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Applying the Trust Game to Group Lending

INTRODUCTION

This paper uses the Trust Game to study microfinance, with a specific application to developing nations. Moreover, it develops new hypotheses and tests a theory of group lending. Although similar experiments have already been conducted, this experiment integrates ideas from two experiments and an online lending platform. The study takes place in Tajikistan's capital Dushanbe and aims to capture the mutual incentives of 100 male farmers to repay their loans on time.

In this study, we assign farmers into 25 groups. Failure for one to repay their part of the loan leads to a collective penalty. We evaluate the use of reward and punishment mechanisms for promoting group progress. Furthermore, since this is a field study with real people, we get more realistic results and can make better judgments about the levels of mutual trust than we would by applying theories about what we expect people to do in this situation. We can also evaluate the significance of decreased social distance using the experiment.

The sections in this paper examine the implications of trust and introduce the Trust Game. Through examples, figures, and scenarios, the sections reference models and frameworks from development economics, microeconomics, and experimental economics. We also evaluate similar experiments and provide an overview of the socio-economic factors in Tajikistan. The paper introduces the design of the experiment, the rules and assumptions, and incentives for farmers. Finally, the study concludes with hypotheses about the anticipated results. The paper

also includes Appendix sections with instructions for the farmers and lenders, sample results from the Trust Game, and models from development economics.

TRUST AND ITS RELATION TO ECONOMICS

The meaning of the word “trust” is a fundamental economic concept and depends on personal perspective. Most people interpret it as the expectation of honesty, reliability, and responsibility. Nevertheless, if we were to ask random volunteers for their interpretations, their answers might range from as simple as “believing in something” and “the probability that something will happen”. Based on behavioral questions and personal interactions, we can make judgments about approaching a friend in times of hardship and emergency situations. Should we have the confidence in this person? Are they trustworthy? On the other hand, in case of the financial struggles, the person expects us to pay back the borrowed money with a small interest rate.

On a regular basis, we experience the concept of trust when going to a grocery store or at a local restaurant. In both situations, we have confidence in the quality of products, suppliers, and sanitation. Likewise, an example of trust is hiring an interior designer to renovate a living room or an entire house, but not getting what we had specifically required. Conversely, doing the renovations by ourselves might not have caused this lack of quality work, but it would have resulted in trusting ourselves more than the experienced designer. Having already received an unsatisfactory final good and service as a customer, we are less inclined to hire the same contractor and endorse their skills. Hence, the trust between us has been terminated.

In the construction industry, suppliers can also deliver cement late and a contractor can produce the furniture after the deadline. These are other instances of making projections for the completion of a project. Therefore, we can state that assuring trustworthiness is crucial for the

growth of any economy. The more people trust each other and be trustworthy, the higher the expected growth rate of a country.

THE TRUST GAME

Berg, Dickhaut, and McCabe discovered The Trust Game in 1995 (Holt, 2007). The game involves two people, called First Mover and Second Mover and captures the decision-making process between them. To illustrate, the First Mover get $10 and can 1) send $5 to the Second Mover and keep $5; or 2) send $0 and keep $10. The amount sent determines the profit for the Second Mover after it is multiplied by three. The Second Mover can send some amount back to the First Mover or keep all the payoffs. In this situation, by sharing some of the money, the First Mover seeks profit and expects to get a profit in return for their generosity. Conversely, they can keep the $10 and end the game. The diagram below outlines the process:

