

# Preliminary Thesis Defence

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# Chapter 1

## Introduction

In this Preliminary Thesis Defence I present the research projects that I intend to use for my PhD dissertation. These projects are titled:

- Additional South African Evidence on Pensions and Child Growth (chapter 2)
- Risk and Uncertainty in Unique Equilibria in Currency Attacks (chapter 3)
- Bitcoin and Remittances: The Potential of ‘Stupid Phones’ (chapter 4)

These project are in various stages of completion. Below I will briefly describe the research idea, the current state, and the potential for each project.

Firstly, the paper Additional South African Evidence of Pensions and Child Growth builds upon Duflo (2000, 2003). These papers look at the effect of the gender of grandparents on the growth metrics of their grandchildren. A problem in this comparison lies in the fact that pension eligibility of men was at 65 years, whereas it was 60 for women. This paper makes use of a Household Survey from 2008, 2012 and 2013. The survey is especially of interest, because the pension eligibility age for men was lowered from 65 to 60 in 2009. As it stands now I have analysed the data from 2008 and 2012. The 2013 data was released several weeks ago, I will incorporate these data in future versions of my analysis. I will discuss this in chapter 2.

Morris and Shin (1998) claims that introducing a measure of risk in a model of currency attacks, leads to a unique equilibrium. It thus solves the previous multiple-equilibrium zone called ‘ripe for attack’ for a unique equilibrium. I believe that this is a result of the fact that the risk factor introduces replaces uncertainty, not certainty. We thus gain information. I want to discuss MS1998 in light of the distinction between Knightian uncertainty and quantified risk. This is done in chapter 3.

Lastly, Bitcoin is the first of a new breed of currencies, commonly referred to as a cryptocurrencies. Bitcoin transactions are conducted using an electronic process called signing. I would like to study the role of Bitcoin in remittances. For this I would like to participate in building Bitcoin applications for the type of simple phones common in developing economies (sometimes referred to a stupid phones). We could study the spread of bitcoin by looking at the downloads of the apps from regions, as well looking at how releasing the app in different languages evolves.

After this the papers follow, in the order listed above. A separate citations section is included for each chapter. For ease of reference, the titles of the citations in the bibliography link to the online articles using DOIs and URLs. In the end notes (chapter 5) I present a brief discussion of my dissertation, as it stands now, a whole. I also mention some very preliminary ideas.

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## Chapter 2

# Pensions and Child Growth in South Africa

### Abstract

In this paper I look at differences in child malnutrition levels depending on the gender of the recipient of income.

I do this by comparing z-scores of anthropometrics of South African children living in the same household as state pension recipients. This paper exploits the fact that the data set consists of two surveys, which were done before and after the lowering of the pension eligibility age for men to the same age as women.

The main preliminary finding is that the household effect was only significant in 2012.

### 2.1 Introduction

This paper looks at the effect of the gender of pension recipients on the growth of children in their household in South Africa. The approach is very similar to Duflo (2000, 2003). The difference from international standards (Onis et al. 2006, WHO Child Growth Standards) for weight-for-height and length-for-age are computed as z-scores. These are then compared for different pension recipient status.

The anthropometrics are useful for computing z-scores. These z-scores are considered a good representation of short-term or long-term malnutrition respectively, especially for children between 6 and 60 months old.

The South African pension is a useful variable to measure income because of its criteria. Besides a maximum level of income, the only criterium is the age of a person. Because of this the status as a recipient is quite exogenous and there are few selection bias problems. The problematic difference between the eligibility age of men and women was eliminated between the two surveys which creates an interesting natural experiment.

This study deviates from the Duflo study in several ways. First of all, the data from the Southern Africa Labour and Development Research Unit (2008, 2012) surveys, contains actual information on income, including pension recip-

ient status. Whereas Duflo uses age as a proxy for recipient status. Secondly, between mid 2008 and the end of 2009 the pension age for men was gradually lowered to sixty, which is at par with women. Another deviation is the usage of Onis et al. (2006, WHO Child Growth Standards) in stead of Kuczmarski et al. (2000, CDC Growth Charts: United States). Since these have superseded the CDC charts, however this should not be of any consequence.

The main preliminary result is that the household effect (i.e. having one or more recipients in the household), is very insignificant in the 2008 estimate. But in the 2012 estimate it is very significant.

