THE MANDATE OF HEAVEN:
WHY IS THE CHINESE COMMUNIST PARTY STILL IN CONTROL OF CHINA?

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Preface

No escaping it-
I must step on fallen leaves
to take this path
        -Suzuki Masajo

This thesis started out with a few simple thoughts; China is interesting, Game theory is interesting, and Institutions are interesting. I thought that it had to be possible to combine these subjects. The result has been a fun, interesting, and rewarding journey.

The greatest acknowledgments are reserved for Jo Tori Lind that inspired me throughout the course Institutions and Economic Systems, and who I was lucky enough to convince to be my supervisor. Thank you for useful guidance, productive feedback, interesting discussions, and last but not least good collaboration during the writing of my thesis.

I thank my friend Kristoffer. By now you know *The Model* almost as well as I do. Without your help this thesis would have been a lot harder to write, and I truly appreciate the assistance in various subjects throughout 6 years of studies. I can not help but wonder how you are going to amuse yourself now that you will have so much more time to spare.

I also thank my girlfriend Emilie. It is hardly any topic that it is not enjoyable to discuss with you. You challenge me where I am unclear, and if I manage to convince you to agree to an idea, I know it is a truly good one. You bring out the best in me.

I have, perhaps belatedly, realized that not everyone is blessed with people who actually read trough sixty plus pages of rather dry economic theory. Thank you to everyone who read trough the thesis and helped improve it in various ways. Any remaining mistakes are mine and mine alone.

Anders Norbom Walløe
Oslo, May 2012

Abstract

This thesis argues that there exists a social contract between the Chinese Communist Party (CCP) and the Chinese people. The contract states that the Communist Party will deliver economic growth and in return the people will not rebel. This relationship is examined through a game theoretical setting. First, I present the basic Acemoglu and Robinson (2000) model and it's main insight; that democratization is a consequence of the elite's inability to commit to future transfers unless they give away de facto power to the people by introducing democracy. This dynamic is fueled by the elite's fear of revolution from the poor.

Second, I expand this basic model by using durable investments instead of lump sum transfers. This increases the ability of the elite to commit to redistribution over time, increasing the probability that the elite manage to use investments to prevent democratization, and making it less likely that the elite will choose to repress the populace.

The thesis then goes on to present a quick overview of Chinese history, where the main point is to show that China is far behind its potential. It was the worlds leading economy in 1820, and I argue that it was the institutional framework within China, a lack of focus on technology, and Mao's reforms that lead to two 'lost centuries' of growth. This history is important because it affects the perceptions of China's leaders today, and the turmoils of the past have made social stability one of the main goals of Chinese policy, further increasing the likelihood of the existence of a social contract.

I then apply the expanded model to the institutional framework of the Chinese state in the period from after the cultural revolution until today, and argue that the expanded model gives a good description of the structure of the social contract between the Communist Party and the citizens. By focusing on investments the CCP increases the productivity of the workers, create economic growth, and promotes social stability. All of this allows the elite to stay in power. The ability of the elite to do this is more prominent within

the expanded model than within the base model, and the expanded model might therefore give a better explanation of current Chinese politics.

Contents

List of Figures

1 Introduction

In this thesis I am first going to quickly present the basic Acemoglu & Robinson, (henceforth A&R), model from Acemoglu and Robinson (2000). Secondly I am going to expand this basic model by using durable investments instead of lump sum transfers. This increase the ability of the elite to commit to redistribution over time and therefore increase the probability of the elite managing to use investments to prevent democratization. I then present a short overview of Chinese history. Before I finally use the expanded model to examine the institutional framework of the Chinese state in the period from 1978 to the present, and argue that the expanded model is a good description of the social contract between the Chinese Communist Party and the Chinese citizens.

1.1 Institutions and Growth

There are several countries that it would have been interesting to use my expanded model to examine, for example South Korea, Vietnam, China, or Singapore. But due to the nature of the investment driven economy and the autocratic government, China is a particularly interesting case to look at. This is all the more true since China has become more and more important to the world economy. The focus of the world is in many respects shifting to the East, sped up by the enormous growth in the region, and this process has been further increased by the recent financial crisis, where the economies of the old world seems to be the last to recover.

The premise of the Acemoglu and Robinson approach is that the elite in a country create an institutional[1] framework that helps them maintain power and extract rents from the population, repressing innovation, property rights and meritocracy, ultimately preventing growth, and therefore keeping the country poor. "Egypt is poor because it has been ruled by a narrow elite that

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[1]By institutions I mean the "humanly devised constraints that structure human interaction, [...] [they] are the rules of the game" North (1994).

has organized society for their own benefit at the expense of the vast mass of people" (Acemoglu and Robinson, 2012, p. 3). But if the elite can control institutions to their own benefit, why would they ever agree to implementing democracy? Why did the elites in Western Societies during the nineteenth and early twentieth century extend voting rights to the majority of the adult population if this led to an increased level of taxation on the same elites? Acemoglu and Robinson answer that the extension of the franchise was a commitment device that the elite used to prevent revolution from the more numerous citizens. The elite were forced to implement democracy since the promise of monetary transfers alone lacked credibility, and the alternative was revolution.

In "*Economic Origins of Dictatorship and Democracy*", which can be viewed as the most advanced form of their model, and in their recent book "*Why Nations Fail*", A&R focus on China as an example of a state that do not placate their constituencies, but instead use repression to be able to refrain from concessions (Acemoglu and Robinson, 2012). I, however, argue throughout this thesis that it is natural to see China as a repressive regime, but that it is also quite possible and might be very interesting to view China as using a *different* form of transfer to prevent revolution. Instead of supplying cash transfers or services to the citizens, the elite in China have committed to providing *economic growth*.

I therefore extend the A&R model so that *economic growth*, modelled as lasting investments, can be one of the ways the elite can prevent a revolution. The idea is simply that the Chinese Communist Party has committed to delivering growth through a social contract[2] with the Chinese people, stating that as long as the economy improves, the Chinese Communist Party stays in power and the citizens do not revolt.

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[2]I here use the concept of a social contract quite loosely, I do not use the common argument of Locke that "government derives its just powers from the consent of the governed," Locke, John (2011), but argue implicitly that the absence of an effective rebellion against the social contract is the only legitimacy it needs Pettit (2012). If we use this last criterion, it is easier to argue that a social contract does indeed exist in China.

1.2 Actualization - The Arab Spring

When A&R started their work on democratization, back in 1997, and claimed that democratization was a response from the ruling elite to prevent rebellion, they found historic evidence of this effect from e.g. The Glorious Revolution in England in 1668[3], Germany before the first world war, Britain in the eighteen hundreds, as well as France and Sweden (Acemoglu and Robinson, 2000, p. 1182).

The argument of A&R are now thoroughly corroborated by the recent uprisings in the Middle East. The Arab Spring shows not only that rebellions are a viable way for the poor to rise up against the elite that runs the country, but also that the elite responds very much in accordance with what the A&R theory predicts, using repression, outright bribery, and even democratization to prevent revolution.

The Arab Spring began in Tunisia, and has so far caused rulers to be ousted in Egypt, Libya, and Yemen, while civil uprisings are ongoing in Bahrain and Syria. The common rallying cry is that "The people wants to bring down the regime" (Abulof, Uriel, 2011). The responses from the regimes have been varied. It is for example normal for the gulf countries to subsidize the gas price. This can be seen as a very visible and easily verifiable way to signal to the citizens that they are indeed well taken care of by the current rulers (Krüger, 2010). During the uprisings, the emir in Kuwait gave 4000$ to each and every Kuwaiti citizen, as well as fourteen months of food rations (Krüger, 2011). While in Saudi Arabia they raised public sector wages and announced social benefits and cash handouts worth about US$130 billion (Miller, 2012, p. 2), both clear excamples of the elite using transfers to calm the citizens.

Other regimes in the region choose a different approach in response to the uprisings. Syria i.e. does not have the oil wealth of Kuwait and Saudi Arabia, and the elite therefore have only two options left, (according to the A&R's model): to repress the population, or democratize. They choose repression. This decision led to a revolt from the people, and a civil war that is yet to

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[3]See North, and Weingast (1989) for more about this

be concluded.

All of these examples show that the framework of A&R has clear predictive value, and is not just a theoretical exercise. Even though it simplifies and formalizes a complicated problem, it yields interesting insights. And even though the Middle East would be a very interesting place to apply the model to, the Chinese case is where I will focus my attention throughout the rest of the thesis. I further limit my centre of attention to the strategies of transfers/investments or democratization and do not focus on the strategy of repressing the citizens.[4]

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[4]See for example Acemoglu and Robinson (1997) and (2006) for models dealing with repression strategies.

2 The Acemoglu & Robinson Model

Acemoglu and Robinson (2000), looks at why the elite in Western Societies during the nineteenth and early twentieth century extended voting rights to the majority of the adult population. They also argue that this extension (of the franchise), led to an increase in internal redistribution of wealth and a downturn of the Kuznets Curve. The question is *why* did the elites extend the franchise if this led to an increased level of taxation? A&R answer that the extension of the franchise was a commitment device that the elite used to prevent revolution from the more numerous citizens. The elite were forced to implement democracy since the promise of monetary transfers alone lacked credibility. A&R use historical evidence from Germany, England, Sweden, and France to support their argument (Acemoglu and Robinson, 2000, p. 1167).

2.1 The Model Setup

A&R's model describes an infinite horizon economy with a continuum of size 1 of agents, where a proportion $\lambda > 1/2$ of agents are "poor", while the rest, $1 - \lambda$, is a rich "elite". I will use the terms "rich" and "elite" interchangeably throughout the thesis. The same applies to the terms "poor" and "citizen(s)". All agents, whether rich or poor, are treated as identical (Acemoglu and Robinson, 2000, p. 1169). As we see, the citizens are more numerous than the elite, and therefore in full democracy the median voter will be a poor citizen that can (and will) choose to set a tax rate higher than the elite prefer.

The agents in the model consume a generic consumer good, and can choose to allocate their capital in a way that either uses market technology, but makes the proceeds eligible for taxation, or a less productive home technology, where the production can not be taxed. This creates a natural ceiling to the possible level of taxation, both in a democracy and in elite rule.

All agents have identical preferences, represented by a linear indirect utility

function over net income, and discount future income by $\beta \in [0, 1)$. Everyone, both poor and rich, are taxed at a rate τ and get a transfer T. In the beginning political power is concentrated in the hands of the elite, but the poor agents can at any time overthrow the government.

If the poor attempt a revolution, it always succeeds. In the event of a revolution the poor then get to distribute the capital in society evenly among themselves, except for a part that gets destroyed during the revolution. The rich end up with nothing. A revolution is in other words a large scale redistribution from the rich to the poor. The amount of capital the citizens manage to expropriate depends on the degree of 'revolutionary threat', that is the level of μ. μ is stochastic and can either be μ^h (high) or μ^l (low) with the probability $Pr(\mu = \mu^h) = q$, regardless of whether μ was high or low the previous period (Acemoglu and Robinson, 2000, p. 1169-1171).

This changing value of μ captures the fact that the elite can not prevent the revolution indefinitely by committing to a long term subsidy of the citizens, because the citizens know that the elite will renege on their promise as soon as the threat of revolution is gone. Therefore the elite must find a way to credibly commit to permanent transfers to prevent social unrest. If we look at this problem in a game theoretical setting, then the act of extending the franchise is *a* solution of the game. The rich elite introduce democracy to prevent the revolution from happening.

Acemoglu and Robinson (2000, p. 1171) sum up the various steps of the game in this way:

1. The state μ is revealed, observed by all players

2. The elite decide whether or not to extend the franchise. If they decide not to extend the franchise, they set the tax rate.

3. The poor decide whether or not to initiate a revolution. If there is a revolution, they share the remaining output. If there is no revolution and the franchise has been extended, the tax rate is set by the median voter (a poor agent).

4. The capital stock is allocated between market and home production, and incomes are realized.

2.1.1 A&R's Main Model of Democratization

Because we treat the individuals in each of the two groups as identical, this economy can be represented as a dynamic game between two players: the elite and the poor. A&R characterize the pure Markov Perfect Equilibria of the game, where strategies only depend on the current state of the game and not the entire history of the game. The game is further dependent on who is in control politically and the level of revolutionary threat.

In A&R(2000), the game ends after either democracy or revolution, and continues indefinitely until either of these states are obtained. The possible actions of the poor are: revolution or no revolution. While the rich can choose to extend the franchise or the tax level. Thus a pure Markov Perfect equilibrium is a strategy combination, σ^r, dependent on the political state and the revolutionary threat, and a strategy, σ^p, dependent on the political state, the possible extension of the franchise and the tax level, such that these strategies are best responses to each other for all μ's and political states.

A&R use Bellman equations to characterize the equilibria of the game, where $V^p(\cdot)$, and $V^r(\cdot)$ are different value functions depending on the various states and actions. For example: in state $\sigma_{t=0}(E, \mu^l)$, the elite have political power and there is no threat of revolution.

