant or suspicious

<sup>1</sup> And of growth theory: What is convergence other than the hope that there is talent in every nation?

<sup>2</sup> A contract theorist would probably say an apple is not an apple either – an apple can be stale or fresh, sweet, or sour. If you had a lot of apples to sell, you would probably want to invest in a reputation for selling only fresh and sweet apples.

<sup>3</sup> There is a long tradition in development economics of models that emphasize coordination failures going back at least to Rosenstein-Rodan (1943) and Nurkse (1953). See Murphy, Shleifer, and Vishny (1989) for a model where there is failure of coordination between producers of different goods, and Kremer (1993) for a model of matching between different types of talents.

<sup>4</sup> There is, of course, a long tradition here, going back to Adam Smith. Krueger (1974) and Bhagwati (1982), among others, study the distortions in the allocation of talent and resources that come from government policies.

of more rewarding crops and better seeds.<sup>5</sup> The final answer comes from what has come to be called behavioral economics: People may not always seek out the best options because they are held back by psychological constraints or social norms.<sup>6</sup>

The fact that this survey concentrates on the contract theoretic argument should not be interpreted as evidence for its primacy. However, it is the argument that has received the most elaboration over the past decade or so, and the one that best matches the competencies of the present author. It is therefore the appropriate topic for a survey such as this.

## 2. CONTRACT THEORY IN DEVELOPMENT ECONOMICS

Contract theoretic arguments in development economics go back at least to the work of D. G. Johnson in the 1940s and 1950s in the context of land markets.<sup>7</sup> Stiglitz's 1974 paper on sharecropping, among others, started a tradition of formal contract theoretic models that seek to explain why landlords and tenants often settle into arrangements that are, at least apparently, less than first best efficient.<sup>8</sup>

Since then, similar principles have been applied to the study of all the other important markets: capital, insurance, and human capital. The result is an enormous literature that I could not even begin to do justice to within the limits of this survey. I confine myself, therefore, to elaborating on a single example from the market for capital, which I hope will allow me to draw out the most important themes, though at several points in the text I point out the connections with what is understood about the other asset markets.

## 3. THE CREDIT MARKET

The facts about the credit market are remarkably stark. Although neoclassical theory predicts a single price of capital at which people both borrow and lend, at any point over the past twenty years one could point to a set of peoples in the world (most recently the Japanese) who were earning a negative return on their savings, while another set of people were borrowing at real rates of 60 percent or more.

<sup>5</sup> See Besley and Case (1994) and Munshi (2000). Banerjee (1992) provides theoretical arguments for why such behavior may be rational for individual farmers.

<sup>6</sup> There is a long and controversial literature on this point. The famous Lewis model (Lewis, 1954) argued that family norms could discourage people from seeking outside options. The rational peasant model (Schultz, 1964) was articulated as a critique of models like the Lewis model (see also Cole, Mailath, and Postlewaite, 1992, and Banerjee and Newman, 1998, for two very different attempts to reconcile these views). It is, however, time to revisit this issue: With the increasing sophistication of the psychological models used in economics, it is now possible to reask the question of whether, for example, poverty can have direct discouragement effects.

<sup>7</sup> See Johnson (1950).

<sup>8</sup> See Stiglitz (1974) and Cheung (1968).

Indeed, more often than not, very large differences between borrowing and lending rates can be found within a single subeconomy. Banerjee (2001) reviews a number of empirical studies of individual credit markets in developing countries and lists six salient features.<sup>9</sup>

First, there is a sizeable gap between lending rates and deposit rates within the same subeconomy. Ghatak (1976) reports data on interest rates paid by cultivators in India from the *All India Rural Credit Survey* for the 1951–1952 to 1961–1962 period: The average rate varies between a maximum of 18 percent (in 1959–1960) and a minimum of about 15 percent (in 1961–1962). These numbers are, however, slightly misleading: Around 25 percent of the borrowing reported in these surveys was zero-interest loans, usually from family members or friends. These should be seen as gifts or insurance rather than loans. If these were left out, the average rates in these surveys would be above 20 percent. We are not told what the comparable rates for depositors were in this period, but Ghatak reports that the bond rate in this period was around 3 percent, and the bank deposit rate was probably about the same.

Timberg and Aiyar (1984) report data on indigenous style bankers in India, based on surveys that they carried out. They report that the gap between the average rate charged to borrowers and the average rate to depositors by finance companies was 16.5 percent. The same gap for financiers from the Shikarpuri community was 16.5 percent, 12 percent for financiers from the Gujarati community, 15.5 percent for the Chettiars, 11.5 percent for the Rastogis, and so on.