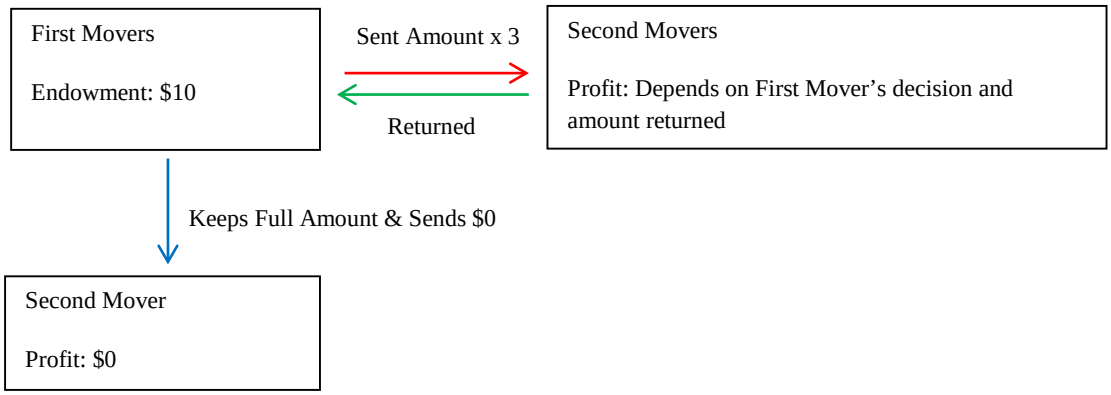


Figure 1: The Trust Game Explained

The First Mover trusts that the other person values their generosity and will return a percentage of the amount sent. If the Second Mover returns, they have established a trustworthy relationship. The Appendix section illustrates sample results from the experiment. Based on experimental data, approximately 50 percent of First Movers send money to the Second Mover. On the other hand, the latter return only about 33 percent of the time.

Reciprocity can influence behavior in the game. Both movers can have a strategy of "If I get good, I will return good" and continue playing the game. The figures below illustrate the individual payments and the incentives for both players to contribute:

First Movers Payoffs:

$10 – [AMOUNT SENT] + [AMOUNT RECEIVED FROM SECOND MOVER]

Second Movers Payoffs:

3 x [AMOUNT SENT FROM FIRST MOVER] - [AMOUNT SENT TO FIRST MOVER]

RELATION TO THE NASH EQUILIBRIUM

The Trust Game has a unique Nash Equilibrium. According to Nash, "Each player does what is best for them given the action of the other player." (Smith, 2011). Therefore, each player would choose the option that gives the maximum self-benefit. As such, players establish a strategy profile related to their choices (Polak, 2008). Therefore, it can be categorized as a self-fulfilling belief. It also relates to the concept of not having an incentive to deviate from the rest and move away from the response of the other players, thus risking not the reach equilibrium. Therefore, the Nash Equilibrium suggests that Player 1 sends nothing, and Player 2 returns nothing, regardless of how much they receive.

RELATION TO ECONOMIC DEVELOPMENT

The experiment is designed based on the "Group-lending as an incentive-compatible coordination plan" from Development Economics. A figure representing the model is attached in the Appendix. This microfinancing model represents the theory and outcomes for overall development and growth. The plan includes variables such as *m*, the interest rate which the borrower pays should the venture reach the break-even point at the minimum and *f*, a joint-liability fee of the group of lenders. The latter is specifically applicable to the Trust Game where

mutual drive for success and reliability are critical factors for the final team accomplishments. However, depending on the rate for the joint-liability fee, it also implies a sense of monitoring the progress of each one of the group members to avoid moral hazard. Thus, the model indicates the concept of choosing both m and f appropriately, which has been considered in the design of this experiment. If chosen appropriately for the economic conditions in the given developing nation, theory suggests that repayment rates rise and the borrowing interest rates decrease. Thus, in this specific scenario, both the lenders' profits rise and the borrowers' utilities rise. Altogether, the model concludes these factors lead to higher development and growth rates in the country (Kantarelis, 2010).

In addition, in the process of designing the experiment, the design of the experiment referred to the Financial Capital Development (FCD) framework established around the world. A figure representing the model is attached in the Appendix. The structure separates FCD into three categories: 1) developed nations; 2) developing nations; and 3) Islamic nations. For the purpose of this paper, the design of the experiment is chosen based on the causes and implications for developing nations and Islamic nations. In this case, the development and growth is reached in the occurrence of microfinancing options and a balance between Profit Maximization & Social Responsibility. As part of the design of the experiment, a microfinancing agency is appointed to establish a presence in a developing country with these characteristics (Kantarelis, 2010).

RELATED EXPERIMENTS

The researcher looked at research done by Alessandra Cassar, Lucas Crowley, and Bruce Wydick. Their paper, "The Effect of Social Capital on Group Loan Repayment: Evidence from Artefactual Field Experiments", was published in June 2005 and discusses group payment in microfinance. The authors closely look at the problems associated with group lending and

suggest how members should react in situations when there are members who are not fully committed to growing their business, or are not capable of utilizing the loan provided. They stress that peer monitoring is crucial in such cases as well as social sanctions. Cassar, Crowley, and Wydick therefore conclude that trust is an important factor in group lending.