The game tree, Figure 1, nicely illustrates the various payoffs in the game:[5]

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[5]I thought it prudent to give a graphical description of the various strategies of the game, even though the proper explanation of the notation in Figure 1 is not given before Section 3
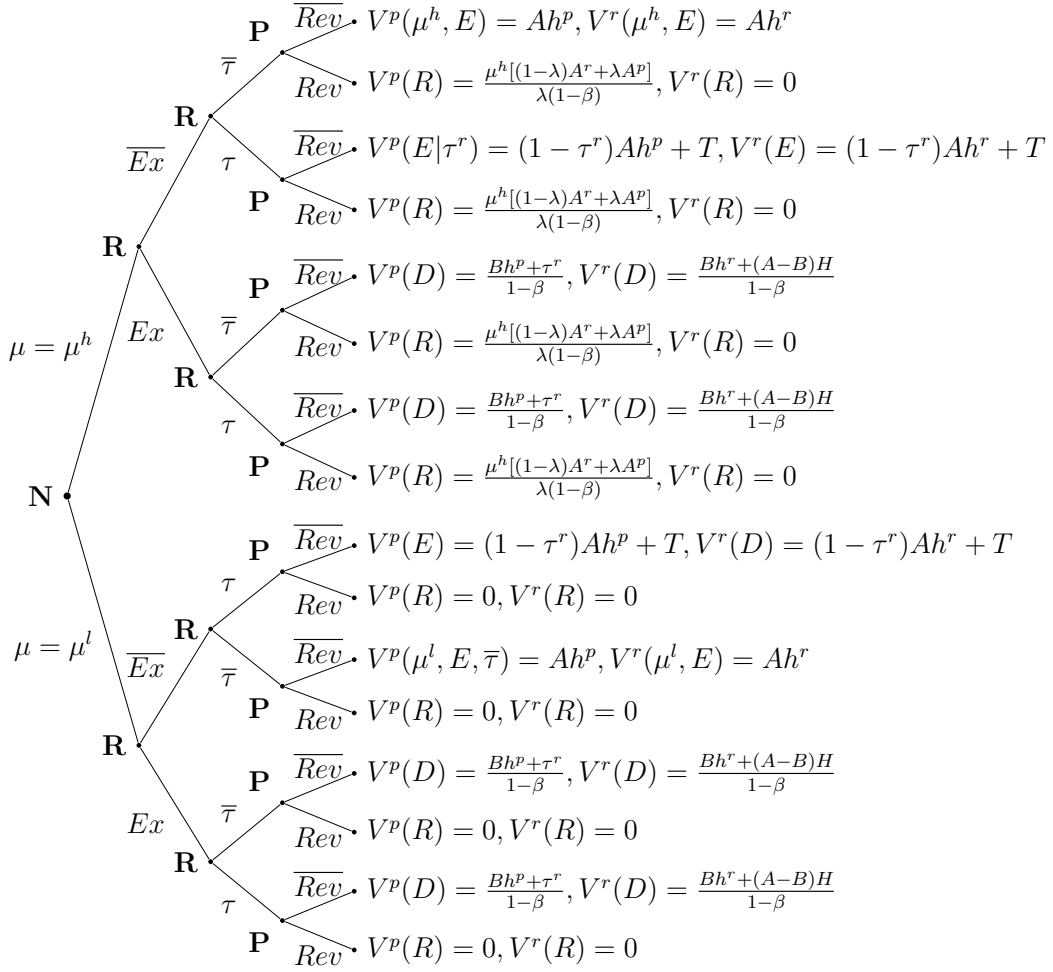
Figure 1: Step 1- 4

Here, player N is nature, R is the rich, and P is the poor. The choice Ex is to extend the franchise and the choice $\overline{Ex}$ is not to extend the franchise. Similarly with transfer, τ, and no transfer, $\bar{\tau}$. Rev is revolution, and $\overline{Rev}$ is no revolution.

As we can see from Figure 1, the payoffs of a revolution in the bottom half of the game tree, where $\mu = \mu^l$, is 0 for both the citizens and the elite, independent on the choices of the rich beforehand. We also know that as long as $\mu = \mu^l$, there is no true revolutionary threat so the elite will play $\tau = 0$, and they will not extend the franchise. Therefore the only viable branch of

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this part of the game tree, $\mu = \mu^l$, is $V^p(\mu^l, E, \overline{\tau}) = Ah^p, V^r(\mu^l, E) = Ah^r$, where we see the poor ends up with; $T = 0$ transfers, no democracy, and the rich get to keep all their resources.

In the top half of Figure 1, we see that there are more interesting results. If the rich do not give the poor any transfers, and do not introduce democracy, the threat of revolution is quite real. So the question the rich face is whether it is cheaper to pay off the poor with transfers, or if the gains from a revolution is so large for the poor that the elite will have to introduce democracy to prevent the revolution. This, as we see in the paragraph below, all depends on the level of q.

2.1.2 Restricting the Model

A&R restrict the game in two ways, first by assuming that the payoff for the poor of a one time payment from the rich can not be larger than the gains from revolution. This makes sense since they argue throughout the paper that it is the lack of certainty in *future* transfers that causes the threat of revolution to eventually bring forth democracy. The second restriction is that the payoff from revolution cannot be larger than the gains from democracy. If the opposite were true, we would have seen a lot more revolutions than democracies, and their argument would not hold.

This then creates a 'level' of probability q of μ^h, that is the probability of having a high revolutionary threat in the next period, that gives the appropriate response from the elite and the citizens. So if: $q < q*$ generally is true, then the revolutionary threat will be met with franchise extension, and as a result the max tax rate. If however: $q > q*$, then the threat will be met with temporary redistribution at a level that just equals the payoff of a revolution[6].

The consequence of this setup is that the rich play the strategy of extending the franchise when $q < q*$, even though this leads to a higher total tax

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[6]See Section 4, Proposition 1, or Acemoglu and Robinson (2000) for a more detailed explanation of these effects.

burden for the rich over time. This happens because the poor know that transfers now and a promise of transfers in the future is not credible, and would therefore prefer a revolution unless the franchise is extended. A&R argue that this is the path that Britain, Sweden and France took.

The other result is, paradoxically, that a stable revolutionary threat would not lead to revolution, but rather lead to a level of constant transfer from the elite to the poor. A&R argue that this is what happened in Germany before the first world war. The socialist party in Germany was the most developed, and therefore the ruling elite got a constant reminder of the revolutionary threat. This reminder equalled a revolutionary threat higher than $q*$. In other words, q was high enough over time to make the promise of future transfers credible, so there were no 'need' for a revolution, and the poor ended up with regular transfers. If we then examine history, we see that Germany did indeed implement the welfare state, while Britain and France, which did not have this constant reminder, ended up extending the franchise.

2.2   Extensions

In the book "*Economic Origins of Democracy and Dictatorship*" (2006), A&R expand their basic model in a number of different ways, for example adding a middle class, the possibility of a coup from the rich after democracy is implemented, the option of repressing the citizens, and targeted transfers. They also create a dynamic model environment (Acemoglu and Robinson, 2006, p. 20).

A&R do not, however, focus on economic growth, and this is where my small contribution comes in. In the rest of the thesis I am going to examine at how the elite can enhance the productivity of the poor over time by investing in lasting productivity increasing infrastructure, instead of handing out lump sum transfers in each period. After I have developed this extension, I am going to argue that this is the 'social contract' we have seen in China from after the Cultural Revolution and until the present day.

3   An Expanded Model of Democratization

3.1   Introduction

In this section I present the changes to the basic A&R model. I let the elite be able to invest in infrastructure that increases the productivity of the poor, and therefore increases their consumption possibilities. I also introduce a dynamic environment with depreciation, that reduces the productivity of the poor unless there are new investments. In sum, these changes lead to an increased ability for the elite to commit to future productivity growth for the poor, and this gives, as we shall see, an increased freedom in how to deal with the threat of rebellion.

3.2   The Model Set Up

3.2.1   The Economy and it's Participants

Just like in A&R (2000), I consider an infinite horizon economy, with a continuum of size 1 of agents, where a proportion λ of agents are "poor", while the rest $1 - \lambda$ is a rich "elite". All agents of the various groups, rich (r) and poor (p) are treated as identical. There is a unique consumption good y with price normalized to unity that can be produced in two ways, both linear in productivity. Either it can be produced using market technology; A^i, ($i = p, r$), or it can be produced in the informal sector using home technology;[7] B^i. Where the rich and the poor have access to different home technologies, and $B^p = 0$. The rich have a productivity of A^r in every period, while the poor have the productivity A^p_t. For simplicity the production function is only dependent on the different levels of productivity,[8] thus $y^p = A^p_t$, and $y^r = A^r$.

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[7]The home technology of the poor can be viewed as "returning to the farm" to do subsistence farming, thus $B^p = 0$, while the rich, on the other hand, has a real alternative to produce in the home sector since, $B^r > 0$.

[8]This is a change from A&R, who vary the capital h^i, and keep the productivity constant, while I keep the capital h constant and equal to 1. Thus in my model: $y^i = A^i_t h^i$, where $h^i = 1$.

All agents have identical preferences represented by a linear indirect utility function over net income, and a discount factor $\beta \in [0, 1)$. In my model I make the rich able to invest in infrastructure that enhances the productivity of the poor, see Equation (1). The citizens can not perform this investment themselves.[9]

As we saw, I assume that the poor and the rich have access to different informal technologies, and that market technology for both the poor and the rich are more efficient than home production, such that $A^r > B^r$ and $A^p_t > B^p$, for all t. The only role of informal sector production is to limit the taxes to less than a hundred percent, since production in the informal sector is not taxable, in contrast to production using market technology. So a high value of B^r would mean that the upper limit on the amount of investment that can be imposed on the rich would be lower. This is because they can always choose to produce in the informal sector if the forced investment level is set too high.

In other words, if the median voter in a democracy tried to make the rich pay more investment than the maximum $(\hat{I})$, we would have $I > \hat{I} \equiv (A^r - B^r)$, so the total investment (I) would in fact be 0 because each rich person would move all production to the informal sector. Therefore $\hat{I} \equiv (A^r - B^r)$ is the maximal amount it is possible to make the elite pay, *both in order to avoid democracy and in a democracy.*

Post tax income is $y^r = A^r - I$ for the rich, and $y^p = A^p_t$ for the poor. The productivity of the elite is assumed to be $A^r > \hat{I}/\delta$, where δ is the rate of depreciation, making it impossible to keep the poor at the same productivity level as the rich, even if the rich invest the maximum amount each period.

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[9]This would be similar to making only the rich pay taxes in the A&R model. One can argue that the assumption, that only the rich pay taxes, is a bit unrealistic, but this deviation from A&R only highlights the fact that the model rests on the assumption that the rich pay to avoid revolution. And even in democracy the rich pay more than the poor, so the gain from taxing the poor as well as the rich does not really manifest, other than the fact that it makes some of the expressions 'neater'.

For the poor the productivity varies in the following way:[10]

$$A_t^p = (1 - \delta)A_{t-1}^p + \frac{I_t(1 - \lambda)}{\lambda} \qquad (1)$$

Making the productivity of the poor directly dependent on the level of investment from the rich.

For the setup described in Equation (1) to make sense, we must have that: in period t, the rich produce first, then the level of investment I_t is decided, and *then* the poor produce with the productivity A_t^p dependent on the level of investment the elite choose in the same period. The reason for this setup is that since the whole basis of the model is a commitment problem, it seems unreasonable to create a model where the poor trust the rich enough to believe the investment will really happen in the next period, i.e. in a period where the poor might not even have a real revolutionary threat. This is really a technicality, and have no real consequence for the results of the model either way, but I feel it makes much more sense to have the investments made in period t count in period t instead of in period $t + 1$.

Equation (1) is important in quite a few respects. First it creates a form of commitment possibility for the rich that is not an extension of the franchise. As we see from Equation (1), as long as $\delta \neq 1$ some of the investment the rich did in period $t - 1$ remains in period t. And therefore the citizens are better off not just in the current time period, but also in every period after period t.

It might be helpful to i.e. view this investment as an investment in a factory, or some form of infrastructure, that gives the poor the opportunity to work more efficiently, and therefore increases their productivity. Because of the model set up, this factory is not producing profit for the rich investors but only improves the productivity, and therefore the consumption possibilities, of the poor. It is also not possible to chop up the factory and sell it abroad,

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[10]Here I change the conventional way of writing a dynamic model; usually the investment bears fruit in the beginning of the next period. The reason for this becomes clear in the next paragraph

so by investing they produce some of the same effects as if they had extended the franchise.

An investment at any time creates several periods where the citizens are better off. This would be similar to the rich agreeing to pay to the poor a smaller and smaller transfer (not investment) over time in the A&R framework. But this, as we know, is not credible because the rich can renege on their promises, and the poor therefore have to maximize the one period transfer. Not so if the elite can invest in an unsellable factory that only benefit the poor. This is a true commitment over time, and therefore resolves some of the credibility problem.

3.2.2 Revolution

The citizens, λ, are for all practical purposes excluded from the political process, but they can at any time $t \geq 0$ overthrow the sitting government and take over the production technology of the rich. If a revolution is attempted it always succeeds. Post revolution we can therefore imagine that the poor would appropriate the technology and assets of the rich and distribute them among themselves. In other words, the poor take control over all the assets in the economy, but a fraction $1 - \mu_t$ of the technology gets destroyed in the process. So if there is a revolution at time t, the perpetual discounted value for the poor would be:[11]

$$V^p(A_{t-1}^p, R) = \mu_t \left(\frac{A^r(1-\lambda)}{\lambda(1-\beta)} + \frac{A_{t-1}^p}{1-\beta(1-\delta)} \right) \qquad (2)$$

In other words, after a revolution, each poor citizen receives a productivity that is a mix between their old productivity and the rich productivity, dependent on the degree of revolutionary threat, forever. There is no further investments, but the poor have appropriated a fraction of the productivity of the elite, they are therefore better off than before the revolution.[12] After

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[11]See Appendix A.1.2 for the math.

[12]In the post revolutionary state, the rich technology, A^r, does not depreciate even when it is taken over by the poor. This is of no real consequence, but some ways to rationalize

a revolution the rich are assumed to get[13] $V^r(R) = 0$.

It is further assumed that μ is stochastic and changes between two values $\mu_t = \mu^h$ whit the probability q, and $\mu_t = \mu^l = 0$ with the probability $1 - q$. A low value of q would imply that the threat of revolution is rare. This variation captures the fact that some periods might be more prone to social unrest than others, and allows us to model that a promise of redistribution today might not be adhered to tomorrow, because the revolutionary threat then might be lower. As we see, a low value of μ would mean that a revolution is very costly, since a big part of the post revolutionary resources would get destroyed during the revolution.[14]

The 'end' of the model setup is then for the elite to choose whether or not to extend the franchise. If it is extended the economy becomes a democracy forever,[15] and the median (poor) voter sets the tax rate. The layout of the game so far is quite close to the layout shown in section 2.1.

3.3 Solving the Game

The game is made easier by using two features of the model setup. Because we have identical agents, and they therefore have identical preferences, we can treat all the agents in one of the groups (rich/poor) as one player. This economy can therefore be characterized as a dynamic game between two players, the *r*ich elite and the *p*oor citizens. I just follow A&R in saying that

this could be to assume that the workers take better care of the capital because they now own it themselves, see Craig, and Pencavel (1992) for arguments of this kind. Another solution is that during the revolution the capital that would be depreciated is destroyed in the revolution, rendering depreciation after the revolution close to zero. Or one can imagine that the poor just learned the magic that keeps the rich productivity from being depreciated in the first place.