The “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989) reports results from a number of case studies that were commissioned by the Asian Development Bank and carried out under the aegis of the National Institute of Public Finance and Policy. For the rural sector, the data are based on surveys of six villages in Kerala and Tamil Nadu, carried out by the Centre for Development Studies. The average interest rate charged by professional moneylenders (who provide 45.61 percent of the credit) in these surveys is about 52 percent. Although the average deposit rate is not reported, the maximum from all the case studies is 24 percent and the maximum in four out of the eight case studies is no more than 14 percent. For the urban sector, the data are based on various case surveys of specific classes of informal lenders: For finance corporations, they report that the maximum deposit rate for loans of less than a year is 12 percent, whereas the minimum lending rate is 48 percent. For hire-purchase companies in Delhi, the deposit rate was 14 percent and the lending rate was at least 28 percent. For autofinanciers in Namakkal, the gap between the deposit rate and the lending rate was 19 percent.<sup>10</sup>

<sup>9</sup> The review focuses on the informal sector because the formal banking sector in most developing countries has tended to be quite rigid (interest rate caps, strict rules about collateral, inflexible credit limits, etc.; see Ghate, 1992), with the result that the informal sector has become the supplier of the marginal units of capital for all but the very largest of firms.

<sup>10</sup> This number and all other information about this gap are measured in percentage points.

For handloom financiers in Bangalore and Karur, the gap between the deposit rate and the lowest lending rate was 26 percent.<sup>11</sup>

Aleem (1990) reports data from a study of professional moneylenders that he carried out in a semiurban setting in Pakistan in 1980–1981. The average interest rate charged by these lenders is 78.5 percent. The bank rate in that year in Pakistan was 10 percent. However, it is possible that depositors in this area may not have been depositing in the banks, so an alternative measure of the gap can be obtained by using Aleem's numbers for the opportunity cost of capital to these moneylenders, which is 32.5 percent.<sup>12</sup>

Second, there is extreme variability in the interest rate charged by lenders for superficially similar loan transactions within the same economy. Timberg and Aiyar (1984) report that the rates for Shikarpuri financiers varied between 21 percent and 37 percent on loans to members of local Shikarpuri associations and between 21 percent and 120 percent on loans to nonmembers (25 percent of the loans were to nonmembers and another 50 percent were loans through brokers). In contrast, the Gujarati bankers charged rates of no more than 18 percent. Moreover, the rates faced by established commodity traders in the Calcutta and Bombay markets were never above 18 percent and could be as low as 9 percent.

The "Summary Report on Informal Credit Markets in India" (Dasgupta, 1989) reports that finance corporations offer advances for a year or less at rates between 48 percent per year and the utterly astronomical rate of 5 percent per day. The rates on loans of more than a year varied between 24 percent and 48 percent. Hire-purchase contracts offer rates between 28 percent and 41 percent per year. Handloom financiers charge rates between 44 percent and 68 percent, yet the Shroffs of Western India offer loans at less than 21 percent and Chit Fund members can borrow at less than 25 percent.

The same report tells us that, among rural lenders, the average rate for professional moneylenders (who in this sample give about 75 percent of the commercial informal loans) was 51.86 percent, whereas the rate for the agricultural moneylenders (farmers who also lend money) who supply the rest was 29.45 percent. Within the category of professional moneylenders, about half the loans were at rates of 60 percent or more but another 40 percent or so had rates below 36 percent.

The study by Aleem (1990) reports that the standard deviation of the interest rate was 38.14 percent compared with an average lending rate of 78.5 percent. In other words, an interest rate of 2 percent and an interest rate of 150 percent are both within two standard deviations of the mean.

Swaminathan (1991) reports on a survey of two villages in South India that she carried out: The average rate of interest in one village varied between

<sup>11</sup> A number of other lending institutions are also mentioned in this study. However, the range of both deposit rates and lending rates is so wide in these cases that the gap between the minimum lending rate and the maximum deposit rate is not very large. This does not rule out the possibility that the gap between the *average* borrowing and lending rate is quite substantial even in these cases.

<sup>12</sup> This, however, understates the gap, because the moneylenders themselves borrow this money, and the original lenders are paid much less than 32.5 percent.

14.8 percent for loans collateralized by immovable assets (land, etc.) and 60 percent for loans backed by movable assets. The corresponding rates in the other village were 21 percent and 70.6 percent. Even among loans collateralized by the same asset – gold – the average rate in one village was 21.8 percent but it went up to 58.8 percent when the loans were to landless laborers.

Ghate (1992) reports on a number of case studies from all over Asia: The case study from Thailand found that interest rates were 2–3 percent per month in the Central Plain but 5–7 percent in the North and Northeast (note that 5 percent and 7 percent are very different).

Gill and Singh (1997) report on a survey of six Punjab villages that they carried out. The mean interest rate for loans up to Rs. 10,000 is 35.81 percent for landowning households in their sample, but 80.57 percent for landless laborers.

Fafchamps' (2000) study of informal trade credit in Kenya and Zimbabwe reports an average monthly interest rate of 2.5 percent (corresponding to an annualized rate of 34 percent) but also notes that this is the rate for the dominant trading group (Indians in Kenya, whites in Zimbabwe). Blacks pay 5 percent per month in both places.<sup>13</sup>

Irfan et al. (1999) report that interest rates charged by professional money-lenders vary between 48 percent and 120 percent.