## 2.2 Data

In this paper I use data from two sources. The first is the South African National Income Dynamics Survey (Southern Africa Labour and Development Research Unit 2008; 2012; 2013, NIDS) and the second is the World Health Organization’s Child Growth Standards (Onis et al. 2006, WHO).

The main source of data is the NIDS. This survey collects data on a representative set of approximately 10,000 South-African households. The primary information types I use are, the child anthropometrics, the age and gender of household members, and the status as state pension recipients.

For adults several variables measure the different amounts and sources of income. Among those, a variable if the adult receives a state pension, and if so, how much. This is a numeric variable, the values of which lie very close together. For simplicity I have temporarily used this variable as a dummy.

Children’s anthropometrics are taken, these are length/height, weight, and waist. Using these anthropometrics and WHO growth standards, z-scores have been calculated. Unfortunately wave 2 (2012) accidentally omitted the z-scores, so that these cannot be evaluated until an updated version is published. However, I have computed the length-for-age z-scores manually.

In 2006 the WHO published its standards for child growth (Onis et al. 2006). These standards are based on the scores of children from different ethnic populations in households which observed a healthy lifestyle. The standards provide the means and standards deviations used. These are on a monthly basis for height-for-age, and on a semi-centimeter level for weight-for-height scores.

## 2.3 Analysis

I perform three types of analysis. The first analysis uses the Duflo method, whereby I compute the z-scores (using WHO in stead of CDC, this is of no consequence) and then compare based on living in the household with an of-pension-eligible adult. Secondly, I use my computed z-scores and the data set provided variable which describes the actual pension received (or lack thereof). Lastly, I use this state pension variable to evaluate the z-scores provided in the dataset.

The first type of analysis is almost identical to Duflo. Using an international set of standard anthropometrics for healthy children between 6 and 60 months old, I standardize observed anthropometrics. I then construct a number of dummies of different ages and gender of the pension recipients.

In the second analysis, I use the same z-scores I calculated for the Duflo method. However, here I use the state pension recipient variable provided by the NIDS data set. For simplicity I change the numerical variable to a dummy variable (as the benefits are virtually identical this is without much loss of information).

This method uses the pre calculated z-scores from the data set and the state pension dummy. Unfortunately the 2012 z-scores are missing except for height-for-age. I therefore use only the height-for-age z-scores for the 2012 estimates.

In all of these methods the z-scores can be compared on a number of properties. Firstly, the status of living in the same household as a state pension recipient or not is the first property to compare. Secondly, when living with a recipient, the effects of male and female recipients can be compared. Thirdly, the effects based on the gender of the child can be compared.



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## Chapter 3

# Risk and Uncertainty in Unique Equilibria in Currency Attacks

### Abstract

Morris and Shin (1998) finds that the introduction of a risk factor leads to a unique equilibrium coming to be in their model of currency attacks. The self-fulfilling currency attack model which they propose thus has the surprising feature, that with the introduction of risk perceptions, the multiple equilibria region, thus seems to solve to a single equilibrium. It is my contention that this is not a surprising result, since the risk factor, replaces a previous existant, Knightian uncertainty, effectively increasing the body of knowledge. Furthermore, the quantifiable risk only solves a certain part of the multiple equilibria region. Lastly, if we replace the somewhat stange assumption of a bounded uniform distribution of risk perceptions, with the more orthodox, normaly distribution, we cannot come to the same results.

### 3.1 The Idea

This paper addresses the issue multiple equilibria in models of currency attacks. In situations of a currency peg, there is the possibility of a currency attack. Speculators will short the pegged currency, hoping the government will release the peg. If a sufficiently large proportion of the market participates in this, the cost of maintaining the peg for the government becomes too high, which will lead to the government releasing the peg. Currency attacks thus have a self-fulfilling nature, which leads to a situation of multiple equilibria, as described in Obstfeld (1986, 1995, 1996).

In Morris and Shin (1998) the authors describe such a model and expand on it by introducing a second-order mechanism. Hereby speculators do not only look at the economics fundamentals of a currency, but also at other speculators' perceptions of these fundamentals. This leads to a standard situation where there is a stable, unstable, and a 'ripe for attack' region (based on the economic

fundamentals.