[13]That the rich get nothing is just for simplicity, see i.e. Acemoglu and Robinson (2000) for more discussion on this.

[14]If one imagines that the economy has a lot of human capital, this would be very difficult to expropriate, and this would be the same as a low value on μ^h

[15]This is for simplicity, it is quite possible to imagine the elite attempting a coup after democracy is implemented, think of various countries in Latin America. For a more thorough discussion on this see for example Acemoglu and Robinson (1999) and Acemoglu and Robinson (2006).

the potential free rider problem between the poor agents can be solved by e.g. only distributing the bounty from a revolution to the actual participants, rendering it a loss not to take part. It is however perfectly possible to argue that there exists a real coordination problem.[16] As in A&R(2000), I ignore this issue.

Secondly, the choice of whether to use market or home technology is fairly simple. As stated earlier, if $I > \hat{I} \equiv (A^r - B)$, then each individual rich person would produce using home technology and there would not be any way for the elite to get income to deliver the desired level of investment. This is true both in a Democracy and in Elite rule. Therefore only the action $I \leq \hat{I}$ is worth our attention, and this, thankfully, reduces the number of interesting actions to look at.

As A&R, I only characterize the pure strategy Markov Perfect Equilibria of this game, where the strategies only depend on the current state of the world, and not on the history of the game.[17]

3.3.1 The State of the System

The state of the system consists of the current opportunity for revolution; μ^l or μ^h, the current level of A^p, and the political state; P - either Democracy D, Elite control E or the post revolutionary state R. The action of going from $P = E$ to $P = D$, is denoted by ϕ. If $\phi = 0$, P stays at E and if $\phi = 1$ P switches to D forever. More formally, let $\sigma^r(\mu, P)$ be the actions taken by the elite when the state is $\mu = \mu^h$ and $P = E$ or D. This action consists of a choice between extending the franchise $\phi = 1$ when $P = E$, or choosing the level of investment I^r when $\phi = 0$. Similarly $\sigma^p(A^p_{t-1}, \mu, P|\phi, I^r)$, are the actions of the poor. Their actions consists of initiating a revolution, notated by ρ, where $\rho = 1$ represent a revolution. The poor also have to select the level of investment $I^p = \hat{I}$ if the political state is $P = D$. As we see, the

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[16]See for example Apolte (2012) for a thorough discussion of this.

[17]To see that the general results in the model do not change even outside Markov Equilibria, see e.g. the appendix in Acemoglu and Robinson (2000).

actions of the poor are conditioned on the actions of the rich, since the rich make their choices of possibly investing or extending the franchise *before* the poor choose between revolution or no revolution.

A Pure Strategy Markov Perfect Equilibrium is then a strategy combination: $\{\sigma^r(\mu, P), \sigma^p(A_{t-1}^p, \mu, P|\phi, I^r)\}$ such that σ^r and σ^p are best responses to each other for all μ and P.

We can characterize the equilibria of the game by writing the appropriate Bellman equations. Define $V^p(A_{t-1}^p, R)$ as the return to the poor citizens if there was a revolution starting in state $\mu = \mu^h$ and where the productivity of the poor is $A_t^p = A_{t-1}^p$. Since only the value of μ and A_{t-1}^p at the time of revolution matters, $V^p(A_{t-1}^p, R) = \mu \left(\frac{A^r(1-\lambda)}{\lambda(1-\beta)} + \frac{A_{t-1}^p}{1-\beta(1-\delta)} \right)$, which is the per period return from revolution for the infinite future discounted to the present.[18] The value function of the rich if there is a revolution is, as we might recall, $V^r(R) = 0$. The same is true for the poor, $V^p(A_{t-1}^p, R) = 0$ when $\mu = \mu^l = 0$, so we see that the poor would never attempt a revolution when $\mu = \mu^l$.

Therefore, if we examine the state (μ^l, E), we see that the elite are in power and that there is no real revolutionary threat. And in any Markov Perfect Equilibrium, $\phi = 0$ (that is, there is no extension of the franchise), and $I^r = 0$, the value of the rich agents is $V^r(\mu^l, E) = A^r + \beta\big[(1-q)V^r(\mu^l, E) + qV^r(\mu^h, E)\big]$. While the value of the poor agents is given by:

$$V^p(A_{t-1}^p, \mu^l, E) = A_{t-1}^p(1-\delta)$$
$$+ \beta \left[(1-q)V^p(A_t^p, \mu^l, E) + qV^p(A_t^p, \mu^h, E) \right] \quad (3)$$

As we see, the poor are dependent on the level of their production technology: A_{t-1}^p, the level of depreciation: δ, as well as the current state of μ.

If we then analyze the state (μ^h, E), and suppose the elite play $\phi = 0$ and $I^r = 0$, in words: neither extend the franchise or invest, then we would have $V^p(A_{t-1}^p, \mu^h, E|\phi = 0, I^r = 0) = \frac{A_{t-1}^p(1-\delta)+I^r}{1-\beta(1-\delta)}$, where we know that $I^r = 0$.

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[18]See the Appendix, Section A.1.2 for the math.

The inequality that would guarantee revolution in this state is if:

$$V^p(A^p_{t-1}, R) > V^p(A^p_{t-1}, \mu^l, E) \tag{4}$$

So if this is true, $\mu = \mu^h$, and if the rich do not give the poor either franchise extension or investment, then the citizens will prefer to revolt.

Here I follow A&R in not only using the above revolution constraint Equation (4), but to use a slightly stronger assumption as a starting point for the further analysis.

Assumption 1 [19]

$$\mu \left(\frac{A^r(1-\lambda)}{\lambda(1-\beta)} + \frac{A^p_{t-1}}{1-\beta(1-\delta)} \right) >$$

$$A^p_{t-1} \left\{ \frac{\left[(1-\beta(1-\delta))\right](1-\delta)+1+\dfrac{\hat{I}(1-\lambda)}{\lambda}}{1-\beta(1-\delta)} \right\} + \frac{\hat{I}(1-\lambda)}{\lambda} \tag{5}$$

This assumption is really just; $V^p(A^p_{t-1}, R) > A^p_{t-1}(1-\delta)$ + the perpetual value of receiving the maximum transfer ($\hat{I}$) just one time. In words; redistribution for just one period is not supposed to be enough to prevent a revolution. If $\mu = \mu^h$ and the poor get investment from the rich one time, and do not believe that this will happen again, ever, then this one transfer should *not* be enough to prevent a revolt.[20]

Since $V^r(R) = 0$, revolution is the worst outcome for the rich, and they will do anything to prevent a revolution from happening. In the model environment there is two ways they can do this. First, the elite can choose to maintain political power $\phi = 0$, but redistribute income by investing, in this case the poor get $V^p(A^p_{t-1}, \mu^h, I^r)$, where I^r is the amount of investment chosen by the rich. Second, they could extend the franchise, that is implement democracy, and thus give the poor $V^p(A^p_{t-1}, D)$. But there is no guarantee

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[19]See the Appendix A.1.2 and A.1.3 for the math

[20]See Acemoglu and Robinson (2006, p. 136-142) for several interesting examples of revolts, nevertheless stopped this way.

that either of these actions will be enough to stop a revolution. The poor would still choose the action that gives them the best long term value. The choice for the poor is therefore really between:

$$V^p(A^p_{t-1}, \mu^h, E) = max\Big\{V^p(A^p_{t-1}, R); \phi V^p(A^p_{t-1}, D)$$
$$+ (1 - \phi)V^p(A^p_{t-1}, \mu^h, E, I^r)\Big\} \qquad (6)$$

In words, this means that the poor would choose the best option between either revolution *or* democracy *or* transfers. It is the elite that can decide if the decision is between revolution and democracy or between revolution and a transfer I^r, so for the poor it is always really a choice between two states.

If the elite choose the redistribution strategy that is $\phi = 0$ in Equation (6), the return to the poor is:

$$V^p(A^p_{t-1}, \mu^h, E, I^r) = A^p_{t-1}(1 - \delta) + I^r$$
$$+ \beta\Big[qV^p(A^p_t, \mu^h, E, I^r) + (1 - q)V^p(A_t, \mu^l, E)\Big] \qquad (7)$$

The elite redistribute some of their income by investing an amount I^r, and the poor therefore ends up with the productivity they had in the period before the investment plus the productivity gain from the investment. In the next period, if $\mu = \mu^h$, investment continue, but if the state switches to $\mu = \mu^l$ then the investment stop, $I^r = 0$, and the poor get $V^p(A^p_{t-1}, \mu^l, E)$ in that period. As we see, this illustrates the fact that the elite can not commit to future investment unless the future also has a real threat of revolution.

However, if the elite choose the 'extending the franchise' strategy, $\phi = 1$, the comparison for the poor is between $V^p(A^p_{t-1}, R)$ and $V^p(A^p_{t-1}, D)$. The perpetual return to a rich agent in democracy is simply: $V^r(D) = \frac{A^r - \hat{I}}{1 - \beta} = \frac{B^r}{1 - \beta}$, and the returns to a poor agent is:[21]

$$V^p(D, A^p_{t-1}) = \frac{A^p_{t-1}}{1 - \beta(1 - \delta)} + \frac{\hat{I}\beta(1 - \delta)(1 - \lambda)}{(1 - \beta[\delta + \beta(1 - \delta) - 2])\lambda} \qquad (8)$$

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[21]See the Appendix Section A.1.1 for the math

19

To simplify the discussion further I focus on the area of the parameter space where a democracy actually prevents a revolution. That is where $V^p(A_{t-1}^p, D) > V^p(A_{t-1}^p, R)$. This second assumption looks like this:

Assumption 2

$$\frac{A_{t-1}^p}{1 - \beta(1-\delta)} + \frac{\hat{I}\beta(1-\delta)(1-\lambda)}{(1 - \beta[\delta + \beta(1-\delta) - 2])\lambda} >$$
$$\mu\Big(\frac{A^r(1-\lambda)}{\lambda(1-\beta)} + \frac{A_{t-1}^p}{1 - \beta(1-\delta)}\Big) \tag{9}$$

If the value for the poor in a democracy is larger than the value of performing a revolution, the elite can not prevent the revolution no matter what they do. Therefore it is much more interesting to look at the parts of the game where the elite are able to prevent a revolution, and that is when Assumption 2 holds.

3.3.2 A Graphical Explanation of the Game

As we can see in Figure 2, the game has quite a few end states. And it is these end states that must be compared to find the various strategies of the elite and the citizens. As in Figure 1, player N is nature, R is the rich, and P is the poor. The choice Ex is to extend the franchise and the choice $\overline{Ex}$ is not to extend the franchise, Rev is revolution, and $\overline{Rev}$ is no revolution. But in Figure 2, instead of transfers, we have the choice between Investment, I, or no investment $\bar{I}$.

As we can see from Figure 2, the payoffs of a revolution in the bottom half of the game tree, where $\mu = \mu^l$, is 0 both for the citizens and the elite, independent on the choices of the rich beforehand. We also know that as long as $\mu = \mu^l$, there is no true revolutionary threat so the elite will play $\overline{I}$, and they will not extend the franchise. Therefore the only viable branch of the game tree is $V^p(\mu^l, E, \overline{I}) = A_t^p = (1-\delta)A_{t-1}^p, and V^r(\mu^l, E) = A^r$, where the poor ends up with $I = 0$ investments and no democracy, and the rich get to keep all their resources.

In the upper half of Figure 2, we see that there are more interesting results. If the rich neither invest, (so the poor get increased productivity), nor introduce democracy, the threat of revolution is real. The question the rich face is whether it is cheaper to pay off the poor with investments, or if the gains from a revolution is so large for the poor that the elite will have to introduce democracy to prevent the revolution. This, as we see in Section 4 below, all depends on the level of q relative to q^* and the level of δ.
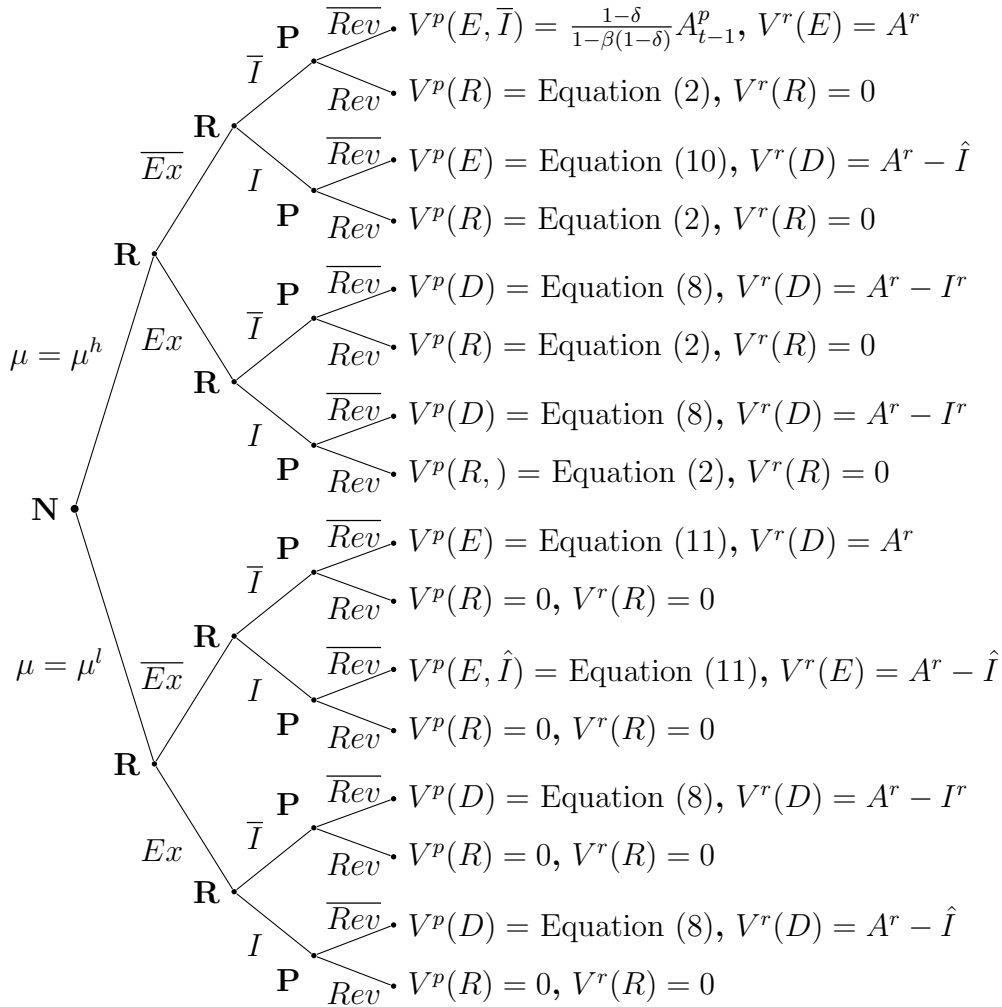

Figure 2: Here I have simplified the notation a bit to get the Figure into one page. I have basically removed the information you find by following the game tree. So where $\mu = \mu^l$ I do *not* include μ^l in the value function, even though this would be more correct. The same applies to the productivity of the poor: A^p_{t-1}, which is in every one of the poor's value functions.