Third, there are low levels of default. Timberg and Aiyar (1984) report that average default losses for the informal lenders they studied range between 0.5 percent and 1.5 percent of working funds.

The "Summary Report on Informal Credit Markets in India" (Dasgupta, 1989) attempts to decompose the observed interest rates into their various components,<sup>14</sup> and it finds that the default costs explain 14 percent (not 14 percentage points!) of the total interest costs for the Shroffs, around 7 percent for autofinanciers in Namakkal and handloom financiers in Bangalore and Karur, 4 percent for finance companies, 3 percent for hire-purchase companies, and essentially nothing for the Nidhis. The same study reports that, in four case studies of moneylenders in rural India, default rates explained about 23 percent of the observed interest rate.

The study by Aleem gives default rates for each individual lender. The median default rate is between 1.5 percent and 2 percent and the maximum is 10 percent.

Fourth, production and trade finance are the main reasons given for borrowing, even in cases where the rate of interest is relatively high. Ghatak (1976) concludes on the basis of his study that "the existing belief about the unproductive use of loans by Indian cultivators . . . has not been substantiated."

Timberg and Aiyar (1984) report that, for Shikarpuri bankers (who charge 31.5 percent on average, and as much as 120 percent on occasion), at least 75 percent of the money goes to finance trade and, to a lesser extent, industry.

<sup>13</sup> Fafchamps notes that, when he controls for the sector of the economy, and so on, this difference goes away, but that just tells us that the source of the variation is sector rather than race.

<sup>14</sup> In the tradition of Bottomley (1963).

The “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989) reports that several of the categories of lenders that have been already mentioned, such as hire-purchase financiers (interest rates between 28 percent and 41 percent), handloom financiers (44–68 percent), Shroffs (18–21 percent), and finance corporations (24–48 percent for longer-term loans and more than 48 percent on loans of less than a year), focus almost exclusively on financing trade and industry, and even for Chit Funds and Nidhis, which do finance consumption, trade and industry dominate.

Swaminathan (1991) reports that, in the two villages she surveys, the share of production loans in the portfolio of lenders is 48.5 percent and 62.8 percent. The higher share of production loans is in Gokalipuram, which has the higher interest rates (above 36 percent for all except the richest group of borrowers). Ghate (1992) also concludes that the bulk of informal credit goes to finance trade and production.

Murshid (1992) studies Dhaner Upore loans in Bangladesh (you get some amount in rice now and repay some amount in rice later) and argues that most loans in his sample are production loans despite the fact that the interest rate is 40 percent for a three- to five-month loan period.

Gill and Singh (1997) report that the bulk (63.03 percent) of borrowing from the informal sector goes to finance production. This proportion is lower for the landless laborers, but it is a nonnegligible fraction (36 percent).

Fifth, richer people borrow more and pay lower rates of interest. Ghatak (1976) correlates asset category with borrowing and debt in the *All India Rural Credit Survey* data and finds a strong positive relationship. Timberg and Aiyar (1984) report that some of the Shikarpuri and Rastogi lenders set a credit limit that is proportional to the borrower’s net worth: Several lenders said that they would lend no more than 25 percent of the borrower’s net worth, although another said he would lend up to 33 percent.

The “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989) tells us that, in its rural sample, landless laborers paid much higher rates (ranging from 28 percent to 125 percent) than cultivators (who paid between 21 percent and 40 percent). Moreover, Table 15.9 in that report clearly shows that the average interest rate declines with loan size (from a maximum of 44 percent to a minimum of 24 percent). The relation between asset category and interest rate paid is less clear in their data, but it remains that the second poorest group (those with assets in the range Rs. 5,000–10,000) pay the highest average rate (120 percent) and the richest (those with more than Rs. 100,000) pay the lowest rate (24 percent).

Swaminathan (1991) finds a strong negative relation between the value of the borrower’s land assets and the interest rate he or she faces: The poorest (those with no land assets) pay 44.9 percent in one village and 45.4 percent in the other, whereas the rich (those with land valued at more than Rs. 50,000) pay 16.9 percent and 24.2 percent in the corresponding villages.

Gill and Singh (1997) show that the correlation between the wealth of the borrower and loan size is negative after the interest rate is controlled for. They also find a positive relation between the borrower’s wealth and the loan he or she gets.

Sixth, bigger loans are associated with lower interest rates. Table 15.9 in the “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989) clearly shows that the average interest rate declines with loan size (from a maximum of 44 percent to a minimum of 24 percent).

Ghate (1992) notes that the interest rate on very small loans in Bangladesh tends to be very high (Taka 10 per week on a loan of Taka 500, or 86 percent per annum).

Gill and Singh (1997) show that the correlation between loan size and the interest rate is negative even after they control for the wealth of the borrower.

### 3.1. Taking Stock: The Facts About Credit Markets

The fact that there is a gap between the lending rate and the rate paid to depositors is not, per se, surprising. The fact that intermediation is costly is, after all, entirely commonplace. What is striking is the size of the gap. It is always more than 10 percent and usually more than 14 percent, in a world where interest rates paid to depositors are rarely more than 20 percent and usually closer to 10 percent. In other words, intermediation costs seem to eat up at least a third and often half (and sometimes much more than half) of the income that could go to depositors.

