Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Lecture with Computer Exercises:
Modelling and Simulating Social Systems with MATLAB

Project Report

The Second-Order Tocqueville Paradox.
How Social Inequality and Class-Dependent Decision Behaviour May Dampen Frustration - An Agent-Based Simulation

Joel Berger, Milan Bombsch & Dai Zhonghuan

Zurich
December 2013

Agreement for free-download

We hereby agree to make our source code for this project freely available for download from the web pages of the SOMS chair. Furthermore, we assure that all source code is written by ourselves and is not violating any copyright restrictions.

Name 1 Name 2 Name 3

Contents

1 Abstract **4**

2 Individual Contributions **4**

3 Introduction and Motivations **4**

4 Description of the Model **5**
4.1 Basic Model 5
4.2 Extended Model 7

5 Implementation **8**
5.1 the static baseline model 8
5.2 the dynamic baseline model 9
5.3 the extended dynamic model 9
5.4 additional functions and scripts 11

6 Simulation Results and Discussion **12**
6.1 Results 12
6.2 Discussion 15

7 Summary and Outlook **16**

8 References **16**

1 Abstract

2 Individual Contributions

3 Introduction and Motivations

According to the historian Alexis de Tocqueville, before the French revolution, economic and social conditions improved. Due to these improvements, the French got more frustrated and this ultimately lead to the outbreak of the revolution (Tocqueville 1952 [1856]). Based on this observation, the phenomenon that in a social system aggregate frustration may increase when conditions improve and that regimes are regularly overthrown during times of political liberalisation and economic growth is called "Tocqueville's paradox" (Neckel 2010). Tocqueville's paradox has been observed in further studies: In Iran, the Shah was overthrown after a phase of economic growth and the Soviet Union collapsed during reforms by Gorbatschow (Coleman 1990). Moreover, the English, American, and Russian revolutions occurred in correspondence with Tocqueville's hypothesis (Brinton 1965). A similar phenomenon from a cross-sectional perspective is that soldiers in the US-army were more dissatisfied in branches with high chances for upward mobility compared to low-mobility branches (Stouffer et al. 1965).

Although many explanations of Tocqueville's paradox have been proposed (e.g. Merton and Rossi 1957), the game theoretic model by the French sociologist Raymond Boudon (1988, 1982) provides the most elaborated one (Raub 1984). In the basic model, homogeneous actors are assumed. In the study at hand we relax this assumption by introducing social inequality and investigate into how this influences the occurrence of Tocqueville's paradox. More specifically, we implement the competition model as an agent-based simulation (Epstein 2007, Nigel 2008), extending the basic model by two features. First, we implement the model dynamically, which leads to the endogenous emergence of social inequality. Second, we account for the empirical fact that rich individuals invest with a higher probability in upward mobility than people from lower strata in order to reproduce their social position (Breen and Goldthorpe 1997). Our research question is whether social inequality in combination with class-specific decision behaviour alters the model predictions of rising frustration under improved circumstances. It is important to know under which conditions Tocqueville's paradox occurs: When opening a mobility structure, it is essential to prevent the diffusion of frustration and a waste of resources.

The further paper is organised as follows. First, we outline the basic model and its extension (4) and describe the model implementation (5). Subsequently, the results are presented and discussed (6). The paper concludes with a summary and an outlook (7).

4 Description of the Model

4.1 Basic Model

The competition model was introduced by Boudon (1982, 1988), but more exactly specified by Raub (1984). The following sketch of the basic model relies on work by Berger and Diekmann (2013) and Raub (1984).

In a social system, N players can decide whether or not to invest resources C, e.g. effort or money, in a competition for a highly valued and scarce good such as a well paid position within a firm. There are k available positions (equivalently: opportunities) and n investors. While k is common knowledge, the number of investors can range from 0 to N. Successful investors get access to the highly valued good and therefore receive the high payoff α, which is given by gross benefit B (e.g. power, money or prestige) minus investment costs C. In the case of a university student, C might be time and money invested in education while other individuals of the same age have already entered the labour market, earning money.