4 Results

Since we know by Assumption 1[22] that a one time transfer alone is not enough to prevent a revolution, it is interesting to look at what level of q that makes the redistribution strategy viable. As we saw in Section 3.2.2, a high q is the probability of having $\mu = \mu^h$, that is a hight threat of revolution. Let $\hat{V}^p(A_{t-1}^p, \mu^h, E|q)$ be the maximum utility, as a function of the parameter q, that can be given to the poor without extending the franchise. In other words, we are interested in finding out what Equation (7) looks like for the citizens when the elite give the citizens the maximum possible investment, $\hat{I}$, every time $\mu = \mu^h$.

Here I use the method of undetermined coefficients, also known as "guess and verify", to determine the actual value of the two functional equations, Equation (3) and Equation (7), when $I^r = \hat{I}$. We are mostly interested in the value when the threat of revolution is high, and I therefore focus on this state.[23] This gives the following result for Equation (7):

$$\hat{V}^p(A_{t-1}^p, \mu^h, E|q) = V^p(A_{t-1}^p, \mu^h, E, \hat{I}) =$$
$$\frac{1 - \beta(1-q)}{(1 - \beta(1-\delta))(1-\beta)}\hat{I} + \frac{1-\delta}{1 - \beta(1-\delta)}A_{t-1}^p \tag{10}$$

Equation (10) now has the following interpretation: The first part $\frac{1-\beta(1-q)}{(1-\beta(1-\delta))(1-\beta)}\hat{I}$ can be thought of as the utility today of getting an investment today, modified by the discounted probability of a utility loss when having μ^l in a future period, and therefore no investment in that period.

Analogously, if we look at the true form of Equation (3):

$$V^p(A_{t-1}^p, \mu^l, E, \hat{I}) =$$
$$\frac{\beta q}{(1 - \beta(1-\delta))(1-\beta)}\hat{I} + \frac{1-\delta}{1 - \beta(1-\delta)}A_{t-1}^p \tag{11}$$

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[22]Equation (5).
[23]See the Appendix, Section A.2 for the math.

We see the same expression but with just $\beta q \hat{I}$ in the numerator. Here it is even easier to see this interpretation. The value of an investment for the poor when they have a low revolutionary threat today, is the probability of having a high revolutionary threat in the future multiplied with the present value of this future investment.

If we now look at the rightmost part of both Equation (10) and Equation (11), that is $\frac{1-\delta}{1-\beta(1-\delta)} A_{t-1}^p$ we see that this is the perpetual discounted value of having the productivity A_{t-1}^p in the previous period, which also is an interpretation that makes sense.

Now that we know all the end states of the game, that is $V^p(R)$, $V^p(D)$, and the value for the poor of a high revolutionary threat where the elite pay the maximum investment $\hat{V}^p(A_{t-1}^p, \mu^h, E|q)$, we can draw the following conclusions:

If $\hat{V}^p(A_{t-1}^p, \mu^h, E|q) < V^p(A_{t-1}^p, R)$, then the maximum investment that the elite can make is not adequate to prevent a revolution, and they will have to implement democracy if they want to have a positive payoff at all. It is also worth noting that $V^r(\mu^h, E, I^r)$ is decreasing in I^r and that it is greater than $V^r(D)$ for all $I^r \neq \hat{I}$. This last comment follows from the fact that as long as the elite are in power and there is not a democracy yet, it will come a period where the state is μ^l, and in this state the rich get to play $I^r < \hat{I}$, unlike in a democracy where they are 'forced' to play $\hat{I}$ in all periods. Therefore $V^r(\mu^h, E, I^r) > V^r(D)$.

The set up of the model gives us the following nice results: $\hat{V}^p(A_{t-1}^p, \mu^h, E|q = 1) = V^p(A_{t-1}^p, D) > V^p(A_{t-1}^p, R)$ by Assumption 2. In words, we see that if there is no chance for the next state to be μ^l, then this is just like living in a democracy for the poor, since they are guaranteed to get the maximum investment each period. Since we already have assumed that a democracy is better than a revolution, this argument holds.

The next outcome is that: $\hat{V}^p(A_{t-1}^p, \mu^h, E|I^r = \hat{I}, q = 0) < V^p(A_{t-1}^p, R)$ by Assumption 1. This means that if there is no chance for the state μ^h to arrive again, then a one time transfer is not enough to prevent the revolution, since

this is a 'once in a lifetime' opportunity for the citizens, and they know they can not trust the rich' promises . Therefore, unless the de facto power is transferred to the poor by the implementation of a democracy, the citizens will revolt.

These results proves that there exists a $q* \in [0,1]$ such that $\hat{V}^p(A_{t-1}^p, \mu^h, E|q*) = V^p(A_{t-1}^p, R)$. And since we got an expression for the value functions, we know the form of q^*, that is:[24]

$$q^* = \frac{-\hat{I}(\beta - 1) + \frac{\mu^h A^r (1-\lambda)}{\lambda}[1 - \beta(1-\delta)] + A_{t-1}^p(1-\beta)\left[\mu^h - (1-\delta)\right]}{\beta \hat{I}}$$

(12)

And we can see from Figure 3 that $q^*(\delta)$ is monotonically and continuously increasing in δ. From this, we can conclude with the following proposition:

Proposition 1

If we assume assumptions 1 and 2 hold. Then, for all $q \neq q*$, there exists a unique pure strategy Markov Perfect Equilibrium such that: if $q < q*$, then the revolutionary threat will be met by the strategy of extending the franchise. This is so because the probability of having a high revolutionary threat in the future is low, and therefore the value of a revolution for the poor is higher than the expected value of receiving a maximum investment. Because this only happens $q < q*$ times, the elite then have no other choice than to extend the franchise, if they want to avoid a revolution.

Formally, the equilibrium strategies of the poor and the rich, when $q < q*$, look like this: The rich play: $\sigma^r(\mu^l, E) = (\phi = 0, I^r = 0)$, and $\sigma^r(\mu^h, E) = (\phi = 1, [I^r = 0])$. While the strategy of the poor is: $\sigma^p(E, \mu^h, A_{t-1}^p|\phi = 0, I^r = \hat{I}) = (\rho = 1)$, and $\sigma^p(E, \mu^h, A_{t-1}^p|\phi = 1, [I^r = 0]) = (\rho = 0, I = \hat{I})$, and the last poor equilibrium strategy is to play $\sigma^p(D, \mu^h, A_{t-1}^p) = (I = \hat{I})$ when in democracy.

If, however, $q > q*$, then temporary redistribution, in the form of invest-

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[24]See Appendix A.3 for the math

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ments and not a franchise extension, is enough to prevent revolution. This is because the probability of getting a future transfer is above the threshold, $q*$, and therefore the long term value of getting investments from time to time is larger than the payoff of a revolution for the poor. More formally: $\sigma^r(\mu^l, E) = (\phi = 0, I^r = 0)$, and $\sigma^r(\mu^h, E) = (\phi = 0, I^r = \bar{I})$, where $\bar{I} \leq \hat{I}$ is the level of investment that makes the poor indifferent between revolution and this investment. Further, the strategy of the poor looks like this: $\sigma^p(\mu^h, A^p_{t-1}, E|\phi = 0, I^r) = (\rho = 0)$ for all $I^r \geq \bar{I}$. Logically we here also see that the strategy $\sigma^p(\mu^h, E, A^p_{t-1}|\phi = 0, I^r) = (\rho = 1)$ for all $I^r \leq \bar{I}$ is the right response to a too low level of investment from the rich, but both of these strategies are off the equilibrium path.

Assuming the elite are in power and $q < q*$, then the rich set the investments to zero when $\mu = \mu^l$, and extend the franchise when $\mu = \mu^h$. The poor play the optimal strategy of revolting if $\mu = \mu^h$ and the franchise has not been extended. Otherwise, that is $\mu = \mu^l$, they don't revolt. And as we remember, the median poor voter sets the level of investment $I = \hat{I}$ after the franchise has been extended.

In contrast, whenever the elite are in power and $q > q*$, the rich can prevent a revolution by investing. So in the state $\mu = \mu^l$ the rich set the investment level equal to zero, and do not extend the franchise. And when $\mu = \mu^h$, they set the investment level, $I^r = \bar{I}$, that is; just high enough to prevent a revolution.

There is at least two main conclusions to be drawn from this analysis.

Firstly, the elite might extend the franchise when $q < q*$ and the revolutionary threat becomes high. Even though this commits the elite to a high tax burden in perpetuity, it is still preferable to a revolution. This is a result of the argument I have use throughout the thesis: the poor don't trust the elite and a promise of *future* investments from the rich to the poor when the threat of revolution is high at the moment, is not credible. Therefore if the rich believe that the poor would actually choose to revolt, the optimal strategy for the rich is to extend the franchise.

The other main conclusion is perhaps somewhat paradoxical; a high q makes democratization less likely. This is because a high q actually leads to a stable redistribution from the rich to the poor, because the rich would choose to invest "sufficiently often" to satisfy the poor, and therefore a high q does *not* lead to democracy but to frequent investments. This is opposite from what I would assume was the normal intuition. In other words, a high level of revolutionary threat can *in it self* work as a form of commitment device by "reminding" the elite that the poor might revolt next time. It is perhaps helpful to think of a high q as a society where the poor are well organized, or perhaps a country where the neighbouring, and similar, countries just had a revolution.[25]

4.1   Comparative Statics

It is important to notice that if the value of μ^h increases, this tightens the revolution constraint, i.e. it is more difficult for the elite to use investments to avoid a revolution. When $q < q^*$ this has no effect at first, since the threat of revolution already made the elite choose to extend the franchise.

If we instead examine the situation where $q > q^*$, we see that a higher level of μ^h increases the level of investments the rich need to make to appease the poor, but it does not force them to extend the franchise since the probability of a high revolutionary threat is sufficiently large. It is also important to note that it is possible for μ^h to be so large that Assumption 2 would be violated, and there would not be possible for the elite to prevent revolution even with democratization, because the value for the poor of going through with a revolution would be larger than the value of living in a democracy.

Another variable it is interesting to examine is B^r. An increase will limit the amount of investment the rich as a group can be forced to supply, and therefore, as B^r increases, it will be harder and harder to use redistribution to appease the poor with temporary investments, because the taxes that can be

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[25]Again it is tempting to refer to the Arab Spring and the various reactions of the regimes around Tunisia.

gathered from the rich are lower. The general conclusion that can be drawn from this is that it is more difficult to prevent revolution where democracy creates only limited gains for the citizens.[26]

4.1.1 The Effect of δ

All of the previous results in Section 4, however, are modified by the fact that I have a model with depreciation. Whether q is below or above q^*, changes with the level of δ, because the $q*$, (that decides which of these policies that are viable), is dependent on the level of δ. Figure 4 is thus a good summary of the main result of the expanded model.

As we see in Figure 3 below[27], the level of depreciation drastically changes the action space for the policies of the elite.
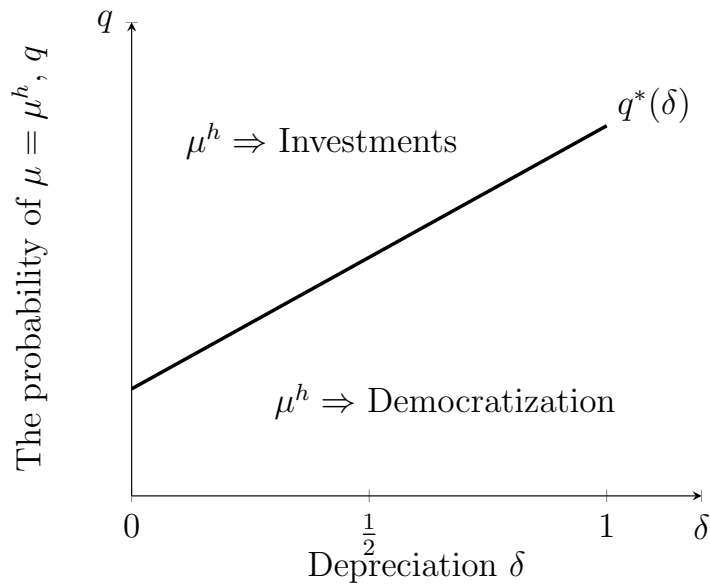
Figure 3: The figure illustrates how the level of q^* depends on δ. As we see, if q is larger than q^* for any level of δ, Investments would be enough to prevent revolution. If, however, q is less than q^*, for any level of δ, then democratization is the only way to prevent revolution.

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[26]see Section 6.3.1 for more about this effect
[27]See the Appendix A.4 for the numerical values used

As the caption of Figure 3 says, this illustrates the action space for the elite, and thus how much leeway the elite have depending on the level of q relative to q^*.