However, this argument overstates the point slightly. The probability that a moneylender would default on his or her deposit liabilities is substantially lower than the probability that borrowers would default on the loan, which implies that the default premium on loans should be much greater than the default premium on deposits. From the evidence reported herein, default is relatively rare and default costs rarely raise the interest rate by more than 10 percent. The gap between loan rates and deposit rates would be very large even if we were to deduct 10 percent from the loan rate.<sup>15, 16</sup>

The fact that interest rates vary quite so much is particularly striking given the standard neoclassical prediction that in market equilibrium the marginal unit of capital in every firm should earn the same return. However, given that people might be rationed in the credit market, it is theoretically possible that the marginal product of capital is actually equal in all its uses, despite the enormous disparities in the interest rate. Note that the incremental capital/output ratio for the Indian economy is estimated to be around 4.3, implying a marginal return

<sup>15</sup> One might be worried that although default rates are low on average, default may be very important in those cases where the interest rate is high. However, this is not a problem because, for the most part, we look at interest rates and default rates weighted by volume (or equivalently, do a Bottomley, 1963, decomposition). Moreover, in the one detailed microstudy we have in which the average interest rate is very high (Aleem, 1990), default rates are actually very low (always less than 10 percent, and usually less than 2 percent).

<sup>16</sup> Delay in repayment for which no extra interest is charged is another factor that raises the interest rate. In Aleem’s data, delay is much more common than default, but in a significant fraction of the cases the lender is able to charge interest for the extra days. Moreover, the percentage of loans that are late never exceeds 25 percent and the average delay is no more than six months, so at worst this would raise the interest rate by a factor of 1.12.

on capital of 24 percent. This is, however, a gross measure and the true return, net of depreciation, is clearly substantially lower (no more than 20 percent). The fact that interest rates above 35 percent are standard, and those above 75 percent are by no means rare, suggests that at least some of the users of capital must value capital at substantially more than 20 percent.

Could it be that all of the demand at relatively high interest rates comes from people who have particularly insistent consumption needs today? This is certainly not the stated purpose of the loans, as already noted. Of course, money is fungible and one cannot rule out the possibility that some of these people are either deluded or untruthful. However, it remains that when a handloom producer borrows at 48 percent or more to finance consumption, he or she chose to do so instead of taking the money out of his or her existing business. Therefore, it must be that the handloom producer would lose more than 48 percent on any money that comes out of his or her business. This may be in part because, in the short run, his or her assets are not liquid, but this could not explain why the producer accepts ongoing financing on these terms. Therefore, the producer must be earning marginal returns that are close to 48 percent.<sup>17</sup>

The fact that the marginal product of capital varies substantially across borrowers in the same subeconomy is supported by more direct evidence from the knitted garment industry based on data that I collected in joint work with Kaivan Munshi (Banerjee and Munshi, 2001). Tirupur produces 70 percent of India's knitted garment exports, and India is a major exporter of knitted garments. There are two communities of producers in Tirupur: Gounders, who are linked by community ties to a rich local agricultural community; and Outsiders, a motley crew of businessmen from all over India. They produce exactly the same goods, yet they use radically different technologies. Gounders invest much more than Outsiders at all levels of experience, both in absolute terms and relative to output. Average capital/output ratios for Gounders can be three times as large as that for Outsiders and is typically twice as large. However, all the evidence points to the Outsiders being more able: They enjoy faster output growth, and their output outstrips that of the Gounders after a few years.

One possible situation in which high-ability people may invest less would be if capital were less useful for them, which would be the case if ability and capital were substitutes in the production function. The evidence, however, points against this explanation: When we compare Gounders with Gounders or Outsiders with Outsiders, it is clear that those who grow faster and produce more also invest more. Therefore, it seems relatively clear that the Outsiders invest less *despite having a higher marginal product of capital*.<sup>18</sup>

<sup>17</sup> There is, once again, the possibility that a part of the reason why these rates are so high is because of default risk. In other words, the expected return on the marginal units of capital need not be as high as 48 percent. However, as already observed, defaults contribute relatively little to the level of the interest rate.

<sup>18</sup> This is what Caballero and Hammour (2000) call scrambling. The proximate reason, it appears, is the Gounders have a lot of investible funds that they cannot profitably lend out because

What explains why the credit markets behave in this way? Why is intermediation so inefficient with some people and so efficient with others? Why are the rich borrowers and those who borrow more favored by the market?

The standard theory of interest rates decomposes them into default rates, opportunity cost, transaction costs, and monopoly rents. This is useful descriptively but stops well short of an explanation – the problem is that none of these can be seen as independent causal factors. Take the example of default rates. The fact that default rates are relatively low is not a fact about the nature of default: Timberg and Aiyar (1984) observe that some branches of the state-owned commercial banks in India have default rates up to 60–70 percent. The low default rates observed in the studies we mention are a result of the steps taken by lenders to avoid default.