The authors proceed by introducing a measure of risk around perceptions of the fundamentals by investors. Investors do not know the actual state of the fundamentals, but rather a distorted form of it. As a result, the investors' perception of other investors' perceptions are even more distorted. Paradoxically, the leads to model being solvable to a unique equilibrium.

## 3.2 The Model

I will give a brief description of the model as it is defined, and some of its features. There is a state of economic fundamentals  $\theta$  which is distributed as  $\theta \sim U[0, 1]$ . The exchange rate is the hypothetical situation of no government intervention is a function only of these fundamentals ( $f(\theta)$ ), it is assumed that  $\frac{\partial f}{\partial \theta} > 0$ . The currency is pegged at a level larger than that derived from the fundamentals ( $e^* \geq f(\theta)$ ). Speculators can short the currency at a cost  $t$ , their payoff is described by:

$$e^* - f(\theta) - t \quad (3.1)$$

The government derives a positive value  $\nu > 0$  from defending the peg. The cost of the peg is determined by the economic fundamentals and the proportion of the speculators ( $\alpha$ ) that attack the currency. The payoff the government is thus:

$$\nu - c(\alpha, \theta) \quad (3.2)$$

Lastly, the following assumptions are imposed:  $c(0, 0) > \nu$  (with worst fundamentals the peg always has to be released),  $c(1, 1) > \nu$  (with all speculators attacking, the peg always has to be released),  $e^* - f(1) < t$  (with best fundamentals, it is inopportune for speculators to attack).

### 3.2.1 The possible outcomes

When we set Equation 3.1 and Equation 3.2 equal to zero, we derive the two turning points in the model. We define  $\underline{\theta}$  which solves  $c(0, \theta) = \nu$ . Also,  $\bar{\theta}$  solves  $f(\theta) = e^* - t$ .

Using the turning points described above, we can define three possible outcome intervals:

1.  $[0, \underline{\theta}]$ , the cost is always too high, this is the unstable region.
2.  $[\underline{\theta}, \bar{\theta}]$ , if enough speculators attack, the cost of defending the peg becomes too high, this is the 'ripe for attack' region.
3.  $[\bar{\theta}, 1]$ , the cost of shorting the currency will always outweigh the possible gains, this is the stable region.

The two corner intervals have unique equilibria, however, the middle interval, does not. This is thus the multiple equilibria region.

### 3.3 The introduction of risk (replacing uncertainty)

The authors expand the model by introducing a measure of risk for fundamentals:

$$x \sim U[\theta - \epsilon, \theta + \epsilon] \quad (3.3)$$

Where  $x$  is the state of the fundamentals *observed* by the speculators. A speculators observation can thus *at most* deviate from the true value of the fundamentals by  $\epsilon$ . The speculators are also aware of the nature of the distortion. This means that they are also aware of the fact that other speculators' perceived value of the fundamentals can at most, deviate from their own with a magnitude of  $2\epsilon$ .

#### 3.3.1 The outcomes with risk

Having established the new model, the authors state:

The unique optimal strategy for the government is then to abandon the exchange rate only if the observed fraction of deviators,  $\alpha$ , is greater than or equal to the critical mass  $a(\theta)$  in the prevailing state  $\theta$ .  
(Morris and Shin 1998, p. 591)

By solving out this government 'optimal' strategy, the speculators can ensure themselves of a certain abandonment of the peg, for a sufficiently low observed  $x$ . The authors proceed to derive from this the main result of the paper, which is:

THEOREM 1: There is a unique  $\theta^*$  such that, in any equilibrium of the game with imperfect information, the government abandons the currency peg if and only if  $\theta \leq \theta^*$ .  
(Morris and Shin 1998, p. 592)

### 3.4 The Issues

By introduction the idea of perceptions of other speculators' perceptions, the authors give a more complete picture of such a currency attack. It is thus very surprising that the outcome of their more realistic model, corresponds less to reality and the more incomplete models. That is to say, the nature of currency attacks does seem to be characterised by multiple equilibria. This is explicitly expressed by the authors in their introduction, with the mentioning of Eichengreen et al. (1993) and Dornbusch et al. (1994). It is therefore quite surprising that the more realistic leads to a the unrealistic situation of a unique equilibrium, whereas the less intricate model gives us the more realistic multiple equilibria.