The next figure, Figure 4 below, is almost the same as Figure 3, but I here illustrated the difference between the Transfer approach from A&R with full depreciation and the approach I use with Investments and limited deprecia-tion. We see that the area labeled 'Transfers and Investments' is the same in both models, but the area labeled 'Investments' only exists in the expanded model. And as wee see, the level of $q > q^*$ needed when $\delta = 1$ and the level of $q > q^*$ for $\delta = 0$ is substantially different. With $\delta = 0$, $q > q^*(0)$ is enough, but with $\delta = 1$, $q > q^*(1)$ is required, to be able to prevent revolution.
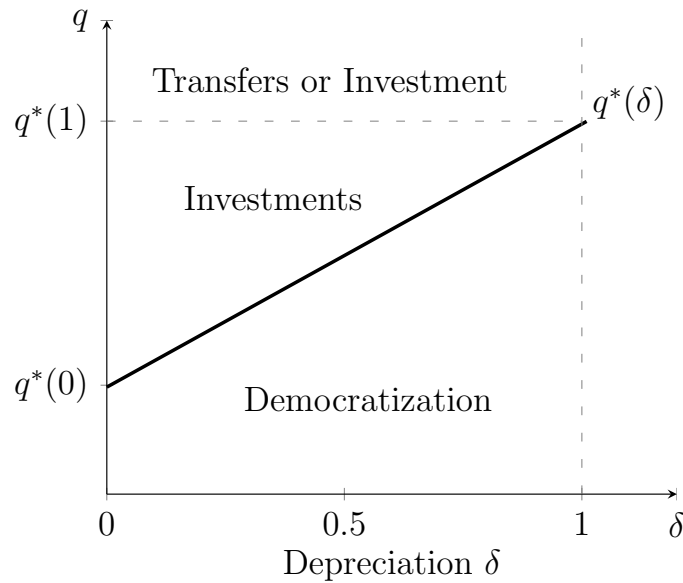
Figure 4: Here I have illustrated the difference between the Transfer approach from A&R with full depreciation, and the approach I use with Investments and depreciation. We see that the area labeled 'Transfers and Investments' are the same in both models, But the area labeled 'Investments' only exists in the expanded model.

As we have seen, the inclusion of durable investments and the increased level of commitment this allows the elite to show, is dependent on the level of depreciation δ, since the level of depreciation decides the durability of the productivity gain the poor get from the investment. In other words δ decides

the level of commitment the elite are able to give. Since q^* increases in δ, the bigger δ the less of a commitment device the investments become, and the harder it is to use investments to overcome the revolutionary threat. If, however, the depreciation is a hundred percent each period, then there is no real difference between the A&R approach with transfers, and the expanded model with Investment, since there is no commitment possibilities. In other words the basic A&R model turns out to be just a special case of the more general expanded model whenever δ equals 1.

5 China

5.1 Introduction

I want to build the argument that historically the Chinese had a huge sense of moral and cultural superiority, and that the last two hundred years are a low point in their historical development. Further I will argue that this is of vital importance to understanding the framework the Chinese leaders act within today[28].

This section provides a short overview of Chinese history, before the next section proceeds to apply the expanded model to China, and explains some of the insights the model gives about how the relationship between the elite and the citizens of China is shaped today.

In the 1820's, before the First Opium War, China was the world's largest economy with 33% of world GDP. At the same time, Western Europe and the USA had 17% and 2% of world production, respectively. With 20% of the world's population today, it would be 'natural' for China to have at least 20% of world's production as well. But with a share of only 9%, China still has a long way to go. This section tells some of the story of why China ended up so poor compared to the western powers.

As we see from the recent 2009 numbers, China was the 98th largest economy in per capita GDP. A level of GDP, that is 16 times the 1978 level, entailing an average growth of 10 percent a year for thirty years. Despite these achievements, it is still a paradox that China on one hand, is the world's second largest economy in absolute numbers, and on the other hand it is barely in the top hundred, when we measure by GDP per capita (Bekkevold, Kristoffersen, 2012, p. 14).

Nonetheless it is important to remember just how far China has come in

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[28]Even though I am tempted to quote the old maxim that; "Those who cannot remember the past are condemned to repeat it" (Santayana, George, 1906, p. 284), and use this as the sole reason to have a bit of Chinese history in my thesis.

the last twenty years. Even as late as 1992, Deng, extolled that the "four big items it was essential to make available to consumers in the countryside were: a bicycle, a sewing machine, a radio, and a wristwatch." (Kissinger, 2011, p. 447). And we now know that even though the richest Chinese still live in the coastal areas, the living standards have improved tremendously also in the countryside. During the last two decades more than 600 million people have been lifted out of poverty, and one of the world's last communist regimes is in most respects in fact capitalist, albeit not a democratic, country (Bjerkholt, 2012, p. 43).

How did this transformation take place, and *why* did this transformation happen? These questions are big enough to warrant several papers on just one of them alone, so I can do no more than to sketch the shadow of an answer here, but I still think the exercise is useful to understand at least some of the motivation for the elite and their choices regarding China. A brief examination of the historic foundation of China and the Chinese Communist Party, shows how and why the CCP came into power, and that the death of Mao opened up the possibility for the elite to embark on economic reform. This again created the necessary prosperity to make a social contract possible.

5.2 Chinese History

5.2.1 Entering the Modern Era

For several hundred years the Chinese had the world's leading economy and a flourishing culture. Even when they were threatened, or even conquered by barbarians, the would-be-conquerors themselves soon became "sinified", and things continued much as it always had. Kissinger sums it up like this:

> China was severed from the general historical development [of the world] [...] within these distinctive traditions and millennial habits of superiority, China entered the modern age a singular kind of empire: a state claiming universal relevance for its culture and institutions but making few efforts to proselytize; the

wealthiest country in the world but one that was indifferent to foreign trade and technological innovation [. . .] a political unit of unparalleled geographic extent that was unaware of the technological and historical currents that would soon threaten its existence (2011, p. 37-38).

Then the Europeans came. And, for the first time, the Chinese faced a threat from someone that did not recognize the moral and natural superiority of China, and that were not interested in assimilation based on Chinese culture or values. This difference in perspectives led to the First and Second Opium Wars, when China tried to stop the British selling opium inside China. Unfortunately China remained absolutist even after these losses, without the war forcing the transition that e.g. Japan undertook during the Meiji Restoration (Acemoglu and Robinson, 2012, p.294-297).

As the nineteenth century progressed further, China experienced almost every imaginable shock to its historic self image. Before the Opium War, it conceived of diplomacy and international trade mainly as forms of recognition of China's preeminence. Now, even as it entered a period of domestic turmoil, it faced three distinct and dangerous foreign challenges: the Western powers that wanted economic concessions, an expansionist and militarily dominant Russia, and the largest threat: the Japanese.

[. . .] neither the Western powers nor Russia had any ambition to displace the [Chinese Qing empire] and claim the Mandate of Heaven[29]; ultimately they reached the conclusion that they had much to lose from the Qings fall. Japan, by contrast, had no vested interest in the survival of Chinas ancient institutions or the Sinocentric world order. From the east it set out not

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[29]The Emperor's second, metaphysical, role was his status as the "Son of Heaven, the symbolic intermediary between Heaven, Earth, and humanity. This role also implied moral obligation on the Emperor's part. [. . .] If the Emperor strayed from the path of virtue, All Under Heaven would fall into chaos. Even natural catastrophes might signify that disharmony had beset the universe. The existing dynasty would be seen to have lost the "Mandate of Heaven by which it possessed the right to govern: *rebellions* would break out, and a new dynasty would restore the Great Harmony of the universe (Kissinger, 2011, p. 12).

only to occupy significant portions of Chinese territory, but to supplant Beijing as the center of a new East Asian international order. The ensuing catastrophes are viewed with considerable dismay in contemporary China, as part of an infamous "century of humiliation", that ended only by the reunification of the country under an assertively nationalist form of Communism (Kissinger, 2011, p. 51)[my emphasis].

A direct consequence of this inability to adapt to a changing world[30], was the breakdown of the last Chinese empire, and a chaotic period with warlords in control of huge areas. This state of affairs endured up until the communist victory in the civil war.

5.2.2 World War II

In 1931 Japan invaded Manchuria. The war was as mentioned the result of a decades-long Japanese imperialist policy aiming to dominate China politically and militarily and to secure access to China's vast natural resources. Although the two countries had fought since before 1931, war was not declared before 1937, and did not end before the surrender of Japan in 1945. In the meantime the Chinese government was fractured and weak. The Nationalists, the Communists, and various warlords were engaged in infighting, and were therefore not prepared for war. This led the Japanese to capture large areas of China, and eventually even the Chinese capital of Nan-king (Dupuy, and Dupuy, p. 1125).

There was resistance against the Japanese both by the Nationalists, under

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[30] "The pretensions underlying this traditional Chinese world order endured well into the modern era. As late as 1863, Chinas Emperor dispatched a letter informing Abraham Lincoln of Chinas commitment to good relations with the United States. The Emperor based his communication on the grandiloquent assurance that, [h]aving, with reverence, received the commission from Heaven to rule the universe, we regard both the middle empire [China] and the outside countries as constituting one family, without any distinction. "When the letter was dispatched, China had already lost two wars with the Western powers, which were busy staking out spheres of interest in Chinese territory. The Emperor seems to have treated these catastrophes as similar to other barbarian invasions that were overcome, in the end, by Chinas endurance and superior culture." (Kissinger, 2011, p. 9).

Chiang Kai-Shek, and the Communists, under Mao. The communists conducted guerrilla warfare, with soldiers based behind the Japanese lines. This strategy worked well and therefore gained huge popular support. The best way to see this effect is perhaps to compare the party membership numbers, which increased from 100,000 in 1937 to 1.2 million by 1945. The relevance of the Japanese invasion for the eventual communist takeover of China, can probably best be summarized by Mao himself:

> Mao's policies permitted the Japanese to destroy the Nationalists and thus strengthen the Communists, [...], 'Mao credited Japan with the communist victory in the civil war.' When Japanese premier Kakuei Tanaka 'tried to apologize for his country's invasion of China, Mao assured him that it was the "help" of the Japanese invasion that made the communist victory and this visit between communist and Japanese leaders possible' (Waldron, 1996, p. 972).

5.2.3 China Under Mao

After the Chinese civil war and the victory over the nationalists, Mao had total control over the party, and thus China. The communists had restored China to its historical borders, beaten back the Japanese and eliminated anyone who could threaten their control. Their ideological dominance was complete. Under Mao's leadership China had reached the early stages of communism; Soviet style five year plans were introduced, collectivization and nationalization had been completed, the bourgeois no longer existed, and class warfare had ended" (Vogel, 2011, p. 39).

Mao used this period to introduce several important reforms, for example "The Great Leap Forward" where 30 million Chinese died, without any real industrial gain, and "The Hundred Flowers Campaign", where the CCP encouraged a variety of views and solutions to national policy issues, launched under the slogan: "Letting a hundred flowers blossom and a hundred schools of thought contend". But when people surprised Mao with the dept of their

34

criticism and even dared to criticize the "Great Helmsman" himself, there was a back clash in a huge "anti rightist campaign" where Mao discredited everyone who had been openly or implicitly critical of the party and Mao's ideas (Vogel, 2011, p. 40).

But the biggest threat to stability ended up being the Cultural Revolution and its consequences.

5.2.4 The Cultural Revolution

During 1966 and until 1968, Mao encouraged youths to rise up against their elder leaders, allegedly to prevent rightist elements. Anyone with any education were to go and learn the value of physical work in the countryside, while inexperienced but zealous youths, called the Red Guards, took over vital positions. This caused Mao's personality cult to grow to immense proportions. Even Deng Xiaoping, widely regarded as a possible successor and a Mao supporter from before the Long March, was put through severe criticism and ended up repairing tractors in the countryside for tree and a half years.

The result of the Cultural Revolution was utter chaos, and it ended with Mao having to disperse the youths back to the countryside (Vogel, 2011, p. 35-55). Despite all this, the Cultural Revolution, to some extent, worked as intended and conciliated Mao's rule. The fear of being labeled "rightist" prevented anyone from deviating from Mao's intended policies. But the costs were immense, it created a lost generation of intellectuals, since everyone with any skill was sent to the countryside, or assaulted by the Red Guards. Deng later described the Cultural revolution as being a form of "civil war" (Xiaoping, 1994, p. 359).

5.2.5 The Era of Deng Xiaoping

In march 1979, the country was still reeling from the Cultural Revolution where, as we saw, high-level officials had been attacked, and with Mao's support, pushed aside, as the country with almost one billion people were

plunged into chaos. The average per capita income of Chinese peasants, that still comprised 80 percent of the population, was at 40$ a year. The amount of grain produced per person had fallen below the level before the Great Leap Forward, and was at 1957 levels. Factories were operating with technology that came from the Soviets in the 50's. Military officials had civilian jobs, revolutionaries had taken over jobs they had neither the education nor knowledge to perform, and the transportation and communication infrastructure was not working (Vogel, 2011, p.1-2).

It was in this situation Deng Xiaoping, after the death of Mao, eventually gained the mantle as China's undisputed leader. And Deng set out to reform the country, since he believed that China desperately needed radical reform to fix these problems. He also realized that "one could not solve problems simply by opening markets: one had to build institutions gradually, [...] to provide *order* during this rebuilding, [Deng] believed there was only one organization that could manage the process - *the Communist Party*" (Vogel, 2011, p. 3)[my emphasis].

Deng broke with the precedent set by Mao by downplaying his own expertise rather than presenting himself as a genius in any particular field. He trusted his subordinates to innovate, then endorsed what worked (Kissinger, 2011, p. 344). Deng did not have a clear blueprint of how to bring wealth to the people and power and stability to the country. He did, however, see improving the standard of living and enhancing productivity as the best guarantee of social stability" (Kissinger, 2011, p. 444). So it was with this background that Deng launched his program of the four modernizations, that eventually led to greater prosperity and growth than even the most optimistic forecaster could imagine, with a Chinese GDP that is set to overtake the GDP of the US already in 2017[31], according to one of the latest IMF reports (IMF, World Economic Outlook, 2011).

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[31]In PPP terms.

6 Applying the Expanded Model to China

6.1 Introduction

In this section I am going to apply the expanded model on China to shed some light on certain aspects of China's development. I will argue that the focus on investment driven growth that the CCP has had since the reforms began in 1978, is because of an implicit social contract that gives the CCP the 'mandate of heaven' as long as they deliver increased prosperity to the people.