Monitoring the borrower is an obvious example of the kind of steps that lenders take. It is also an important source of what goes under the rubric of transaction costs: Aleem (1990) and Irfan et al. (1999) provide a list of steps taken by the lender to avoid default. These include getting to know the borrower through other transactions, visiting the borrower's establishment, making inquiries about the borrower, and going after the borrower to make sure he or she repays.

Lenders also protect themselves by limiting their lending to borrowers they know.<sup>19</sup> This has four important consequences. First, it pushes capital toward well-connected borrowers and away from less well-connected borrowers, even when there is no difference in their productivity. Second, it makes it important that lending be local – the lender must know and trust his or her borrowers. This adds one or more layers of intermediation to the process of lending, with additional transaction costs entering at each of the stages, which raises the opportunity cost of capital. Third, it forces the lender to limit his or her lending, with the consequence that both the lender's capital and skills as a lender may remain unused for a significant part of the time. This raises both the opportunity cost of the capital and the transaction cost (which includes a part of the lender's time). Finally, it gives the lender some ex post monopoly power, as a borrower would find it hard to leave a lender who knows him or her well. Under competitive conditions, these ex post rents will be dissipated in ex ante competition, with lenders in effect subsidizing new borrowers in order to extract rents later from those who will become his or her long-term clients.

What this tells us is that the four components of the interest rate are all jointly determined in the process of the lender making his or her lending decisions. Depending on the lender's strategy, it could be that the transaction costs dominate

intermediation is so inefficient in India. Instead, they set up their own garment firms or lend to friends and family in the garment business. Because these firms are set up as a conduit for this surplus capital, they are not required to be particularly productive. The Outsiders, by contrast, come from traditional entrepreneurial communities and, as a result, their capital probably has many alternative uses. In other words, they do not invest in Tirupur because they lack other choices. This makes them more likely to be productive but also less willing to invest a lot.

<sup>19</sup> See McMillan and Woodruff (1999).

or the opportunity cost dominates, or that default or monopoly rents become very important. The strategy could be very different depending on the nature of the clientele and other environmental characteristics. This may be a part of the reason why different people have taken very different views of informal credit markets: Aleem, for example, finds that for every rupee lent, about half a rupee goes into transaction costs, whereas Dasgupta (1989) finds that only about 30 percent of interest costs are explained by transaction costs (strictly establishment costs); Gbate (1992) argues that transaction costs are unimportant except in the case of very small loans.<sup>20</sup>

The fact that all these decisions are interrelated clearly makes it dangerous to use any single one of these components as a measure of the efficiency of intermediation. For example, Gbate (1992) sees the low level of transaction costs in his sample as evidence for the remarkable efficiency of informal lending. But, as has already been noted, transaction costs may be low because the lenders are very choosy about to whom they lend. This raises the opportunity cost of capital (because capital is often idle) and limits credit access, both of which have their welfare costs. Likewise, the low rate of defaults in informal transactions is often mentioned as evidence for their efficiency, but this is obviously misleading if it comes at the cost of increased monitoring or reduced lending. Finally, the presence of rents in lending is not, *per se*, evidence for lack of competition in the market. As pointed out herein, in this type of market, *ex post* rents are consistent with *ex ante* competition.

A further implication of this observation is that both loan size and the interest rate are jointly determined, and therefore one cannot give a causal interpretation of the relation between interest rates and loan size reported herein. Rather, one should see both of these as outcomes that are determined by more primitive variables, such as the wealth of the borrower, the borrower's productivity, the liquidity of his or her assets, and so on. This also makes it harder to interpret the reported negative relation between the borrower's wealth and the interest rate. In principle, it could be entirely a result of the fact that rich borrowers borrow more.

What is most important is that this line of argument underscores the significance of developing a proper theory of credit markets. Such a theory would explain the variation in interest rates and the gap between interest rates and deposit rates in terms of the true primitives of the model, and make predictions about the relation between loan size and interest rates and borrower and lender characteristics. Although there is a long tradition of models of imperfect credit markets going back to Jaffee and Russell (1976) and Stiglitz and Weiss (1981), and the arguments behind why credit markets can fail, based on moral hazard and/or adverse selection, are well known, I feel that it is useful to develop a framework that has a more direct empirical orientation.

<sup>20</sup> Even within the set of case-studies reported by Gbate, there seems to be considerable variation. In Kerala, the case-study concludes that transaction costs are of negligible importance while the Thai study concludes that transaction costs added between 3 and 14 percentage points to the interest cost.

### 3.2. A Simple Model of Moral Hazard in the Credit Market

There is an investment opportunity whose gross returns are  $F(K)R(p)$  with probability  $p$  and 0 otherwise, where  $K$  is the amount invested and  $F(\cdot)$  is a production function. If an investor wants to invest more than his or her wealth,  $W$ , the investor will need to borrow. There is a capital market and the (gross) cost of capital in that market is  $\rho$ . To make this problem interesting, we assume the following.