We can summarise the main problem with the model as follows:

1. Multiple equilibria exist in the interval  $(\theta, \bar{\theta})$ .
2. The introduction of quantified risk, removes uncertainty with  $2\epsilon$  of  $x$ .
3. Here  $u(x, \theta) > 0$  leads to  $\pi(x) = 1$ .

4. Authors claim that  $u(x, \theta) < 0$  leads to  $\pi(x) = 0$ .
5. This is assumption is false.
6. Outside the certain risk area, the previously existing uncertainty remains.
7. Multiple equilibria remain possible here.

In the technical proof of the paper, we can pinpoint the non sequitur in two different but related points. Firstly, the previously mentioned:

The unique optimal strategy for the government is then to abandon the exchange rate only if the observed fraction of deviators,  $\alpha$ , is greater than or equal to the critical mass  $a(\theta)$  in the prevailing state  $\theta$ .  
(Morris and Shin 1998, p. 591)

This should say "...abandon the exchange rate *always* if the observed fraction is great than or equal to...". Since

Secondly,:

For the next step, consider the strategy profile where every speculator attacks the currency if and only if the message  $x$  is less than some fixed number  $k$ .  
(Morris and Shin 1998, p. 592)

The risk profile of the speculator is being redefined here. In the first iteration of the model, speculators might decide the attack the currency without knowing what other investors would do. In this second iteration, speculators will only attack if they believe that there is a sufficient number of other attackers doing the same. Yet in the first model, attacks were possible, in absense of this certainty. It thus follows that speculators should be willing to attack the currency, even in the absense of the quantifiable-risk induced certainty.

In my understanding of the model, the fact that a unique equilibrium only comes to be with the introduction of a risk factor, is the result of the fact that this risk factor eliminates the previously existing uncertainty. In other words, the unique equilibrium is not a surprising result, since Knightian uncertainty is exchanged for quantifiable risk, which is completer body of knowledge. This view is enforced by the fact that, the equilibrium is most pronounced when the risk factor ( $\epsilon$ ) is minimised (i.e. set equal to zero), as the authors state themselves. Furthermore, I have doubts about the authors claim that the domain which is solved by the equilibrium, is in fact the entire 'ripe for attack' domain.

Also, the authors assume that the investors perception of other investors perception takes the form of a bounded uniform distribution. It is unlikely that perceptions would best be described by a uniform distribution. More importantly, it is unlikely that this distribution would be bounded, such as is assumed by the authors. If we replace the bounded uniform distribution, with a normal distribution (which is unbounded), then we cannot derive the same results.

We can summarise the issues with the paper as follows:

1. The introduction of risk adds information, rather than removing it.
2. This does not in fact lead to a unique equilibrium.
3. The assumption of a bounded risk interval is problematic.

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## Chapter 4

# Bitcoin and Remittances: The Potential of ‘Stupid Phones’

In the 2009 whitepaper (Nakamoto 2009) called ““Bitcoin: A Peer-to-Peer Electronic Cash System”” an anonymous individual or collective referred to as Satoshi Nakamoto (the Japanese equivalent of John Smith) describes an online currency called Bitcoin (BTC). This currency -the first of a group called cryptocurrencies- has the following economics features:

- public transactions
- anonymous addresses
- fixed amount of units
- high granularity (1 Bitcoin = 100,000,000 Satoshi)
- no or low transaction costs

An addition to these economic features, the key feature of Bitcoin is decentralisation. All transactions are kept in a public ledger called the blockchain. An incentive in the form of transaction fees is provided to stimulate the creation of multiple copies of this ledger. Conflict resolution, in this system, is done through majority consensus of blockchain copy holders.

There are a number of features which make Bitcoin attractive for remittances. Firstly, the low transaction costs are a huge step up from the current facilitators, which charge high percentages. Secondly, government intervention (especially in the recipient country) is prevented by the anonymity. Thirdly, recipients can choose to keep their remittance in a currency which is not controlled by their government. Fourthly, the granularity ensures very small transactions can be conducted.