6.2 Fear of Revolutions

"Men must be either crushed or pampered"

This quote by Machiavelli from 'The Prince', (1981, p. 37) stays as fresh today as it was five hundred years ago; the choice, for the ruling elite, is indeed between repression or some concession in one form or another. As I have argued in the preceding paragraphs the "legitimacy [of the CCP] now depended in part on delivering China's people a measure of wealth and comfort and a respite from the previous century of upheavals and privations"(Kissinger, 2011, p. 502). This is the main argument in my thesis of why the investment lead growth model is chosen in China. The CCP saw that they needed to change the way they governed to continue to control China.

As mentioned, Deng thought only the CCP could manage the necessary transition into "socialism with Chinese characteristics", the alternative would be no reform and then chaos. So when the reforms began it was vital that they created results fast. And as we have seen, they did; between 1978 and 1984, the income of Chinese peasants doubled (Kissinger, 2011, p. 406). The economic reforms managed to create enough wealth for the citizens to prevent rebellion, but the CCP still did not feel safe. When the zeal of economic reform slowed down in the beginning of the 1990s, Deng entered

37

the central stage again. In his famous 'Southern Tour' in 1992, Deng argued that economic reform and development were fundamentally revolutionary acts: "abandoning reform", Deng warned, would lead China down a "blind alley". To quote Deng directly:

> "Any one who attempted to change the line, principles and policies adopted since [the reforms began in 78] would not be countenanced by the people; *he would be toppled.* I have said this several times. Had it not been for the achievements of the reform and the open policy, we could not have weathered June 4th. And if we had failed that test, there would have been chaos and civil war. The "cultural revolution" was a civil war. *Why was it that our country could remain stable after the June 4th Incident? It was precisely because we had carried out the reform and the open policy, which have promoted economic growth and raised living standards.*" (1994, p. 359)[My emphasis].

He argued that in order to "win the trust and support of the people," the program of economic liberalization must continue for "a hundred years". Reform and opening up, Deng insisted, had allowed the Peoples Republic to avoid civil war in 1989 (Xiaoping, 1994, p. 358-362). We see here that the CCP did not feel safe unless the economic reforms continued, and the commitment to the path of economic development was one of the key messages that Deng wanted to get through.

The reference to "the June 4th Incident" is a reference to the Tienanmen square incident, where several thousands of protesters gathered to protest, rising inflation and lack of jobs. The protesters called for more economic reform, before the protests eventually morphed into a mass movement for political reform and freedom of the press. The CCP ended up using the army to clear the streets of Beijing, and they are widely considered to have seen this peaceful protest as a serious challenge to their rule[32] (Kissinger, 2011, p. 425-428).

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[32]See for example Deng's comment in the quote above.

A&R also argue in 'Economic Origins' that crises, economic, or otherwise, increase the likelihood of transition from one form of government to another (Acemoglu and Robinson, 2006, p. 65). It is awfully tempting to interpret, for example China's rather extreme stimulus program in response to the recent financial crisis, as an effect of just this kind of mechanism. Because the Chinese are more worried than democracies of sudden change, they are more focused on their response to the crisis. And if we look at the numbers[33], we see that China's response to the crisis was substantially larger than the western democracies. This might just be an effect of a autocracy in itself, because they do not need to water down a deal to get it through e.g. the US Congress, but it is equally likely that because they are more worried about unrest, they had a response that made sure that the effects of the crisis were as small as possible.

One more example that promotes the fact that the CCP is concerned with rebellions, is the fact that the regime recently arrested several people and shut down more than 15 websites because they spread rumours that military vehicles where on the streets of Beijing the 31th of March this year. The rumors came because one of the main contenders for promotion within the CCP - Bo Xilai - in the once-in-a-decade leadership change later this year, had just been sacked. This suggest a fierce fight behind the scenes for control of the ruling positions within the CCP. The People's Daily, the party's main newspaper, said in a commentary: "Internet rumours and lies packaged as 'facts' will turn conjecture into 'reality,' stir up trouble online and disturb people's minds.[...] If allowed to run amok, they will seriously disrupt social order, affect social stability and harm social integrity" (BBC News China, 2012). The CCP are in other words continually worried about unrest. In the next section I illustrate the choices of the CCP through the eyes of the expanded model.

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[33] "China's new bailout package has been set up to make the US government look cheap. At \$586 billion its ratio to GDP is impressive. [...] An American equivalent would have to total at least \$2.4 trillion. So far, the US government has settled on the \$700 billion" (McIntyre (2008)).

6.3   Repression or Investment

Acemoglu and Robinson argue that: "The Chinese experience is an example of growth under extractive political institutions" (Acemoglu and Robinson, 2012, p. 439). They further argue that this is mainly because property rights are not entirely secure and labor movement is not free but regulated through e.g. the hukou system[34]. They assert that China's economic system is more inclusive than for example Soviet's old system, but claim that since the CCP is still all powerful, there are no real inclusive institutions and thus no social contract in China (Acemoglu and Robinson, 2012, p. 440).

Fukyama, on the other hand, claims that the Acemoglu and Robinson model and the approach they use can not adequately explain the growth spur of China. He states that: "A&R pull a sleight of hand by arguing that Chinese growth won't last and that their system will eventually come crashing down (like Rome did, after about 200 years?)". He argues that a model that can not explain China's growth is not very convincing (Fukuyama, 2012).

In short, A&R claim that China is using repression to stay in control. They agree that China has taken steps towards inclusive institutions after 1978, but they still argue that:

> [. . .]   there are grounds to be skeptical that there is a social contract in China where the Communist Party will refrain from acting in ways that damages the economy. The Party controls the judiciary, the military, the bureaucracy and the media. So even if they claim their authority from a social contract, the moment this supposed contract strongly conflicts with the interests of those at the helm, the chances are that it will be worth not much more than the paper it's written on (Acemoglu and Robinson, 2012).

This statement only makes sense if one uses the A&R model from Section 2, and if we further imagine that the reasoning of A&R is that China has the opportunity to repress as a first choice. Therefore if we examine the

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[34]see for example Kam Wing Chan and Buckingham, Will (2008) for more information

game tree representing my game, Figure 2, this tree spouts from an even larger tree, Figure 5 below, where the elite first have to choose between; not repressing the population: ($\overline{Repress}$) or repressing the population: *Repress*. If *Repress* is chosen then we don't even move down the branches that leads to where my model is. If however the elite choose to $\overline{Repress}$, then we start on the game that I have examined throughout this thesis. We can illustrate this preliminary choice in a game tree as we see in Figure 5, below, where A&R believe that $R > T$, and the elite will therefore choose repression.
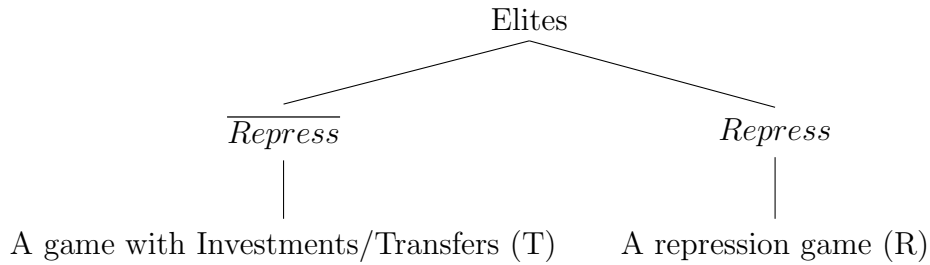
Elites

$\overline{Repress}$ *Repress*

A game with Investments/Transfers (T)   A repression game (R)

Figure 5: This is a basic game where if we assume that $R > T$, the Elite would choose *Repress* as their strategy. If, on the other hand, $R < T$ it is in the interest of the elite to play $\overline{Repress}$.

If we now instead revisit Figure 3 in Section 4.1.1, and imagine that we operate with, e.g. 10 percent depreciation, then the difference between A&R where, $\delta = 1$ and my model, where $\delta = 0.1$, is quite considerable. As we see in Figure 6 below, there's is a big difference in the conclusions one would draw when one thinks of China using a model with full depreciation, or a model with low depreciation. The whole triangle, labeled 'Increased Flexibility for the Elite', is the difference for the elite between A&R's model with transfers, and my expanded model.
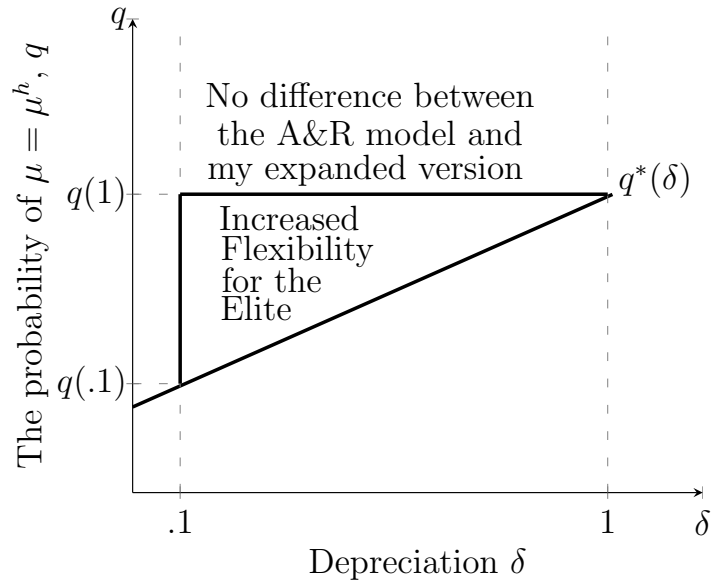
Figure 6: Here we see the difference between the A&R model and the expanded model. The area labeled 'Increased Flexibility for the Elite' only exist in the expanded model, and this gives the elite a larger action space, an extra area, where they can use Investments to prevent a revolution.

Since China had almost no infrastructure in 1978, before Deng's reforms began, it is not unreasonable to imagine that they had a low rate of depreciation, since the depreciation cost of low levels of capital is normally assumed to be close to zero. In other words, if the area 'Increased Flexibility for the Elite' above, is large enough to increase the payoff of the elite sufficiently to choose $\overline{Repress}$ in the game in Figure 5, the conclusion we came to in the previous paragraph would change. Because of the increased leeway for the elite, they might now instead value $T > R$, and they would opt for increased economic interaction and the use of investments to placate the populace instead of using repression, because this gives wider flexibility and a larger economy to extract rents from.

This is exactly what I argue that China did from 1978 and forward, and the reason A&R don't come to the same conclusion is because their model use transfers instead of durable investments. Since investments increase the ability of the elite to commit, the payoff of playing $\overline{Repress}$ increases, and we

end up with the dynamics we have examined thoroughly throughout Section 3.

As we have seen through my focus on investments and depreciation, the elite have a larger playing field within the expanded model, and this makes it more desirable to move down the game tree in Figure 5, above, on the non-repressive route, than in the basic A&R model. And this extra space makes the argument for the existence of an implicit social social contract stronger.

6.3.1 Increasing B^r

It is also interesting to examine some of the more technical aspects of the model and how they might interact with the 'real world'. It is especially interesting to see that something the model uses as an important foundation can be found outside the model. As we might remember, the level of B^r determines how much the rich can earn in the "non market sector".

The relevance in the theoretical framework for this is that B^r serves as a reference point, and a way to limit the poor from taxing the rich the full amount of their income in a democracy, as well as limiting the total level of investments it is possible to make the elite pay. Therefore it is very interesting to see that the top 10 % richest people in China in 2008, earn 66% of their total income from the gray economy. In other words, China has a "hidden" economy of 98 thousand million yuan, almost 30% of total GDP, where two thirds of the income from this sector accrue to the richest ten percent (Bekkevold, 2012, p. 101-102).

The logic behind this within my framework would be that the rich are "positioning" themselves for a eventual democracy, and are working to increase the income they will have in the future. This would be equivalent to the rich being able to increase the value of B^r in my model, and even though this is not something I have opened up for in my framework, since the main focus of the model is on the actions of the poor, it might have been an interesting extension. As we discussed in Section 4.1, this would increase the future pay-

off of not having democracy for the elite, and therefore making them more willing to pay more now. But the problem is that they are limited in what it is individually rational to pay now, and the increased B^r would lower this amount. Therefore the actions of the elite are uncertain, and I might have had to change the "rules of the game" and how I model this, if I were to adhere to the possibility to change B.

But if we use some comparative statics and compare two economies where everything is equal but the level of B^r, we see that the rich are better off individually if B^r change, but we also see that since this change lowers the value of $\hat{I}$, it would also help ferment rebellion[35], since the rewards in democracy goes down, making Assumption 2 less likely to hold. If we differentiate Equation (7), that is the value for the poor of having a high revolutionary threat when the elite rule, with respect to B^r, we see that the effect comes through maximum investment: $\hat{I} = A^r - B^r$, and that the differential of $\hat{I}$ with respect to B^r is less than zero, and that the value for the poor obviously goes down from an increase in B^r.

It is also possible to examine an increase in B^r graphically. An increase would shift the level of $q^*(\delta)$ upwards in i.e. Figure 6. It would also reduce the max transfer that the rich can pay in any one period, so if the level of δ is high (that is a move to the right along the curve $q^*(\delta)$ in Figure 6), this further complicates the ability of the elite to use investments as a device to prevent revolution.

All of this would indicate that the Gini-coefficient within China might be more than 0,5, that is that the elite now have more than 50 percent of the total wealth, something that traditionally means that there is a great risk of social unrest. And indeed the number of people protesting against the increased income gap have increased substantially in recent years. So even if it is individually logical to work to increase your B^r, it is not collectively

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[35] "A recent survey of 980 Chinese millionaires found that 46 percent of them were considering leaving China and another 14 percent had already emigrated or were completing the paperwork for relocating [. . .] Many potential emigrants, not surprisingly, are working on a Plan B in case [of] widespread social unrest takes hold or the political winds begin to blow against them." Pettis (2012)

optimal. We can speculate that an attempt to change this dynamic might be one of the real motives behind the new five year plan, with the new focus on welfare and not just growth in GDP [36].

6.4   An Investment Driven Economy

As we have seen, the Chinese model of growth has mainly been driven by investments from the government and growth through a massive export industry. China can reasonably be described as 'the world's factory', and the claim that most of our consumption goods are labeled 'made in China' is not an understatement. But this model of growth, despite its apparent success, has not been without its costs.