1.  $p$  is a choice for the investor but is unobserved by the lender.  $p$  takes a value between  $p_0$  and  $p_1$ .
2.  $E(p) \equiv pR(p)$  has the property that  $E'(p_0) > 0$ , and  $E''(p) \leq 0$ .
3. The only possible contract is a loan contract.<sup>21</sup>

#### 3.2.1. The Basic Moral Hazard Problem

The optimal value of  $p$ ,  $p^*$ , is clearly greater than  $p_0$  and may or may not be less than  $p_1$ . The combination of the rest of the assumptions tells us that there is no guarantee that  $p^*$  would be chosen in equilibrium. To see this, note that the borrower, who is assumed to be risk neutral, will choose  $p$  to maximize  $F(K)E(p) - pr(K - W)$ , where  $r$  is the interest rate that has to be paid to the lender to make him or her willing to lend.

The borrower will choose  $p$  such that  $E'(p)F(K) - r(K - W) = 0$ .<sup>22</sup> This is quite obviously inconsistent with the social optimum: the borrower clearly wants to choose  $p < p^*$ . This is the standard incentive problem in credit markets: Society cares about net output but the borrower cares only about what remains after paying interest. This is the essence of all models of ex ante moral hazard in the credit market.

Next, notice that the first-order condition for the borrower's choice of  $p$  can be rewritten in the following form:

$$E'(p) \frac{F(K)}{K} = r \left( 1 - \frac{W}{K} \right). \quad (3.1)$$

From this equation it is evident that  $p$  depends on three things: the average product of capital,  $F(K)/K$ ; the leverage ratio,  $K/W$ ; and the interest rate,  $r$ . If capital is more productive, the borrower is less inclined to misbehave, and this is reflected in a lower  $p$ . Being more leveraged worsens the borrower's incentives and so does a higher interest rate, which is consistent with the observation made earlier that the interest cost burden is the source of the distortion.

<sup>21</sup> This rules out making the borrower's payments depend on the project's realized returns. Diamond (1989) justifies this assumption by assuming that the realized return is not publicly observable except by making use of a liquidation proceeding, which is costly to the point of using up all available output. This makes sure that a borrower will not willfully default as long as the lender threatens to go into liquidation whenever he or she defaults.

<sup>22</sup> Assuming an interior optimum exists.

**Property 1** (Efficiency). There is less inefficiency in the credit relationship when there is less leveraging, when the interest rate is lower, and when the project is more productive.

From this it follows that the equilibrium value of  $p$  can be written in the following form:

$$p = p(R, F(K)/K),$$

where  $R = r[1 - (W/K)]$  is the interest cost per unit of investment. Clearly  $\partial p / \partial R < 0$ , and  $(\partial p) / [\partial F(K)/K] > 0$ . Writing the relation in this form draws attention to the important role played by the shape of the production function. When  $F(\cdot)$  is concave,  $F(K)/K$  decreases as a function of  $K$ . Therefore, those who invest more will be more liable to moral hazard, even after controlling for the leverage ratio. However, if  $F$  is convex, at least over a range, increasing the level of investment may increase profitability and improve the borrower's incentives. As we will see, this distinction may be very important for some questions.

### 3.2.2. The Interest Rate

We have so far treated  $r$  as a parameter. In fact, if there is competition in lending, lenders should not make any profits, which would imply that

$$r = \rho / p, \quad (3.2)$$

or

$$R = \frac{\rho(1 - W/K)}{p} = \frac{\Gamma}{p},$$

where  $\Gamma$  is the cost of capital per unit of investment.<sup>23</sup> Solving  $p = \tilde{p}(R, F(K)/K)$  along with  $R = \Gamma/p$  gives us  $p = \tilde{p}(\Gamma, F(K)/K)$  and  $R = \tilde{R}(\Gamma, F(K)/K)$ . However, it is easy to construct examples where these equations have multiple solutions: Intuitively, a fall in  $p$  raises  $r$ , but a rise in  $r$ , as we already saw, puts downward pressure on  $p$ . It is not clear, however, that we can interpret these as multiple equilibria – if the lender knows the rules of the game, then the lender knows that he or she can pick the best equilibrium and make everyone better off, simply by setting the right interest rate. Therefore, unless

<sup>23</sup> The assumption of perfect competition in the credit market is not uncontroversial. There is a long tradition of papers that view high interest rates as evidence for monopoly power in the credit market. However, as already pointed out, the issue of rents in the credit market is likely to be quite delicate, because competition operates *ex ante* rather than *ex post*. Therefore, the absence of *ex ante* rents is consistent with Bhaduri's (1977) model of how lenders trap borrowers into a permanent cycle of debt and debt repayment. The evidence seems to support the hypothesis of *ex ante* competition: The few studies (Ghate, 1992, Dasgupta, 1989, and Aleem, 1990) that compute the gap between the interest rate charged and the various costs of lending (opportunity cost, monitoring costs, and default costs) do not find a large gap on average, though one cannot reject the possibility that there is a large rent component in many individual transactions.

the lender is boundedly rational, we should probably assume that the best equilibrium is always chosen. This is the equilibrium with the lowest interest rate.