Bitcoin initially became popular in advanced economies such as those in Europe and North America. However, since mid 2013 there has been a large shift towards developing economies, in which comparative advantages of Bitcoin are more pronounced. For example, since its inception, Mt.Gox (located in

Japan) was the largest Bitcoin exchange (marketplace), however in October 2013, Mt.Gox was overtaken by a Chinese exchange.

Bitcoin transactions are conducted by the electronic ‘signing’ of a transaction. This is a very simple electronic process. Currently many smartphone apps are available to this purpose. However, in the targeted developing economies, many phones are not smartphones, the vast majority using Nokia Operating System (Nokia OS). These phone can also run applications, using the Java Mobile App platform. Currently there are no Bitcoin apps available for this platform.

I propose to participate in the development of open-source applications which would enable the users of stupid phones. We can then exploit the temporal difference when releasing the applications in different languages at different times, as well the downloads from traceable IP addresses.

## 4.1 Data

Funds held at Bitcoin exchanges are not held in the owners bitcoin wallet. Rather, the exchange holds them in their wallet, and the clients have a claim on this wallet. Much like the way bank clients have a claim to their money, which is in the bank’s vault.

Therefore Bitcoin purchases at exchanges do not lead to transaction being recorded in the blockchain. Since the Bitcoins remain in the Exchange’s wallet, the only thing which changes is the claims of the clients.

- The blockchain (public ledger)
  - IP address
  - Language of transaction notice
  - Transaction times
- The exchanges
  - Location of exchanges
  - Transaction costs for each currency
  - The order books
  - Transaction times
  - The traded currency
- Software
  - Downloads
  - Translation contributions (?)
  - Connections to server



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## Chapter 5

## End notes

In the previous chapters I have presented my current research projects. These projects are in various stages of completions.

I believe that my South Africa paper provides an interesting opportunity to exploit the data from the household survey, done before and after a highly relevant policy change. Especially since the methodology and location are the same as in Duflo (2000, 2003). In addition to this there is now a third data wave which has become available. This provides us with more data, and mostly the opportunity to use more interesting methodology. The text of the paper still has to be written.

The discussion of Morris and Shin (1998) is in a very early stage. I have looked at the paper in detail, I have also done a brief analysis of my main critique, namely the conflation of risk (quantifiable) and Knightian uncertainty (unquantifiable). However, I would like to present a worked out example which demonstrates how this conflation leads to the main result of the paper. In addition to this, this example should demonstrate how only a part of the ‘ripe for attack’ region is solved for the unique equilibrium.

Finally, relating to Bitcoin (Nakamoto 2009), I think that there is a enormous potentation for uncontrolled low-cost remittances using Bitcoin. I would like to analyse the spread of this. I propose to follow the spread of applications for platforms which are popular in developing economies.

At this point, three out of four of the previously discussed research projects are some form of a replication of prior work. As replications they are mostly critiques of others’ work, rather than constructive ideas. This is mostly a result of the fact that these projects progress faster. For this reason, these research projects have progressed more than the projects which are primarily based on my own ideas. However, it is my attention to shift the focus of my thesis to include more original work. Here I present two more ideas which are too preliminary to include in the main body of the text, but are based on my own work.

Firstly, I was in charge of setting up a baseline diagnostic into security perceptions in Conakry, Guinea. This diagnostic will be used to analyse the impact of a police reform conducted here. The reform constitutes of the implementation of a model of ‘police de proximitee’. The baseline consist of 4500 interviews using smartphones in the comune of Conkary as well a large number of interviews in N’Zerekore (east Guinea). Some time after the implementation of the police

reform as follow up study will be conducted. I propose to conduct an impact evaluation using the results from the studies in which I have taken and will take part.

Secondly, I have previously studied philosophy of science in my bachelors in Theoretical Philosophy. I would like to write one paper about an issue relating to this. In particular I would like to at the effect of outliers. The effect how these outliers has extensively been discussed in contexts such as finance and international economics (Taleb 2010; Sornette 2009), as well as individual behaviour (Kahneman 2011). I would like to see how these principles affect research in development microeconomics.

In this document I have tried to give a description of my research projects. None of these projects are near completion and many are in fact in a very early stage. The purpose of this has been to describe the direction I am taking with my thesis, and to receive feedback on this. As a result of this being work in progress, the articles are still incomplete, this includes lacking the proper attribution of ideas using citations.

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