If the number of investors n exceeds the amount of free positions k, some investors fail to obtain a lucrative position. Even though they have spent the same amount of C as the successful investors, the losers get nothing in return and consequently are frustrated. The losers receive the low payoff γ, which is given by the status quo minus C. A real-life example is an overeducated, yet underpaid university graduate (Peiro, Agut and Grau 2010). Sustainers, e.g. individuals entering the labour market early and not competing for desirable but scarce positions, will neither get a well high-prestige job nor will they lose any resources. This is represented by the moderate payoff β. The payoffs satisfy the inequalities $\alpha > \beta > \gamma$.

Probability of promotion for an agent choosing the strategy 'invest' is given by the ratio of the number of lucrative positions k to the number of investors n. It should be noted that all N players decide simultaneously whether or not to invest. Thus, before the decisions are made, the actual number of investors n is not known while the number of desirable positions k is common knowledge. The higher the number of investors for a given number positions, the lower the chances of success for each agent.

Given α, γ, and k the expected payoff $E\_invest(k, n, \alpha, \gamma)$ for a specific number of investors n can be obtained from equation (1):

$$E\_invest(k, n, \alpha, \gamma) = \begin{cases} \frac{k}{n}\alpha + \frac{n-k}{n}\gamma & \text{for } k < n \\ \alpha & \text{for } k \geq n \end{cases} \tag{1}$$

Given this, the game matrix from the perspective of a player i can be constructed (see figure 1). The assumptions of this baseline model are in accordance with classical game theory. The rules of the game are common knowledge and each player knows that the other players are rational and maximise their expected utility.

		Number of other investors ($n-1$)				
		0	1	2	...	$N-1$
Player i	invest	E(k, 0)	E(k, 1)	E(k, 2)	...	E(k, $N-1$)
	not invest	β	β	β	...	β

Figure 1: *Game matrix from perspective of player i.* $E(k, n-1) = E\_invest(k, n, \alpha, \gamma)$

If the expected payoff of the strategy 'invest' for a specific number of positions and competitors $E\_invest(k, n, \alpha, \gamma)$ exceeds the sustainers payoff β independently of the actual number of investors, 'invest' is the dominant strategy. For the case that no dominant strategy exists, there is a threshold n^* with the following property: As long as maximally n^* players choose to invest, the expectation of an investment exceeds the payoff β. So there are $\binom{N}{n}$ asymmetrical Nash equilibria in pure strategies, in which n^* agents choose 'invest' and $1 - n^*$ gents choose 'not invest'. However, since homogeneous actors are assumed and communication is not possible, none of these pure-strategy equilibria is likely to be realised. Thus, the rational solution lies in mixed strategies (Gintis 2009, Nash 1950), with an optimal investment probability p^* that can be derived from equation (2). The more positions k there are, the higher is the probability that a given actor chooses to compete.

$$
\begin{aligned}
&E\_investOverall(k, N, \alpha, \beta, \gamma)\\
=&\binom{N-1}{0} \cdot p^0 \cdot (1-p)^{N-1} \cdot E\_invest(k, 1, \alpha, \gamma) +\\
&\binom{N-1}{1} \cdot p \cdot (1-p)^{N-2} \cdot E\_invest(k, 2, \alpha, \gamma) +\\
&\binom{N-1}{2} \cdot p^2 \cdot (1-p)^{N-3} \cdot E\_invest(k, 3, \alpha, \gamma) +\\
&\ldots +\\
&\binom{N-1}{N-1} \cdot p^{N-1} \cdot (1-p)^{N-N} \cdot E\_invest(k, N, \alpha, \gamma) = \beta
\end{aligned}
\tag{2}
$$

The expected relative share of investors then equals p^*, which is the solution of

$E\_investOverall$. In the case that there are more investors than free positions, the relative frequency of winners in a group of N is given by the ratio of scarce positions k and the group size (k/N) and the loser rate can be obtained by subtracting the winner rate from the investor rate ($p^* - k/N$). In the case that the number of investors is lower than the number of positions, every investor wins. The rate of the frustrated equals zero.