Andrew Schotter and Barry Sopher ran another experiment in March 2005. This experiment focuses on the effects of different generations and the impact of decision-making guidance from advisors. The study has a different approach and includes a monetary reward. By itself, each generation gets a payoff depending on the payoff from the previous generation. Advisors set a strategy for the upcoming generation, including how much they should send and return. The researchers found it interesting that trust decreases and so does the Sender's willingness to send more money to the Returner.

Finally, the design of the experiment relates to Kiva's business model, an online community for lending money to people. However, loans are not limited to developing countries. The researcher evaluated the model and the effect of the platform. As described on their website, a borrower contacts one of Kiva's field partners. The field partner processes the request through KIVA's website where users act as the lenders. Once the borrower reaches the amount needed, the loan gets disbursed. Kiva is responsible for returning the money to the lenders (Kiva, 2013). Having such a model, the repayment rate is 98.86 %.(Kiva, 2013). The design of the experiment applies some of these concepts.

EXPERIMENTAL DESIGN

LOCATION

The experiment takes place in Tajikistan's capital Dushanbe, which is located in Central Asia. With an area of 143,100 square kilometers, the former Soviet republic has a population of 7, 768,385 people (July 2012), 704,000 people of which live in the capital.

Figure 2: Map of Tajikistan (Central Intelligence Agency)

ECONOMICAL AND POLITICAL OVERVIEW

Tajikistan has a GDP of $17.61 billion and a GDP – per capita (PPP) of $2,200, both estimated in 2012. However, 53% of Tajik people live below the poverty line and live an average of 66.03 years. The agricultural sector occupies 49.8 % of the country's labor force, where cotton is largely produced (Central Intelligence Agency).

DESCRIPTION OF THE EXPERIMENT

This experiment combines concepts from the original Trust Game developed by Berg, Dickhaut, and McCabe in 1995 (Holt, 2007), an experiment designed in an intergenerational setting by Schotter and Sopher, and KIVA's model. The study incorporates ideas from all three and presents a new model which evaluates the motivations for repayment in group lending situations and its relation to economic growth in developing countries.

DEMOGRAPHICS

The experiment uses a random sample of 100 male farmers from Dushanbe. The sample is based on a government subsidy request form filled out a year ago. Each farmer applied with their own business idea. Reliability, potential for success, and commitment to the experiment were the key admission criteria. However, there was no restriction on the age limit. Participants in the experiment vary from ages between 18-29, 29-40, 40-51, and 51-62.

DESIGN

In the group, each farmer has a different business idea; no one else can have the same. For example, Farmer 2 has requested a loan to buy chickens and sell eggs, Farmer 6 needs to borrow money to grow potatoes, and Farmer 8 wants to buy sheep and sell milk.

Borrowers need lenders to help them subsidize their small businesses. As such, a large Microfinance Institution, Virtual Finance LLC, volunteers to participate in the experiment. Lenders are retired microfinance experts with respectable experience and are not affiliated with the institution. The lending organization selects three representatives and sends them to Dushanbe. The institution does not receive any benefits from participating in the experiment. Virtual Finance LLC provides each with a microcredit budget of $400. Lenders can spend the entire money or keep certain amount for themselves for personal investments in stocks and bonds. Additionally, they serve as advisers to the newly sent lenders, as described in the sections below. Since this experiment tests the Trust Game in a group setting, there are 25 groups with 4 farmers per group.

RULES AND ASSUMPTIONS

To begin with, farmers are not initially aware they will be separated in groups, thus having to share a joint liability with other farmers. Therefore, each one of them is liable for

repaying other farmers' loans, given that they do not utilize the money to successfully launch their small business (Cassar, Crowley, & Wydick, 2005). Additionally, they have never met with each other before. Hence, factors such as personal trust and social homogeneity have not been established (Cassar, Crowley, & Wydick, 2005). They are only relying on their intuition and hope that the other members of their group will be able to successfully grow their business (Cassar, Crowley, & Wydick, 2005).