The greatest winners of the early reforms were the farmers. They suddenly got the right incentives and were allowed to sell their surplus production on the market. This led to the countryside taking the lead in the early income growth. But as the Chinese economy has changed to more and more investment and export focused growth, the countryside lost out. The average income in the countryside, even though it has increased substantially, is now just one third of the average income of the city dwellers, and the highest income is found in the cities on the coast, such as Shanghai, which have have an average income of five times that on the countryside (Bekkevold, 2012, p. 100).

During the last decade, consumption as a proportion of GDP has fallen with over ten percent. The marginal propensity to save has gone from an already historic high of 40, that is people save 40 cents of every dollar they earn[37], to a propensity to save of close to 60 percent (Guonan Ma and Wang Yi, 2010). This means that investments in production capacity and infrastructure have been prioritized before welfare enhancing services to the citizens.

To create the required transportation systems, expand the production ca-

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[36]See for example Chapter 5 in Bekkevold, Kristoffersen (2012) for more about this.

[37]In comparison, a US citizens spent marginally more than a dollar per dollar earned, before the financial crisis.

pacity, and create the necessary infrastructure for growth, a country needs to have hight levels of investments in the beginning. After this period it is common to have investments relative to consumption to fall, and consumption starting to carry the demand side of the economy, but this has not yet happened in China. To give an example, China recently reached a level of GDP of 1000$ per capita, but they have an investment rate of more than 42 percent. In comparison, Japan and South Korea had an investment rate of 33 percent and 29 percent, respectively, when they had the same level of GDP per capita. In other words, the propensity to consume is still a lot lower in China than in comparable countries, and the economy is still mainly driven by investments.

One of the chief reasons for this high level of savings is the change in the provision of government services. Traditionally, the Chinese government took care of the citizens from the cradle to the grave, with free education, free health care, and guaranteed employment. This system was called the "iron rice bowl". But the iron rice bowl emptied in the 1990's, and a system where people had to pay for these services replaced the old system. In addition, this new system basically only worked in the urban areas, further increasing the discrepancies between the cities and the countryside (Bekkevold, 2012, p. 103). So a 'normal' Chinese citizen is forced to save. They must save towards the child's education, to provide for their parents, and to be able to handle unforeseen expenditures like health care (Moody, 2012).

If we then add the two hundred million migrant workers to this equation, and realize that these have even less access to basic social services, since they work outside their home district[38], we see that the incentive to save in this rather large part of the population is even higher. They are forced to save more, because they can rely even less on the state providing any services (Bekkevold, 2012, p. 105-107).

A high level of savings and the resulting investment level are some of the motivations for creating a model based on investments and not just transfers.

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[38]This is also a consequence of the Huoku system

We might imagine that the people 'agree' to sacrifice some short term benefits for increased growth in the long run, and this is best captured in my expanded model. I would argue that the investment focused growth path is a good validation for the approach the expanded model took towards China.

But changes might be soon to come. The latest five year plan for the period 2011-2015, accepted in the People's Congress in March 2011, gives clear signals of a more consumption driven growth model with more focus on providing welfare. The goal is the creation of a middle class that could provide enough internal demand to fuel the economy for years to come, without the economy being so dependent on the high level of investments. This might again make the investment approach less useful, but so far it has shown itself to be a valid effort to describe the logic behind the Chinese growth miracle, and the fact that the CCP still maintains the 'mandate of heaven'.

7 Concluding Remarks

> Whenever I get stuck on a Chinese macro issue, I always go back
> to two key words – *social stability.* They are, in many respects,
> the Holy Grail of the Chinese growth miracle. I remain abso-
> lutely convinced that China's leadership would do everything in
> its power to avoid destabilizing the social fabric of the nation's
> vast population (Roach, 2012).

This quote sums up my main argument. The elite in China are obsessed with
social stability. This is both because of historical experiences, and because
in order to create growth, stability is a main requirement. In this thesis,
I have examined whether a model that use durable investments instead of
lump sum transfers can be used to better understand the framework behind
China's economic growth. I use the framework developed in Acemoglu and
Robinson (2000), and argue that with some changes, this model is a good
tool to understand the dynamic between the elite and the citizens in China.

As we have seen, I accomplish this by first presenting the insights of A&R
(2000); that democratization is a consequence of the elite's fear of rebellion.
The argument is that because it is impossible for the elite to commit to
future transfers, since they have incentives to break their promise as soon
as the revolutionary threat subsides. The only way the elite can credibly
commit is to give away their power to renege by creating i.e. a democracy.
The second insight we can draw from this model, is that a constant high
threat of revolution does not necessary lead to democratization, but might
help the elite keep power by ensuring a certain level of transfers to the poor.
This last insight is what, I argue, is keeping the elite in China on their toes.

Despite this prediction from their model, we saw that Acemoglu and Robin-
son do not agree that there is an implicit social contract in China. I argue
that this is because they focus on lump sum transfers in their models, and if
we instead let the elite be able to commit to some degree by adding durable
investments as an option to placate the people, we see that there is indeed

good arguments for a social contract. I accomplish this by introducing investments that increases the productivity of the poor into the model. And we see that it is easier for the elite to control the population and prevent revolution, in a model with investments.

More formally, I show that if we build an infinite horizon dynamic model, the inclusion of durable investments and the increased level of commitment this allows the elite to show is dependent on the level of depreciation, δ. Since the level of depreciation decides the durability of the productivity gain the poor get from the investment, the level of depreciation gives an upper limit to the level of commitment that the elite are able to reach. We saw that since q increases in δ, the larger δ, the less of a commitment device the investments become, and the harder it is to use investments to overcome the revolutionary threat.

We also saw that if depreciation is a hundred percent each period, then there is no real difference between the A&R approach with transfers and the extended model with investment, since there is no commitment possibilities. In other words the A&R model turns out to be just a special case of the more general extended model where δ equals 1.

In sum, the expanded model can be said to give a good description of the possible dynamics between the elite and the citizens of China. The inclusion of investment driven growth to create social stability, and the argument that the lessons of history causes social stability to be important, is at least something that Deng Xiaoping, the architect behind China's reforms, argue was the main motivation behind the investment driven growth path. And even though China has gone through huge changes and faced enormous challenges, the last 40 years, the CCP has so far proved adept at using the tools they have at hand to provide growth, and thereby continue to control both the world's second largest economy and the most populous country.

References

Abulof,Uriel, 2011 *What Is the Arab Third Estate?*. The Huffington Post, 10 March 2011

Acemoglu, D. and J.A. Robinson, 1999 *A Theory of Political Transitions* in Massachusetts Institute of Technology Working Paper

Acemoglu, D. and J.A. Robinson, 2000 *Why did the West extend the franchise? Democracy, inequality and growth in a historical perspective* in Quarterly Journal of Economics, 115. pp. 1167-1199.

Acemoglu, D. and J.A. Robinson, 2006 *Economic origins of dictatorship and democracy* Cambridge University Press, Cambridge, 2006

Acemoglu and Robinson, 2012 *Why Nations Fail* Crown Publishers, New York, 2012

Acemoglu and Robinson, 2012
Why Nations Fail - The Blog, http://whynationsfail.com/blog/2012/3/26/further-reader-comments-on-arab-spring.html, 26.03.2012

Apolte, Thomas, 2012 *Why is there no Revolution in North-Korea?* in Journal of Public Choice, 150-3. pp. 561-578.

BBC News China, 2012
China arrests over coup rumours, http://www.bbc.co.uk/news/world-asia-china-17570005, 31 March 2012

Bekkevold, Jo Inge and Kristoffersen, Henning 2012 *Kinas økonomi* Gyldendal Akademisk, Oslo, 2012

Bekkevold, Jo Inge. Kinas utviklingsmodell - fra vekst til velferd? In Bekkevold, Jo Inge and Kristoffersen, Henning, editors, *Kinas Økonomi*, pages 97–115. Gyldendal Akademisk, 2012.

Bjerkholt, Olav. Kina fra fattig u-land til økonomisk stormakt In Bekkevold, Jo Inge and Kristoffersen, Henning, editors, *Kinas Økonomi*, pages 97–115. Gyldendal Akademisk, 2012.

Craig, Ben and Pencavel, John, 1992 *The Behavior of Worker Cooperatives: The Plywood Companies of the Pacific Northwest*, in The American Economic Review, 82. pp. 1083-1105

Dupuy, R. Ernest, and Dupuy, Trevor N., 1970 *The Encyclopedia of Military History: From 3500 B.C. To The Present* New York: Harper & Row, 1970.

Fukuyama, Francis, 2011 *The Origins of Political Order: From Prehuman Times to the French Revolution* Farrar, Straus and Giroux 2011

Fukuyama, Francis, 2012 *Democracy, Development, and the Rule of Law: Acemoglu and Robinson on Why Nations Fail*, http://blogs.the-american-interest.com/fukuyama/2012/03/26/acemoglu-and-robinson-on-why-nations-fail/ 26.03.2012

Guonan Ma and Wang Yi, 2010 *Chinas high saving rate: myth and reality* BIS Working Papers, No 312, June 2010

IMF, 2011 *World Economic Outlook, April 2011* http://www.imf.org/external/pubs/ft/weo/2011/01/index.htm

Kam Wing Chan and Buckingham, Will *Is China Abolishing the Hukou System?* The China Quarterly, 195 , pp 582-606

Kissinger, Henry 2011 *OnChina* Penguin Press, 2011

Krüger, Ingrid, 2010 *Den sære bensinavgiften* Kronikk i Dagsavisen, 6. September 2010.

Krüger, Ingrid, 2011 *Olje kveler ikke opprør* Kronikk i Dagens Nringsliv, 21. June 2011

Locke, John, 2011 *Second Treatise of Government* Hackett Publishing Co, 2011

Machiavelli, Niccolo, 1981 *The Prince* Harmondsworth, UK: Penguin, 1981

McIntyre, Douglas A., 2008 *China Bailout: Making The US Look Cheap* http://247wallst.com/2008/11/09/china-bailout-m/

Miller, Rory, 2012 *Short Term Answers to Long Term Problems: The Arab Revolution and Socio-Economic Planning in the GCC* BRISMES Annual Conference 2012: Revolution and Revolt: Understanding the Forms and Causes of Change 26-28 March 2012, London School of Economics and Political Science

Moody, Andrew, 2012
China Daily: *Reform 2.0* http://europe.chinadaily.com.cn/epaper/2012-03/02/content_14739619.htm, 2012-03-02

North, Douglas C. and Weingast, Barry R., 1989 *Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth Century England* Journal of Economic History, 1989. 48 (4). pp. 803-832.

North, Douglas C., 1994 *Economic Performance Through Time* American Economic Review, 1994. Princeton University Press. 84 (3),. pp. 359-368.

Pettis, Michael, 2012 *When will China emerge from the global crisis?* January 30, 2012

Pettit, Philip, 1997 *Republicanism: A Theory of Freedom and Government* Oxford University Press, New York, 1997

Roach, Steven, 2012 *Spillet om Kinas stabilitet* Kronikk i Aftenposten, 20. April 2012.

Santayana, George 1906 *Reason in Common Sense, volume 1 of The Life of Reason* Archibald Constable & CO. Ltd, London 1906

Vogel, Ezra F., 2011 *Deng Xiaoping - and the transformation of China* Belknap Press of Harvard University Press, Cambridge, 2011

Waldron, Arthur, 1996 *China's New Remembering of World War II: The Case of Zhang Zizhong* Modern Asian Studies , Vol. 30, No. 4, Special Issue: War in Modern China (Oct., 1996), pp. 945-978

Xiaoping, Deng *Excerpts from Talks Given in Wuchang, Shenzhen, Zhuhai and Shanghai: January 18February 21, 1992, Selected Works of Deng Xiaoping, vol. 3* Foreign Languages Press, Beijing, 1994

A   Appendix: Math

A.1   Sums

A.1.1   The Perpetual Discounted Value for the Poor of the Franchise Being Extended

$$V^p(A_{t-1}^p, D) =$$

$$\sum_{s=1}^{\infty} \beta^s \left[(1-\delta)^s A_{t-1}^p + \sum_{\tau=1}^{s} (1-\delta)^\tau \frac{\hat{I}(1-\lambda)}{\lambda} \right] + A_{t-1}^p$$

We see that the "inner sum" $\sum_{\tau=1}^{s} (1-\delta)^\tau \frac{(1-\lambda)}{\lambda} \hat{I}$ equals:

$$(1-\delta) \frac{(1-\lambda)}{\lambda} \hat{I} \sum_{\tau=0}^{s-1} (1-\delta)^\tau$$

$$\Longleftrightarrow$$

$$\frac{1-\delta}{\delta} \hat{I} \frac{(1-\lambda)}{\lambda} (1 - (1-\delta)^s)$$

$$\Longleftrightarrow$$

$$\frac{(1-\delta)}{\delta} \hat{I} \frac{(1-\lambda)}{\lambda} - \frac{(1-\delta)^{s+1}}{\delta} \hat{I} \frac{(1-\lambda)}{\lambda}$$

Continuing with the large expression, now with the solved "inner sum":

$$V^p(A^p_{t-1}, D) =$$

$$A^p_{t-1} + \sum_{s=1}^{\infty} \beta^s \left[(1-\delta)^s (A^p_{t-1} - \frac{(1-\delta)}{\delta} \hat{I} \frac{(1-\lambda)}{\lambda}) + \frac{\hat{I}(1-\lambda)}{\lambda} \right]$$

$$\Longleftrightarrow$$

$$A^p_{t-1} + \sum_{s=1}^{\infty} \left[\beta(1-\delta) \right]^s \left(A^p_{t-1} - \frac{\hat{I}(1-\lambda)}{\lambda} \right) + \sum_{s=1}^{\infty} \beta^s \frac{\hat{I}(1-\lambda)}{\lambda}$$

$$\Longleftrightarrow$$

$$A^p_{t-1} + \beta(1-\delta) \left\{ \sum_{s=1}^{\infty} \left[\beta(1-\delta) \right]^{s-1} \left(A^p_{t-1} - \frac{\hat{I}(1-\lambda)}{\lambda} \right) \right\}$$

$$+ \beta \sum_{s=1}^{\infty} \beta^{s-1} \frac{\hat{I}(1-\lambda)}{\lambda}$$

$$\Longleftrightarrow$$

$$A^p_{t-1} + \beta(1-\delta) \left(A^p_{t-1} - \frac{\hat{I}(1-\lambda)}{\lambda} \right) + \beta \frac{(1-\delta)}{\delta} \hat{I}) \frac{(1-\lambda)}{\lambda} \frac{1}{1-\beta}$$

$$\Longleftrightarrow$$

$$A^p_{t-1} \left(\frac{\beta(1-\delta)}{1-\beta(1-\delta))} + 1 \right)$$

$$+ \hat{I} \frac{(1-\lambda)}{\lambda} \left(\frac{\beta(1-\delta)}{(1-\beta)\delta))} - \frac{\beta(1-\delta)(1-\delta)}{\delta(1-\beta(1-\delta))} \right)$$

$$\Longleftrightarrow$$

$$A^p_{t-1} \left(\frac{1}{1-\beta(1-\delta)} \right) + \hat{I} \frac{(1-\lambda)}{\lambda} \left(\frac{\beta(1-\delta)\delta^2}{\delta^2(1-\beta(\delta+\beta(1-\delta)-2)} \right)$$