If the winners' payoff α is sufficiently attractive in comparison to the sustainers' payoff β and the losers' payoff γ, a small increase in the number of opportunities k can lead to excessive over-investment. The number of competitors exceeds the number of free positions by far and thus, the share of the frustrated grows: Tocqueville's paradox emerges at the aggregate level as the unintended consequences of rational, interdependent individual decisions. Nevertheless, in case that α is not too tempting in comparison to the other payoffs, an increase in the opportunities leads to a comparable increase in investors. Consequently, frustration does not diffuse (Berger and Diekmann 2013). In the following, we investigate parameter constellations that produce an over-investment and thus, a waste of resources. This is the more problematic and thus, the more interesting case.

4.2 Extended Model

Boudon's model predicts the occurrence of Tocqueville's paradox based on the assumptions of homogeneous and perfectly rational agents. In order to make the model more realistic, we relax these assumptions. First, we introduce social inequality, that is, agents with different endowments. Second, the agents' investment decisions depend on their endowments - a fact that has been empirically established (e.g. Breen and Goldthorpe 1997).

We introduce social inequality by implementing the model dynamically. In doing so, starting from a perfectly equal society, inequality emerges endogenously, which is more elegant than introducing heterogeneous agents by assumption (Epstein 2007). Additionally, we investigate what happens, when investment decisions are not perfectly rational but depend on an agents financial endowment. Rich agents, that is, agents with an endowment that deviates positively from the starting value, invest with a higher than the optimal probability while poor agents whose endowment deviates negatively from the starting value rather abstain from investing. This captures the empirical fact that people from higher social strata rather invest in higher education than people from lower strata, given the same ability (Breen and Goldthorpe 1997). According to Breen and Goldhorpe (1997), people have a preference for maintaining their social position. The higher the social position, the higher the investment necessary in order to reproduce this position in the next generation. For instance, for reproducing the parents' upper-middle class position, an offspring has to graduate at the university level. In the framework of our model, one can also argue that the weight of the investing cost C (that is, the difference between β and γ) increases, the lower an endowment of an agent is (analogically to Engel's law, see Pasinetti 1981).

In order to describe the state of the system, we introduce the following measures. *Happiness* H is defined as the relative share of winners minus the relative share of losers in the population, divided by group size N. Negative values indicate a system with more losers while positive values indicate the opposite. Specifically, -1 indicates the worst and 1 the best of all possible societal states. The Gini coefficient G describes the amount of financial *inequality* (see Pyatt 1976). While 0 describes a perfectly equal society, the measure takes on the value 1 if one single individual possesses the whole amount of wealth available. Finally, the *mean* M in a social system is defined as the mean endowment over all agents, which indicates wether the whole society makes progress or regress compared to the start (M = 0).

5 Implementation

The simulation model was implemented with Matlab. First, we programmed the static game theoretic model. As a second step, we implemented the model as a dynamic agent-based simulation. As a third step, we introduced the class-specific bias c.

All code is available online at: https://github.com/MiB3/project_Tocqueville_msssm

5.1 the static baseline model

First we implemented the function $E\_invest(k, n, \alpha, \gamma)$ which corresponds to equation (1) and calculates the expected payoff per investor n for a given number of positions k, the number of investors and the winners payoff α and the losers payoff γ. γ is typically negative, as you pay something if you invest but don't win.
The function $E\_investOverall(k, N, \alpha, \beta, \gamma)$ calculates the ideal strategy for an individuum to invest (using equation 2). It returns the percentage value with which an agent should invest, if there are so and so many positions and other agents in the game. k is again the number of positions and N denotes the size of the hole population (= number of agents). This size should not be choosen to be > 100 as equation 2 involves a lot of binomial coefficients and therefore gets to hard to calculate. This is not a problem since the behaviour of bigger societies would be similar to the one of small ones. This is also the reason why we restrict ourselves in the examples to a society of 49 agents.

With these two functions we can conclude the *static baseline model* and produce the *win_lose_plot*$(N, \alpha, \beta, \gamma)$ (see figure 6), which demonstrates the Tocqueville paradox. This is, it is possible that the number of available positions increases and though the number of loser increases as well (and even faster). In the plot this corresponds to the red line beeing above the green one.