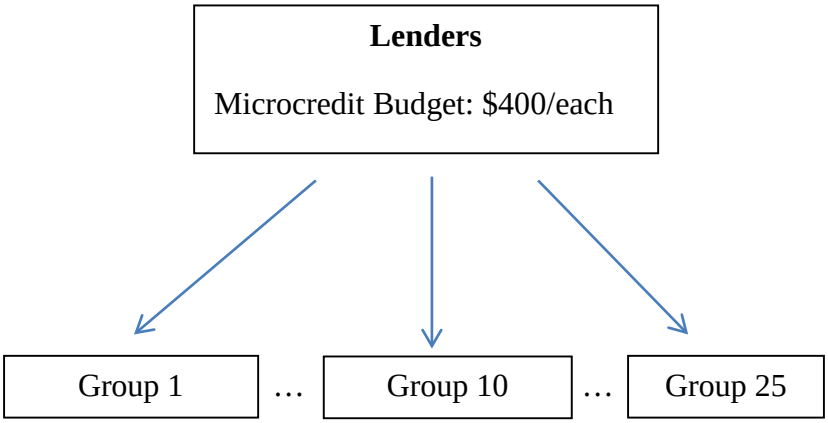
On the other hand, lenders do not have any prior information about the farmers. None of the farmers know any information about the lending process. Lenders have basic information about the experiment, are asked to use their expertise in Dushanbe, Tajikistan, and thus serve as the pioneers in this new experiment. At the beginning of the experiment, they are informed and are assigned a randomly generated number from 1 to 3 using computer software. They also receive a group picture of all their "teammates". However, they do not have any additional information.

Lenders only know each group consists of 4 farmers, each farmer with a minimum required loan amount of $30. Based on their budget, they are able to lend each farmer a maximum of $100, if they are to assume farmers will play Nash to ensure all group members are able to start their business and repay the group loan. Lenders are required to allocate the money evenly between their assigned groups. Every farmer gets the same amount. They are not allowed to communicate and give them higher loans. A flow diagram of the process describes the procedure, illustrates additional details, and associated directions:

Repayment Period: 3 months

Repayment Schedule: End of period

Interest Rate: 27%



- All borrowers need a minimum investment of $30 to start their businesses
- Have the ability to utilize the entire possible amount of $400 per group ($100/farmer)
- Each lender can contribute with a maximum of two loans only

Figure 3: Loan Disbursement Schedule

As shown above, the repayment period established by the institution is 3 months with an interest rate of 27%, compounded at the end of the period. The interest rate is low compared to the global average of 35% (Rosenberg, 2008). The idea is observing what effect this would have on group lending.

INCENTIVES FOR REPAYING ON TIME

As opposed to individual lending, in group lending the collective liability drives the farmers to repay the loan on time. Hence, this increases the farmers' incentives to develop a profitable business. Conversely, if a farmer is not able to replay their part of the loan, the entire group repays their part. Needless to say, the other farmers are not willing to repay their loans and the additional for their partner(s). As such, they have strong incentives to monitor one another's progress and assure the other borrowers are successful too. Given that none of the farmers was

aware that they would be separated into groups, they all now have a common goal of succeeding. Farmers are committed to not only accomplish their personal objectives, but to also help their teammates achieve theirs. Therefore, group lending ensures economic growth and development.

This experiment addresses the relevance of a reward mechanism with *r* representing reward and *p* penalty. Each farmer can receive $10 for repaying the loan on time, which is another incentive to establish a profitable business. However, they have the option of decreasing their repayment by the amount received, save it, or return some to the lender. In any of these cases, they receive a higher profit margin than if they do not repay on time (Cassar, Crowley, & Wydick, 2005).

The penalty, on the other hand, involves paying an additional $15 for each farmer. It is important to distinguish that p > *r*. This encourages farmers to pressure other members in the group and puts more efforts so that group achieves profitability (Cassar, Crowley, & Wydick, 2005).

THE ROLE OF THE ADVISOR

As introduced by Andrew Schotter and Barry Sopher in their "Trust and Trustworthiness in Games: An Experimental Study of Intergenerational Advice" research paper, this experiment applies their approach of having an advisor that makes suggestions for the next generation of lenders. However, they can either follow their suggestions or discard them.

LENGTH

The experiment consists of two rounds and subrounds as identified below:

Round I:

1. Lenders allocate loans according to their judgments and expect repayment in 3 months.
2. Based on the repayment rate, lenders make their second choice. Selected group is the same.

Round II:

1. New lenders replace the previous generation and are assigned into groups. Each group's previous lender provides advice to them.
2. Same rules as above apply for the distribution and second lending.

Given that the repayment period is 3 months, it takes a full year to complete the experiment and analyze the results.