Assuming that this is the equilibrium, the comparative statics of the  $p(\cdot)$  function are inherited by the  $\tilde{p}(\cdot)$  function, and  $\tilde{r} = \rho/\tilde{p}$  shares the properties of the  $\tilde{p}$  function, only reversed. A lower leverage ratio increases  $p$  and lowers the interest rate, as does a higher average product of capital. Lowering the cost of capital lowers the rate of interest more than proportionately because the repayment rate goes up.

**Property 2** (Interest rates). Borrowers who are more leveraged tend to pay higher rates, whereas more productive borrowers pay lower rates. Raising the cost of capital raises the interest rate more than proportionately.

### 3.2.3. The Level of Investment

The next step is to endogenize the level of borrowing. The borrower's choice of  $K$  maximizes

$$F(K)E(p) - \rho(K - W),$$

under the assumption that  $p$  depends on  $K$  through the  $\tilde{p}(\cdot)$  function. The first-order condition for that maximization is

$$\begin{aligned} F'(K)E(p) + F(K)E'(p) \frac{\partial p}{\partial F(K)/K} \frac{\partial F(K)/K}{\partial K} \\ + F(K)E'(p) \frac{\partial p}{\partial \Gamma} \frac{\rho}{W} = \rho. \end{aligned} \quad (3.3)$$

If we compare this with the first-order condition in a first best world,  $F'(K)E(p^*) = \rho$ , we see that there are three sources of distortion. First,  $E(p) < E(p^*)$ , which says that capital is less productive and therefore the borrower wants to invest less. Second,  $\partial p/\partial \Gamma$  is negative, which also discourages investment. Finally, there is the second term on the left-hand side, which can be positive or negative depending on the sign of  $[\partial F(K)/K]/(\partial K)$ . This, as we have already observed, depends on whether the production function is concave or not. If it is concave, the second term is negative and it is unambiguously true that imperfections in the capital market lead to less investment. If not, the second term may be positive, and if this effect is large enough, it could outweigh the first effect and generate overinvestment. Whether this possibility is actually worth taking seriously remains an open question, awaiting more precise calibrations of the model.<sup>24</sup>

Another important property of the first best is that the amount invested is independent of the wealth of the investor. In our present model, if we were to increase  $W$ , keeping  $K$  fixed, we know from Property 1 that  $p$  would go up, raising  $E(p)$  and reducing  $E'(p)$ . As long as  $F$  is concave, both of these effects go in the same direction: They both raise the rewards for investing more,

<sup>24</sup> Lehnert, Ligon, and Townsend (1999) argue that this is a real possibility.

and therefore there is more investment.<sup>25</sup> In fact, in the special case where  $F(K) = \sigma K$ , that is, a linear production technology,  $K$  not only goes up when  $W$  goes up, it is precisely proportional to  $W$ .

The general case of a nonconcave  $F$  tends to be complex. One interesting example, in which there is a single indivisible investment, turns out to be very straightforward. In this case people either invest or do not, and because those who have more wealth choose a higher  $p$  at the same level of investment (Property 1), they are the ones who will invest. More generally, nonconvex production technologies raise the possibility that the poor will actually invest more than the rich: Intuitively, if the production function is convex, increasing investment raises productivity, which improves incentives through its direct effect. However, there is also an indirect effect: Investing more makes the borrower more leveraged and this worsens incentives. The balance of these two effects may be different for the rich and the poor, because their incentive problems are different, and in principle it could be that the poor end up investing more. However, it seems unlikely that these effects would dominate the main effect of being richer, which is that (at the same level of investment) richer people are less leveraged and therefore have better incentives and as a result their capital is more productive.

Lowering the cost of capital in this model increases  $p$ , and this, as argued herein, encourages investment. However, lowering the cost of capital also increases the amount invested in the first best, so that there is no clear prediction for the extent of underinvestment.

**Property 3** (The level of investment). Capital market imperfections lead to underinvestment in the typical case, though it is not inconceivable that they could generate overinvestment. The more wealthy will tend to invest more in absolute terms. When the production technology is linear, the amount invested will be proportional to the investor's wealth. When there is a single indivisible investment, the rich are more likely to invest than the poor. Lowering the cost of capital increases investment.

Capital market imperfections reduce the demand for capital. For a given supply curve of capital, this means that the cost of capital will be lower than it would be otherwise. In the longer run, however, the supply of capital will also respond to the pattern of wealth creation generated by the capital market imperfection, and the net impact on the cost of capital is ambiguous.

**Property 4** (The cost of capital). For a given supply curve for capital, imperfect capital markets will have a lower cost of capital, but this is no longer necessarily true once we take into account the impact of the capital market imperfection on the supply of credit.

<sup>25</sup> Actually, there is a third effect: Increasing  $W/K$ , it can be shown, reduces  $[\partial p / \partial F(K)]/K$ , thereby reinforcing the effect of the fall in  $E'(p)$ .