5.2 the dynamic baseline model

For the *dynamic baseline model* we wrote the function *plot_society_sim*$(k, N, \alpha, \beta, \gamma, c, it, popu)$. The parameters $k, N, \alpha, \beta, \gamma$ denote the same values as before. The paramter c is only relevant for the *extended dynamic model*. For now we set it to 0. With the parameter *it* one can set the number of iterations the simulation should be performed. An iteration corresponds to a timestep in wich each agent decides on its own wether to invest or not. The winners will be rewarded with α and the losers with γ. As we usually choose β to be 0, the noninvestors will keep their current endowment. The last parameter *popu* can be used to start from a different endowment distribution among the agents. It is a matrix which corresponds to the starting society.
In this function all parameters can be omitted, which will set them to default values for the simulation.
This function produces 2 plots and a video.
For these plots we needed to calculate the gini coefficient. For this task we used an extern function *ginicoeff(In,dim,nosamplecorr)*. It's license is provided among the source code of this project.

The first plot (see figure 2) is an overview-plot of the society where each agent is assigned a gray colour between black (low endowment) and white (high endowment). This overview changes in every iteration and after the end of the simulation shows the final state of the society. In each iteration the mean, the gini coefficient and the happiness for this step is shown.

The second plot (see figure 3) shows the evolution of the mean, the gini coefficient and the happiness over time. For each iteration step we record these values.

The video (society_sim.mp4) we produce simply includes all the overview-plots and can be watched to see how the society evolves over time.

5.3 the extended dynamic model

The implementation of the *extended dynamic model* is included in the function *plot_society_sim*$(k, N, \alpha, \beta, \gamma, c, it, popu)$. The relevant parameter for this part is c. If you set $c = 0$ you get the *dynamic baseline model*. If c is greater than 0, this means

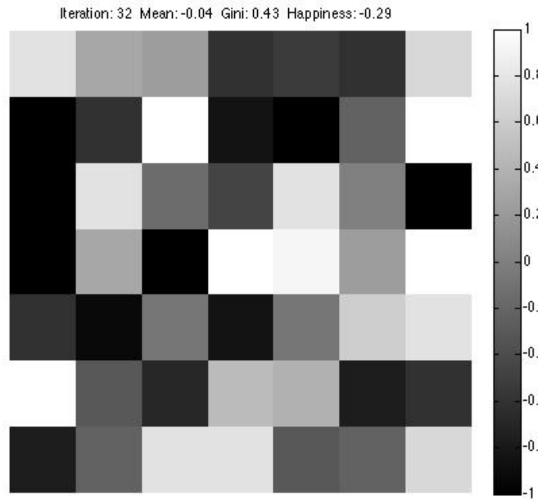

Figure 2: One shot of the society during a simultion. 1 = rich agent, 0 = poor agent.

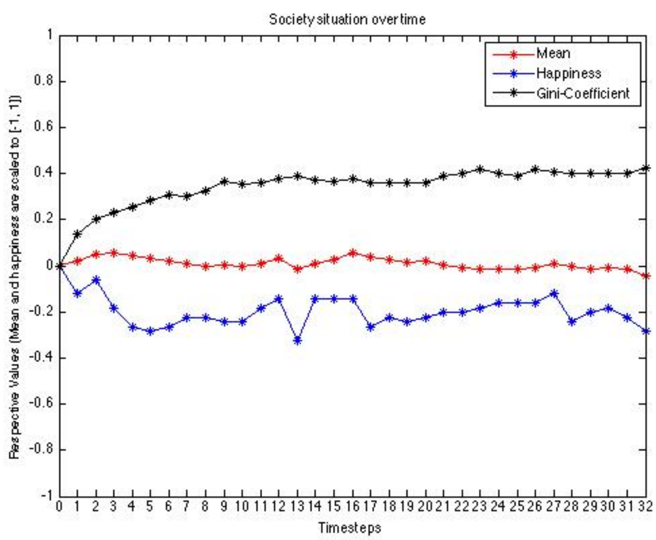

Figure 3: The evolution of the mean, gini coefficient and happiness of the hole society over time.