HYPOTHESES

Hypothesis I:

Lenders contribute less in the beginning and are risk-averse. They act in a safe manner and will be risk-averse. They give the minimum required amount of $30 and invest the remaining. However, given the repayment success rate, they give $400 per group. Their profits rise because of the high interest rate and the borrower's utilities. Therefore, this promotes economic development and growth. The Appendix includes a diagram supporting the hypothesis.

Hypothesis II:

Unlike the results observed by Andrew Schotter and Barry Sopher, the second generation lenders trust their predecessor's experience and use it to maximize their payoffs. In this scenario, the generation's payoffs are not based on previous generations' decisions, which are not relevant. As such, I believe advisors have no incentive to give false information and encourage the lender to invest more.

Hypothesis III:

If all farmers from the group repay their loan on time, this minimizes social distance. Mutual trust increases.

Because farmers have not had prior contact, their initial trust is low. They rely on their intuition about the trustworthiness of the other farmers (Cassar, Crowley, & Wydick, 2005). However, due to being in a group, they are forced to communicate and assure one another's ability to repay the loan. Therefore, this minimizes social distance. On the other hand, assuming they all repay their loan on time, mutual trust increases.

CONCLUSION

This experiment is able to find relationship between the Trust Game and microfinances in a group lending environment. When farmers monitor the progress of their teammates and help each other, they all get rewarded. The results are consistent with the hypotheses. Therefore, based on the increased success repayment rates, lenders give more money to the group, which promotes economic growth and development in Dushanbe.

APPENDIX

INSTRUCTIONS FOR LENDERS (BEFORE THEY GO TO THE ON-SITE LOCATION)

Dear Jose, Muyeed, and Daniel,

Virtual Finance LLC is interested in investing in a field experiment in Tajikistan's capital Dushanbe. The study is about local farmers looking to start their own businesses. However, they lack sufficient financial resources and need to take small loans for their initial capital investments.

As experts in the area of microfinance, our institution invites you to participate in the experiment and help us observe the repayment rate, based on the loan given and the success of each farmer. Specific instructions are listed below:

- The three of you will be sent to Dushanbe, Tajikistan at our expense.
- You will be given a loan budget of $100 each to responsibly allocate among farmers.
- The minimum amount of initial funding per farmer is $30. You can either choose to give any positive amount from 0 to 100, or a portion and invest the rest in stocks or bonds
- Repayment period is in 3 months. You are asked to participate for two rounds, each round being a repayment period.

Should you have any questions or concerns, please let me know! We hope you decide to participate and be the pioneers in this research!

Regards,
Georgi Kardzhaliyski
CEO, Virtual Finance LLC

INSTRUCTIONS FOR LENDERS (AFTER THEY GO TO THE ON-SITE LOCATION)

Dear Jose, Muyeed, and Daniel,

Thank you for participating in this field experiment. There are 12 farmers assigned to three different groups as follows:

Please take a seat and type your name into the RandomGen. The program will generate a random number between 1 and 3. The number you are given represents the group you are assigned to be responsible for giving loans. Further instructions are outlined below:

- Same as before, the minimum amount of initial funding a farmer needs is $30. You can either choose to give any positive amount from 0 to 100, or a portion and invest the rest in stocks or bonds
- You are to allocate the money evenly between your assigned group and assure every farmer gets the same amount
- You are not allowed to individually communicate with group members and give any farmer higher loan than what the others in the groups are given

Should you have any questions or concerns, please let me know!

Thank you for your time commitment!

Regards,
Georgi Kardzhaliyski
CEO, Virtual Finance LLC

INSTRUCTIONS FOR FARMERS (AFTER THEY HAVE BEEN SELECTED)

Dear Selected Candidates,

Thank you for your perseverance and self-motivation to start your own business. We would be glad to assist and help you achieve your goals!

We encourage you to divide into men and women and pick a number from the hat. Please pick a number and keep it for yourself. Your number represents the group you are assigned to. Groups are assigned based on numbers as follows:

Each group gets disbursed a loan. Each of you receives the same amount as your teammates. The lender determined the loan. The amount varies from $0 - $100.

As a group, each of you needs to repay your loan in 3 months. Please note than if one of your teammates fails to repay their part, **the entire group** is liable for repaying their portion of the loan.

Additionally, there are incentives for each of you and your group to develop a successful business:

- If everyone from your group repays their loan on time, each of you gets $10.
- You can either save the money, discount it from the repayment, or give some back to the lender.