After the last little bit of algebra, we then see that t at state A^p_{t-1} is:

$$V^p(D, A^p_{t-1}) = \frac{A^p_{t-1}}{1-\beta(1-\delta)} + \frac{\hat{I}\beta(1-\delta)(1-\lambda)}{(1-\beta[\delta+\beta(1-\delta)-2])\lambda} \qquad (13)$$

A.1.2 The Perpetual Discounted Value of Revolution for the Poor

$$V^p(A_{t-1}^p, R) = \mu \left[\frac{A_{t-1}^p \lambda + A^r(1-\lambda)}{\lambda} \right] + \sum_{s=1}^{\infty} \beta^s \mu \left[\frac{A_{t-1}^p(1-\delta)\lambda + A^r(1-\lambda)}{\lambda} \right]$$

$$\Longleftrightarrow$$

$$\mu \left[\frac{A_{t-1}^p \lambda + A^r(1-\lambda)}{\lambda} \right] + \sum_{s=1}^{\infty} \left[\frac{A^r(1-\lambda)}{\lambda} \right] \beta^s \mu + \sum_{s=1}^{\infty} \left[\beta(1-\delta) \right]^s \frac{\lambda A_{t-1}^p \mu}{\lambda}$$

$$\Longleftrightarrow$$

$$\mu \left[\frac{A_{t-1}^p \lambda + A^r(1-\lambda)}{\lambda} \right] + \left[\frac{A^r(1-\lambda)\mu}{\lambda} \right] \frac{\beta}{1-\beta} + \frac{\lambda A_{t-1}^p \mu}{\lambda} \frac{\beta(1-\delta)}{1-\beta(1-\delta)}$$

After a bit of algebra, we then see that the perpetual discounted value of revolting at state A_{t-1}^p is:

$$V^p(R, A_{t-1}^p) = \mu \left(\frac{A^r(1-\lambda)}{\lambda(1-\beta)} + \frac{A_{t-1}^p}{1-\beta(1-\delta)} \right) \tag{14}$$

A.1.3 The Perpetual Value for the Poor of a One Time Max Transfer

Here we see that the perpetual value for the poor of a **one time** maximum transfer from the rich, equals:

$$A_{t-1}^p(1-\delta) + \frac{\hat{I}(1-\lambda)}{\lambda} + \sum_{s=1}^{\infty} \left[\beta(1-\delta) \right]^s \left(A_{t-1}^p + \frac{\hat{I}(1-\lambda)}{\lambda} \right)$$

$$\Longleftrightarrow$$

$$A_{t-1}^p(1-\delta) + \frac{\hat{I}(1-\lambda)}{\lambda} + \left(\frac{A_{t-1}^p + \dfrac{\hat{I}(1-\lambda)}{\lambda}}{1-\beta(1-\delta)} \right)$$

$$\Longleftrightarrow$$

$$A_{t-1}^p \left\{ \frac{\left[1-\beta(1-\delta) \right](1-\delta) + 1 + \dfrac{\hat{I}(1-\lambda)}{\lambda}}{1-\beta(1-\delta)} \right\} + \frac{\hat{I}(1-\lambda)}{\lambda}$$

A.2 Guess and Verify - Value Functions

These are the value functions for the citizens at the specified states, using "guess and verify" to obtain the value functions. Equation (3) is here (I), and Equation (7) is (II)

$$
V^p(\mu^l, A^p_{t-1}, E) = A^p_{t-1}(1 - \delta)
$$
$$
+ \beta \Big[(1 - q)V^p(A^p_t, \mu^l, E) + qV^p(A^p_t, \mu^h, E) \Big] \tag{I}
$$

$$
V^p(\mu^h, A^p_{t-1}, E, I^r) = A^p_{t-1}(1 - \delta) + I^r
$$
$$
+ \beta \Big[qV^p(A^p_t, \mu^h, E, I^r) + (1 - q)V^p(A_t, \mu^l, E) \Big] \tag{II}
$$

Guess:

$$
V^p(\mu^l, A^p_{t-1}, E) = \alpha_0 + \alpha_1 A_{t-1} \tag{A}
$$
$$
V^p(\mu^h, A^p_{t-1}, E) = \gamma_0 + \gamma_1 A_{t-1} \tag{B}
$$

Verify: Inserting (A) into (I) and (B) into (II).

$$
\alpha_0 + \alpha_1 A_{t-1} = A_{t-1}(1 - \delta)
$$
$$
+ \beta \Big\{ q[\gamma_0 + \gamma_1(1 - \delta)A_{t-1}]
$$
$$
+ (1 - q)[\alpha_0 + \alpha_1(1 - \delta)A_{t-1}] \Big\} \tag{I*}
$$

$$
\gamma_0 + \gamma_1 A_{t-1} = A_{t-1}(1 - \delta) + \hat{I}
$$
$$
+ \beta \{ q[\gamma_0 + \gamma_1(1 - \delta)A_{t-1} + \hat{I}]
$$
$$
+ (1 - q)[\alpha_0 + \alpha_1(1 - \delta)(A_{t-1} + \hat{I})] \} \tag{II*}
$$

Rearranging Equation (I*), and Equation (II*):

$$\alpha_0 - \beta q\gamma_0 - \beta(1-q)\alpha_0 =$$
$$\{(1-\delta) - \alpha_1 + \beta q(1-\delta)\gamma_1 + \beta(1-q)(1-\delta)\alpha_1\}A_{t-1}$$

$$\gamma_0 - \beta q\gamma_0 - \beta(1-q)\alpha_0 - \hat{I}(1 + \beta q\gamma_1 + \beta(1-q)\alpha_0 =$$
$$\{(1-\delta) - \gamma_1 + \beta q(1-\delta)\gamma_1 + \beta(1-q)(1-\delta)\alpha_1\}A_{t-1}$$

We now see that for the expressions within the curly brackets to be 0, then $\alpha_1 = \gamma_1$. Thus we have:

$$(1-\delta) - \gamma_1 + \beta(1-\delta)\gamma_1 = 0$$
$$\Longleftrightarrow$$
$$\gamma_1[1 - \beta(1-\delta)] = (1-\delta)$$
$$\Longleftrightarrow$$
$$\gamma_1 = \frac{1-\delta}{1 - \beta(1-\delta)} = \alpha_1$$

For the left hand side of Equation (I*) to be 0:

$$[1 - \beta(1-q)\alpha_0 = \beta q\gamma_0$$
$$\Longleftrightarrow$$
$$\alpha_0 = \frac{\beta q}{1 - \beta(1-q)}\gamma_0 \qquad\qquad \text{(IV)}$$

Inserting the values for α_1 and γ_1 and setting the left hand side of Equation (II*) = 0:

$$1 - \beta q \gamma_0 - \beta(1-q)\frac{\beta q}{1 - \beta(1-q)}\gamma_0 =$$
$$\hat{I}\left[1 + \beta q \frac{1-\delta}{1 - \beta(1-\delta)} + \beta(1-q)\frac{1-\delta}{1 - \beta(1-\delta)}\right]$$

$$\Longleftrightarrow$$

$$\gamma_0\left[(1-\beta q) - \frac{\beta(1-q)\beta q}{1 - \beta(1-q)}\right] = \frac{\hat{I}}{1 - \beta(1-\delta)}$$

$$\Longleftrightarrow$$

$$\frac{(1-\beta)}{1 - \beta(1-q)}\gamma_0 = \frac{\hat{I}}{1 - \beta(1-\delta)}$$

$$\Longleftrightarrow$$

$$\gamma_0 = \frac{1 - \beta(1-q)}{1 - \beta(1-\delta)(1-\beta)}\hat{I}$$

Inserting back in Equation (IV), we get:

$$\alpha_0 = \frac{\beta q}{1 - \beta(1-q)}\frac{1 - \beta(1-q)}{1 - \beta(1-\delta)(1-\beta)}\hat{I}$$

$$\Longleftrightarrow$$

$$\alpha_0 = \frac{\beta q}{(1 - \beta(1-\delta))(1-\beta)}\hat{I}$$

So now we know that the 4 equations we need look like this:

$$\alpha_0 = \frac{\beta q}{(1 - \beta(1-\delta))(1-\beta)}\hat{I} \tag{15}$$

$$\gamma_0 = \frac{1 - \beta(1-q)}{(1 - \beta(1-q))(1-\beta)}\hat{I} \tag{16}$$

$$\gamma_1 = \frac{1-\delta}{1 - \beta(1-\delta)} = \alpha_1 \tag{17}$$

So the end result is that the true form of Equation (3) is:

$$V^p(A_{t-1}^p, \mu^l, E, \hat{I}) =$$
$$\frac{\beta q}{(1 - \beta(1 - \delta))(1 - \beta)}\hat{I} + \frac{1 - \delta}{1 - \beta(1 - \delta)}A_{t-1}^p \qquad \text{(I**)}$$

And the true form of Equation (7) is:

$$V^p(A_{t-1}^p, \mu^h, E, \hat{I}) =$$
$$\frac{1 - \beta(1 - q)}{(1 - \beta(1 - \delta))(1 - \beta)}\hat{I} + \frac{1 - \delta}{1 - \beta(1 - \delta)}A_{t-1}^p \qquad \text{(II**)}$$

A.3 $q^*(\delta)$

We know that q^* is defined by: $\hat{V}^p(A_{t-1}^p, \mu^h, E|q*) = V^p(A_{t-1}^p, R)$

That is:

$$\frac{1 - \beta(1 - q)}{(1 - \beta(1 - \delta))(1 - \beta)}\hat{I} + \frac{1 - \delta}{1 - \beta(1 - \delta)}A_{t-1}^p = \mu\Big(\frac{A^r(1 - \lambda)}{\lambda(1 - \beta)} + \frac{A_{t-1}^p}{1 - \beta(1 - \delta)}\Big)$$

By rearranging and solving for q^* we get:

$$q^* = -\frac{\hat{I}(\beta - 1)}{\beta\hat{I}} +$$

$$\frac{\left\{\mu^h\left[\dfrac{A^r(1-\lambda)}{\lambda(1-\beta)} + \dfrac{A^p_{t-1}}{1-\beta(1-\delta)}\right]\right.}{\beta\hat{I}}$$

$$\frac{\left.-\dfrac{(1-\delta)A^p_{t-1}}{1-\beta(1-\delta)}\right\}\left(1-\beta(1-\delta)\right)\left(1-\beta\right)}{\beta\hat{I}}$$

$$\Longleftrightarrow$$

$$\frac{-\hat{I}(\beta-1) + \dfrac{\mu^h A^r(1-\lambda)}{\lambda}\left[1-\beta(1-\delta)\right]}{\beta\hat{I}} +$$

$$\frac{A^p_{t-1}(1-\beta)\left[\mu^h - (1-\delta)\right]}{\beta\hat{I}}$$

That is:

$$q^* = \frac{-\hat{I}(\beta-1) + \dfrac{\mu^h A^r(1-\lambda)}{\lambda}\left[1-\beta(1-\delta)\right] + A^p_{t-1}(1-\beta)\left[\mu^h - (1-\delta)\right]}{\beta\hat{I}}$$

Which is the same as Equation (12) in Section 4 is therefore the expression of $q^*(\delta)$ in Figure 3.

If we differentiate Equation (12), we see that we get:

$$\frac{\partial q*}{\partial \delta} = \frac{\dfrac{\mu^h \beta A^r(1-\lambda)}{\lambda} + A^p_{t-1}(1-\beta)}{\beta\hat{I}} > 0$$

Which is strictly positive and independent of δ.

61

A.4 The Values of Figure 3

In Figure 3, I have used the following values on my variables:

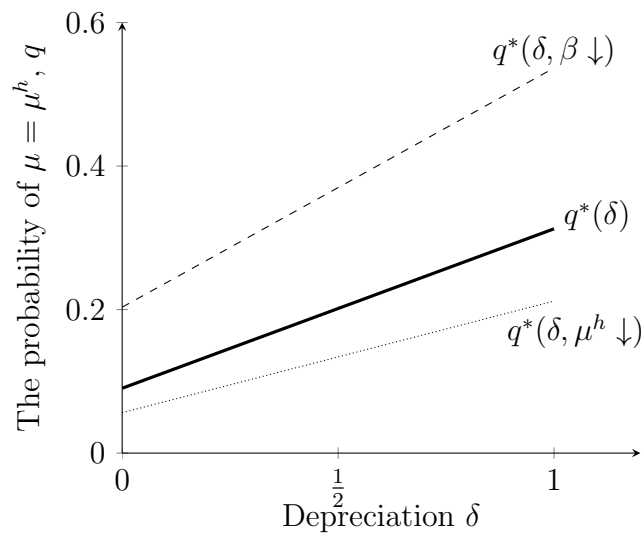|	
A^p_{t-1}	$0,8$
A^r	2
β	$0,9$
μ^h	$0,6$
λ	$0,9$
$\hat{I}$	1

A.4.1 Various Shifts in the Values of Figure 3

Figure 7: Here we see the difference between the $q^*(\delta)$ that uses the values from Section A.4, and a $q^*(\delta)$ where μ^h is lowered from 0,6 to 0,3. And a q^* where β is lowered from 0,9 to 0,8