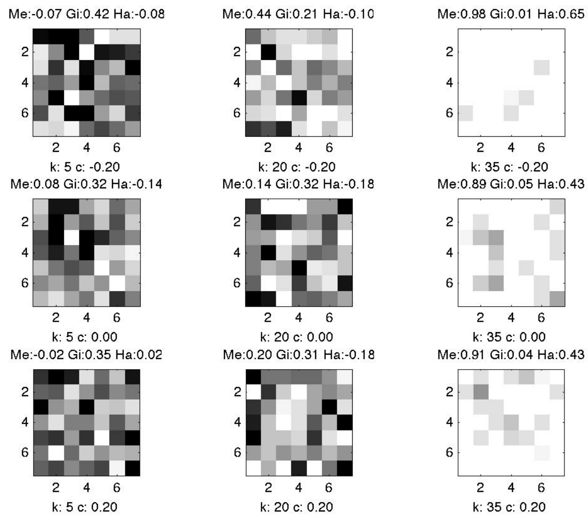

Figure 4: The outcome of simulations with different k and c values.

that rich agents invest with higher probability and poor ones with lower probability. The probability is calculated by $p^* + p^* \cdot c \cdot (\textit{the endowment of the agent})$. Where p^* is the ideal probability to invest. If you set c to a value lower than 0, agents with a high endowment invest with a lower probalility and agents with a low one with lower probability. Empirical test show that $c = 0.2$ is a good choice, which reflects the fact that rich people invest more in upwards mobility and education wehre poor people do not have the endowment to do so.

5.4 additional functions and scripts

$default.mat$ stores some default values for k, N, α, etc. and can be loaded into matlab with: load('default.mat')

create_all_plots.m is a script which creates a comparison plot for diverent k and c values. It produces a video for each combination of a k and a c value. In the end it plots all overview-plots next to eacht other (see figure 4) and a plot which includes the different evolutions of the mean, the gini coefficient and the happiness (see figure 5).

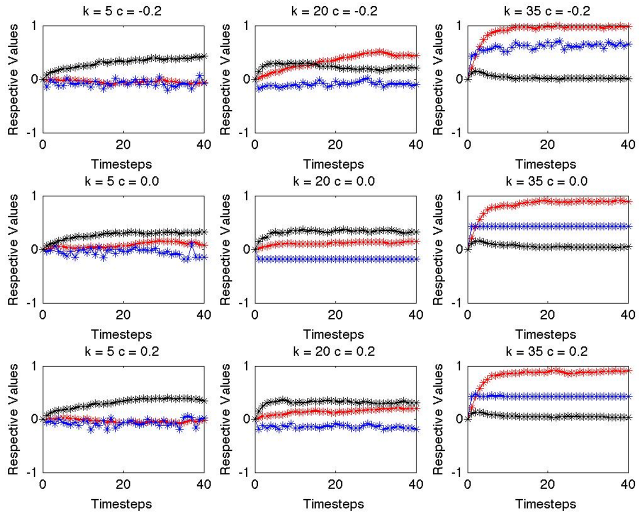

Figure 5: The evolution of the mean, the gini coefficient and the happiness over time for different k and c values.

6 Simulation Results and Discussion

6.1 Results

For the purpose of analysing the simulation model we chose the payoffs $\alpha = 0.3846$, $\beta = 0$ and $\gamma = -0.2308$. It is known how the model reacts to chances in the payoffs (see Raub 1984). Hence, we do not report results on this. As mentioned before, these values were chosen because this leads to the emergence of Tocqueville's paradox, which is a problematic phenomenon: If a society invests in social improvements or an organisation in better chances of promotion this should be done in a way not leading to a waste of resources and an increase in frustration.

In order to report the main results, we selected three typical competition structures, namely a *low-mobility* ($k = 5$), a *moderate-mobility* ($k = 20$), and a *high-mobility* ($k = 35$) structure. All other values of k lead to outcomes that are mixtures of these three ideal types. For each of the three typical values of k we report the results of a simulation that is based on 40 iterations and 49 agents.[1] Robustness checks indicate that both of these values are sufficient to produce stable results. After a short note on the static baseline model, we report results from the dynamical baseline model with rational investment behaviour. Subsequently, the results from

[1] 49 is a quadratic number and this produces more appealing visualisations then an even number such as 50.