However, if at least **one** from your group does not repay on time:

- The entire group encounters a penalty of $15, in addition to the still remaining repayment fee and interest rate.

Lastly, intergroup communication is encouraged. You can ask about other farmers' progress and talk with them if you think they are not giving their full commitment. However, you ***cannot*** communicate with other groups!

I wish you best of luck in your endeavors! Thank you for your time commitment!

Regards,
Georgi Kardzhaliyski
CEO, Virtual Finance LLC

SAMPLE RESULTS BASED ON THE TRUST GAME

Sent	Received (x3)	Returned	Ratio
0	0	0	0
1	3	1	0.33
2	6	2	0.33
3	9	3	0.33
4	12	4	0.33
5	15	5	0.33
10	30	20	0.67

RETURN RATIO = AMOUNT RETURNED/AMOUNT RECEIVED

INCENTIVES FOR REPAYING ON TIME

r = *reward for paying on time ($10)*

Borrowers have three options:

[AMOUNT BORROWED +27% INTEREST - $10]

[SAVE AND DIVIDE EVENLY]

[GIVE BACK TO THE LENDER]

p = *penalty for being late* ($15)

[AMOUNT BORROWED +27% INTEREST + $15]

GROUP-LENDING

Based on Development Economics taught by Professor Demetri Kantarelis

Group-Lending

Lend Small amounts of money to independent investors in groups

m = interest rate (borrower pays if project succeeds)

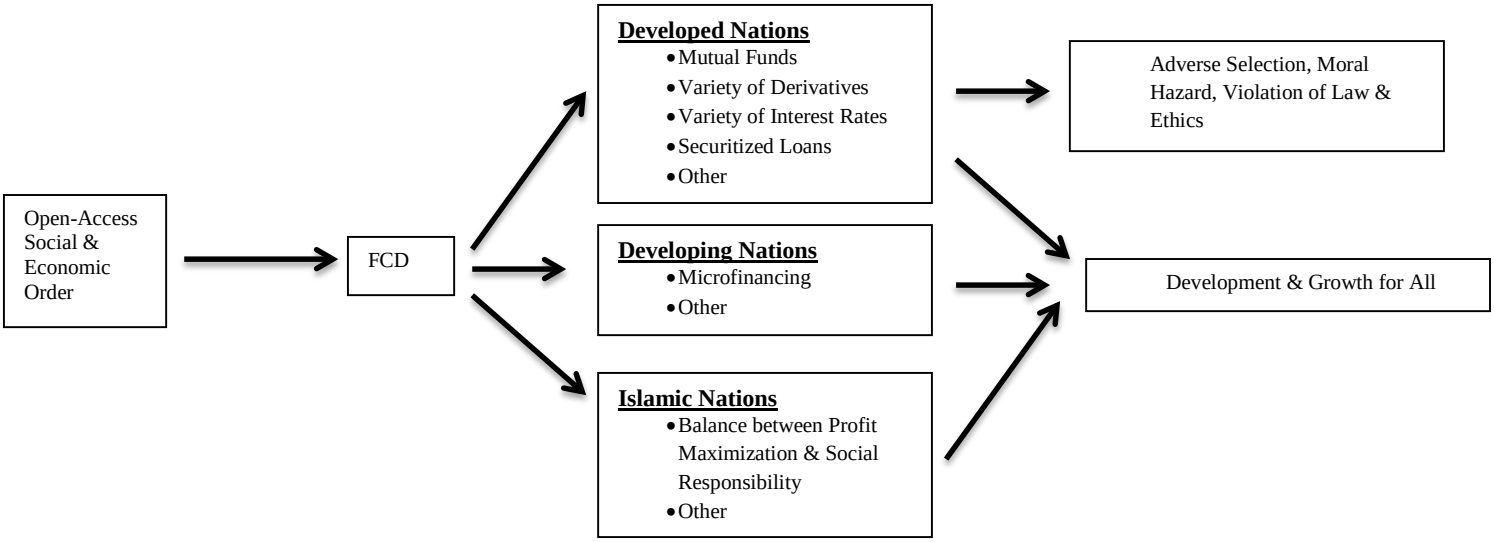
F = joint-liability fee (borrower pays if a group mate fails)

Repayment rates rise; Borrowing interest rates fall

Lender's profits rise

Borrower's utilities rise

Development & Growth



Financial Capital Development (FCD) around the world: Causes and Implications

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