### 3.2.4. *Introducing Monitoring*

The model developed so far is useful in developing intuition about how the credit market works but it has an important limitation in terms of explaining the data. As we have already seen, the repayment rates in most informal credit transactions are very high (over 90 percent). It follows from Equation (3.2) that the interest charged by a competitive lender can be only about 10 percent higher than the cost of capital, which from all the evidence given herein is much too small a margin.

The missing piece of the story is monitoring. We have assumed so far that the lender cannot do anything to affect the borrower's choice of  $p$ . This is clearly an extreme assumption, because, as already mentioned, lenders can and do monitor borrowers.

The point of all these activities is to learn more about the borrower. This helps in two ways: first, by allowing the lenders to pick borrowers for whom the interval  $[p_0, p_1]$  is relatively small, thereby limiting the possibility of moral hazard, and second, by getting to know the borrower's environment, thereby making it easier to find out when the borrower is not doing what he or she has promised to do with the money.

In addition to this kind of ex ante monitoring, there is ex post monitoring of the project, which is checking that the borrower has done what he or she had promised to do with the money. For example, the lender can try to make sure that the borrower is spending the money on inputs for his or her project rather than on consumption. Finally, there is collection: Once the loan falls due, the lender has to spend time chasing each overdue loan.

It is not possible to capture all of these different aspects of monitoring in a single model, so the discussion here is limited to one specific model, though some of the other models are discussed in a later section. We introduce monitoring into the model by assuming that if the lender monitors at a level  $a$ , the borrower will choose a project  $p(a)$  or a project with a  $p$  no lower than  $p(a)$ .<sup>26</sup> We assume that this comes about through either ex ante monitoring of the project (screening of projects before the loan is given) or ex post monitoring of the project (checking on the borrower after he or she has been given the loan and punishing the borrower if he or she has not done what he or she was supposed to do). The problem is that we know very little about the nature of the empirical relation between monitoring and project choice. The only option we have is to reason on purely a priori grounds.

One assumption that has a certain plausibility is that the amount of monitoring necessary is a function of the extent of misalignment of incentives between the borrower and the lender. The borrower in our model wants to choose  $p = p(R, F(K)/K)$ , which gives him or her a payoff of  $F(K)E(p(R, F(K)/K)) - p(K/W, r, F(K)/K)r(K - W)$ , whereas the lender wants the borrower to choose  $p$ , which gives him or her a payoff of  $F(K)E(p) - pr(K - W)$ . The

<sup>26</sup> The borrower will typically choose the lowest permissible value.

extent of misalignment is therefore

$$D = F(K)[E(p(R, F(K)/K)) - E(p)] - [p(R, F(K)/K) - p]RK. \quad (3.4)$$

Our assumption is then that the amount of monitoring is a function of  $D$ . However, to allow for different types of scale effects, we write it in a slightly more general form:

$$M = M(K, D/K, m),$$

where  $m$  is a parameter that shifts the monitoring cost function,  $dM/dm > 0$ .

### 3.2.5. *The Cost of Capital With Monitoring*

The lender's participation constraint (3.2) now takes the form

$$R = \frac{\Gamma}{p} + \frac{M(K, D/K, m)}{Kp}. \quad (3.5)$$

This equation defines  $R(\Gamma, K, p, m)$ , the interest rate for a borrower with a fixed  $W$  who wants to invest an amount  $K$  and promises to choose a project  $p$ . Using this, we can define the expected cost of credit per unit of investment:  $C(\Gamma, K, p, m) = pR$ .

This formulation of the supply side of credit has the obvious advantage that the interest rate can be much higher than the cost of capital even if defaults are rare. This is because monitoring costs can be very high; indeed the reason why there is very little default may be a result of the resources spent on monitoring.

It is useful to begin our analysis of this model with an examination of the properties of the  $C(\cdot)$  function. Simple differentiation tells us that

$$\begin{aligned} \frac{\partial R}{\partial \Gamma} &= \frac{1}{p - \{p - p[R, F(K)/K]\}/K \partial M/[\partial(D/K)]}, \\ \frac{\partial R}{\partial m} &= \frac{\partial M/\partial m}{K(p - \{p - p[R, F(K)/K]\}/K \partial M/[\partial(D/K)])}. \end{aligned}$$

Because  $(p - \{p - p[R, F(K)/K]\}/K \partial M/[\partial(D/K)]) < p$ , this tells us that increases in the cost of lending (represented by a rise in  $\rho$  or in  $m$ ) have a multiplier effect, resulting in a bigger increase in the interest rate than would be warranted by the direct effect of the increase in cost.<sup>27</sup> This is because the initial rise in the interest rate worsens the borrower's incentives and makes it necessary that the borrower be monitored more, which raises the cost of lending even further, and so on. This property is obviously also inherited by the  $C(\cdot)$  function.

<sup>27</sup> In principle, this increase can be very large because  $(1 - \{p - p[R, F(K)/K]\}/K \partial M/[\partial(D/K)])$  can be very close to zero or even negative (in which case, the equilibrium interest changes discontinuously).