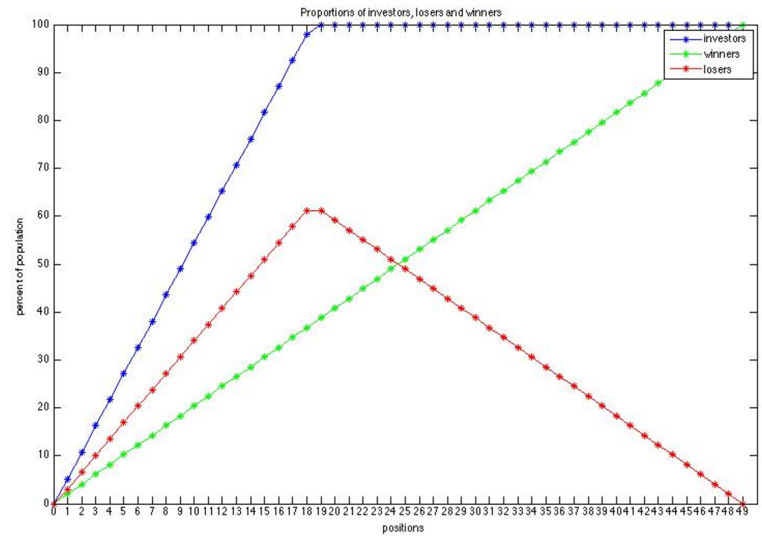

Figure 6: Win-Lose-Plot for a society of 49 agents.

the extended dynamical model with biased decisions are presented. To describe the system state, we report aggregate happiness (H) and, if meaningful, social inequality (G) and the mean (M). Additionally, we refer to the rates of investors and losers, if necessary. Moreover, graphical visualisations are provided.

In the *static baseline model*, the number of agents choosing to invest increases with the number of opportunities. More specifically, the investor rate grows faster than the number of free positions. Thus, the loser rate increases and peaks at $k = 19$. Thereafter, the rate of the frustrated loser decreases again (see figure 6). This suggests that competition structures with either low or high mobility chances lead to more aggregate happiness than moderate-mobility systems - a result that has already been demonstrated by Boudon (1982, 1988).

When running the *dynamic baseline model*, starting with a perfectly equal society, the model generates social inequality endogenously. That is, agents that invest in vain lose money while lucky agents get richer. Thus, in the second round, the losers from the previous round have a lower and the winners a higher endowment compared to the standard endowment. After each round, the endowment of the agents choosing to invest changes. This is reflected by the Gini coefficient that starts with zero and rises over the iterations until reaching a certain level depending on the number of free positions ($G \approx 0.37$ in the case of 5 positions, $G \approx 0.32$ in the case of 20 and $G \approx 0.04$ in the case of 35 positions). When comparing the three typical systems, as in the static model, the loser rate and hence, happiness, is lowest in the system with moderate mobility ($H \approx -0.18$) while it is higher in both other cases (low mobility: $H \approx -0.07$, high mobility: $H \approx 0.43$). The model demonstrates that on the aggregate level, happiness must not necessarily positively correlate with the mean: the mean increases with k while aggregate happiness does not. Note however that the model does not account for happiness that is generated by the absolute amount of wealth (mean x population size), which would probably change this result.[2]

Finally, we ran the *extended dynamic model* based on class-specific decision behaviour. That is, 'poor' agents with an endowment below the starting value invest with a lower than the rational probability p^* while rich agents invest with a higher probability. More specifically, the bias of the optimal investment probability depends on an agent's endowment.This leads to counterintuitive results: The frustration rate lies lower and thus, aggregate happiness higher when the agents behave non-rationally. We refer to this effect as the *second-order Tocqueville paradox*: While more opportunities can lead to a lower level of happiness (Tocqueville paradox), more inequality in combination with class-dependent non-rational investment decisions can rise aggregate happiness (second-order Tocqueville paradox).

To discuss this in some more detail, let us first focus on a moderate-mobility system ($k = 20$). While in the dynamic baseline model happiness equals -0.18 strict, in the extended model, it is around -0.12, but never below -0.18, after 40 iterations. An increase in aggregate happiness is also observed in the low and the high-mobility system. The important observation is that the hapiness of the *extended dynamic model* never gets below the hapiness of the *dynamic baseline model* after the first 10 rounds. A key element leading to over-investment is a coordination problem inherent to the interdependent decision situation. Because actors cannot coordinate, they invest with a certain probability that results in a Nash equilibrium in mixed strategies that, as we have demonstrated, may imply over-investment. Class-specific investment decisions dampens investment and thus frustration. More specifically, when in a given round the competition generates more losers than winners, in the subsequent iteration more individuals are discouraged from investing (the losers) than are encouraged to invest (the winners). Consequently, in the extended model, potential losers are prevented from investing (and losing again) while for the remaining investors the probability of winning increases. This results in a smaller number

[2]Nevertheless, studies demonstrate that at in affluent societies an individual's relative standing in the income distribution matters more for her happiness than absolute income (see Easterlin 1995).

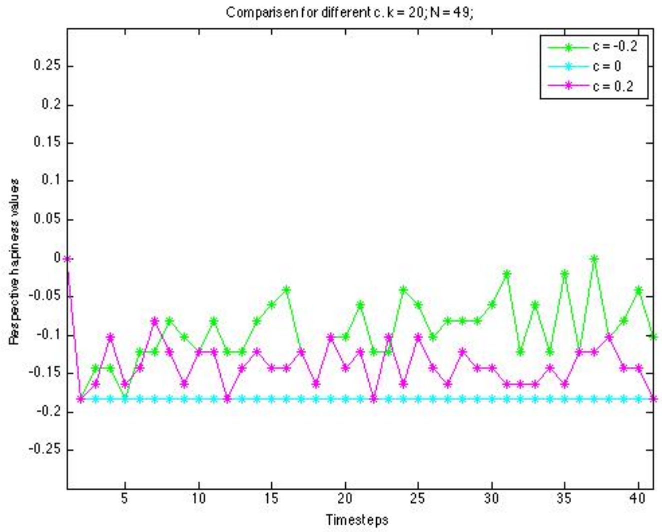

Figure 7: class-dependent investment behaviour ($c \neq 0$) can only have a positive effect on the hapiness!

of losers and a higher number of winners than in a comparable situation in the basic model. Thus, aggregate happiness lies higher in a system with heterogeneous agents that invest with a class-specific bias that depends on their financial endowment.

Is it possible that class-dependent investment behaviour leads to the opposite effect of producing more frustration under certain parameter-constellations? The answer is no. In principle, this would only be possible in situations, in which the system produces more risk seeking winners than risk aversive losers. A precondition for the winners outnumbering the losers is a large share of opportunities k. However, if k is large,investing becomes a dominant strategy, that is, the optimal probability of investing p^* equals 1. This implies that the distortion parameter c only affects the losers' but not the winners' decisions since p^* by definition cannot lie above 1. Thus, even in this situation the rate of the frustrated is somewhat lower and happiness somewhat higher than in the basic model (see figure 7).

6.2 Discussion

The extended model accounting for social inequality and class-specific investment behaviour leads to higher aggregate happiness. Does this imply that policy should foster social inequality? The answer is no. First, the model is still very simple and further factors not considered might affect the well-being of a population. For instance, inequality aversion might dampen happiness when inequality becomes to extreme (Fehr and Schmidt 1999). Further, the positive side effect of inequality and class-dependent decision behaviour lies in dampening the inefficient investment of resources and consequently preventing an increase in frustration. Evidently, any mechanism that produces this effect is an alternative to class-specific investment behaviour. Optimally, exactly k actors would invest and $N - k$ actors would abstain from investing. However, it will not be easy to find an individual decision mechanism that leads to this result. An alternative to a decentralised mechanism is an institutional solution. A real life example are grades: Only individuals with high grades are allowed to attend a university and this prevents an inflation of university certificates.

7 Summary and Outlook

The paper at hand discusses a game theoretic competition model that explains the puzzling phenomena that improved social conditions such as an increase of chances for upward mobility in a social system might foster frustration - a phenomenon that is called Tocqueville's paradox. By implementing the originally static model as a dynamical one, the model generates social inequality. Moreover, we implemented class-specific investment behaviour. That is, the investment probability is dependent on an agent's endowment. The higher the endowment lies above the starting value the more risk seeking an agent becomes. Contrarily, the more an agent's endowment negatively deviates from the starting value, the more risk aversively an agent behaves. This wealth-dependent, irrational decision behaviour dampens Tocqueville's paradox: Aggregate happiness is higher when agents decide with a class-specific bias. We refer to this as second-order Tocqueville paradox.

Future research could be manyfold since the competition model is very flexible. A promising research direction would be to investigate into further individual decision mechanisms or institutions that dampen the occurrence of Tocqueville's paradox. More complex models then could be used to inform the design of institutions such as promotion systems or educational systems. In doing so, systems could be implemented in a way that prevents a waste of resources and produces a maximum level of happiness.

8 References

Berger, J.; Diekmann, A. (2013). The Logic of Relative Frustration. Boudon's Competition Model and Experimental Evidence. *Working Paper*, ETH Zurich.

Boudon, R. (1988). The Logic of Relative Frustration. In Taylor, M. (Ed.), *Rationality and Revolution*. Cambridge: Cambridge University Press, pp. 245-267.

Boudon, R. (1982). *The Unintended Consequences of Social Action*. London: Macmillan.

Breen, R.; Goldthorpe, J. (1997). Explaining Educational Differentials. Towards a Formal Rational Action Theory. *Rationality and Society*, 9, 275-305

Brinton, C. (1965). *The Anatomy of Revolution*. New York: Vintage Books.

Coleman, J. (1990). *Foundations of Social Theory*. Cambridge (MA): Harvard University Press.

Easterlin, R. A. (1995). Will Raising the Incomes of All Increase the Happiness of All? *Journal of Economic Behavior and Organization*, 27, 35-47.

Epstein, J. M. (2007). *Generative Social Science. Studies in Agent-Based Computational Modeling*. Princeton: Princeton University Press.

Fehr, E.; Schmitt, K. M. (1999). A Theory of Fairness, Competition, and Cooperation. *The Quarterly Journal of Economics*, 114, 817-868.

Ginits, H. (2009). *Game Theory Evolving. A Problem-Centered Introduction to Modeling Strategic Interaction*. Princeton: Princeton University Press.

Merton, R. K.; Rossi, A. S. (1957). Contributions to the Theory of Reference Group Behavior. In Merton, R. K. (Ed.), *Social Theory and Social Structure*. New York: The Free Press. Pp. 225-280.

Nash, J. F. Jr. (1950). Equilibrium Points in N-Person Games. Proceedings of the National Academy of Sciences of the United States of America, 36, 48-49.

Neckel, S. (2010). Verbesserungen fuehren zum Umsturz. Alexis de Tocqueville: Der alte Staat und die Revolution - das Tocqueville Paradox. In Neckel S., Mijic, A., Scheva, C. and Tittion, M. (Eds.), *Sternstunden der Soziologie: Wegweisende Theoriemodelle des soziologischen Denkens*. Frankfurt am Main: Campus, pp. 381-386.

Nigel, G. (2008). *Agent-based Models*. Los Angeles: Sage.

Pasinetti, L. (1981). *Structural Change and Economic Growth: A Theoretical essay on the dynamics of the wealth of nations*. Cambridge: Cambridge University Press.

Peiro, J. M.; Agut, S.; Grau, R. (2010). The Relationship Between Overeducation and Job Satisfaction Among Young Spanish Workers: The Role of Salary, Contract of Employment, and Work Experience. *Journal of Applied Social Psychology*, 40, 666-689.

Pyatt, G. (1976). On the Interpretation and Disaggregation of Gini Coefficients. *The Economic Journal* 86: 243-255.

Raub, W. (1984). *Rationale Akteure, institutionelle Regelungen und Interdependenzen. Untersuchungen zu einer erklaerenden Soziologie auf strukturell-individualistischer Grundlage.* Frankfurt am Main: Peter Lang.

Stouffer, S. A.; Suchman, E. A.; De Vinney, L. C.; Star, Shirley A.; Williams, R. M. Jr. (1965): *The American Soldier.* Manhattan (Kansas): Military Affairs, Aerospace Historian Publishing.