

INTEREST GROUPS AND INSTITUTIONAL EVOLUTION

A Master's Thesis

by
YAVUZ ARASIL

Department of
Economics
İhsan Doğramacı Bilkent University
Ankara
September 2011

INTEREST GROUPS AND INSTITUTIONAL EVOLUTION

Graduate School of Economics and Social Sciences
of
İhsan Doğramacı Bilkent University

by

YAVUZ ARASIL

In Partial Fulfillment of the Requirements for the Degree of
MASTER OF ARTS

in

THE DEPARTMENT OF
ECONOMICS
İHSAN DOĞRAMACI BİLKENT UNIVERSITY
ANKARA

September 2011

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Assoc. Prof. Dr. Bilin NEYAPTI
Supervisor

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Assist. Prof. Dr. Hüseyin Çağrı SAĞLAM
Examining Committee Member

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Assist. Prof. Dr. Zeki SARIGİL
Examining Committee Member

Approval of the Graduate School of Economics and Social Sciences

Prof. Dr. Erdal EREL
Director

ABSTRACT

INTEREST GROUPS AND INSTITUTIONAL EVOLUTION

Arasıl, Yavuz

M.A., Department of Economics

Supervisor: Assoc. Prof. Bilin Neyaptı

September 2011

This study proposes an original formal political economy model of institutional evolution to analyze the effects of evolving interest groups on institutional change by extending the model of Neyaptı (2010). Institutions are categorized as formal (F) and informal (N) institutions that exhibit different evolutionary patterns. N evolves with capital accumulation, as in learning by doing, and F is optimally chosen by a government who maximizes the weighted sum of the utilities of two different interest groups. The level of informal institutions, which represents business ethics, way of doing business or the level of technological know-how, differs for each group. F and N together define the production technology and affect the income level of each group. The model is such that institutions, as well as the levels of income and capital stocks are dynamically interrelated. The simulations of the model show that F exhibits a punctuated evolutionary path. This path is observed to be affected by income share of the institutions, income share of the capital, saving rate and cost of institutional change.

Keywords: Institutional evolution, punctuated equilibria, growth

ÖZET

MENFAAT GRUPLARI VE KURUMSAL DEĞİŞİM

Arasıl, Yavuz

Yüksek Lisans, Ekonomi Bölümü

Tez Yöneticisi: Doç. Dr. Bilin Neyaptı

Eylül 2011

Bu çalışmada, zaman içerisinde değişim gösteren menfaat gruplarının kurumsal değişime etkisi, Neyaptı (2010)'u temel alarak genişleten orijinal bir politik iktisat modeli ile açıklanmıştır. Kurumlar resmi (F) ve gayri resmi (N) olmak üzere ikiye ayrılmıştır. N sermaye birikimiyle doğru orantılı olarak gelişirken, F devlet tarafından iki menfaat grubunun toplam fayda fonksiyonlarını ençoklayacak şekilde seçilmektedir. İş kültürü, bilgi birikimi, iş yapma şekli gibi kavramları temsil eden gayri resmi kurumların kalitesi gruplar arasında farklılık göstermektedir. F ile N birlikte üretim teknolojisini belirleyerek ilgili grupların gelir düzeylerine doğrudan etki etmektedir. Bu modelde, her iki grubun da sermaye stoklarının seviyesi ve gelir düzeyleri kurumların kalitesi ile dinamik bir etkileşim halindedir. Modelin simülasyonları resmi kurumların zaman içerisinde bir müddet değişime uğramayıp daha sonra da belirli bir kurumsal kaliteye ani şekilde zıplayarak geliştiğini göstermektedir. Resmi kurumların değişiminin, sermayenin ve kurumların gelirdeki payı, tasarruflar ve kurumsal değişimin maliyeti gibi etkenlere bağlı olduğu görülmüştür.

Anahtar Kelimeler: Kurumsal değişim, büyüme

ACKNOWLEDGEMENTS

I would like to express my sincere gratitudes to Bilin Neyaptı for her excellent guidance, exceptional supervision and infinite patience throughout all stages of my study. I feel indebted to her. Special thanks to my examining committee members Çağrı Sağlam and Zeki Sarıgil for their helpful comments and valuable suggestions which contributed to my study further. I also thank Jaume Ventura for his very useful feedbacks. I am grateful to my family for their unconditional love and support. I thank my friends for their sincere friendship and support. Finally, I would like to convey thanks to İhsan Doğramacı Bilkent University Department of Economics for providing financial support during my graduate studies.

TABLE OF CONTENTS

ABSTRACT	iii
ÖZET.....	iv
ACKNOWLEDGMENTS	v
TABLE OF CONTENTS	vi
LIST OF TABLES	vii
LIST OF FIGURES	viii
CHAPTER 1: INTRODUCTION.....	1
CHAPTER 2: RELATED LITERATURE.....	4
2.1 Collective Action Theory	4
2.2 New Institutional Economics	6
2.3 Punctuated Equilibrium	11
2.4 Formal Models of Institutional Evolution.....	13
CHAPTER 3: THE MODEL AND SIMULATIONS	19
3.1 The Model	19
3.1.1 Features of the Model	19
3.1.2 Solution of the Model	24
3.2 Simulations.....	26
3.2.1 Methodology.....	26
3.1.2 Simulation Results.....	26
CHAPTER 4 : CONCLUSION.....	33
BIBLIOGRAPHY	35
APPENDICES	37
APPENDIX A1	37
APPENDIX A2	47
APPENDIX A3	50

LIST OF TABLES

Table 1: Initial Values of the Parameters and Capital Stocks	27
Table 2: Partial Derivates of F^*	32
Table 3: Second Derivatives and Cross Derivates of F^*	32

LIST OF FIGURES

Figure 1: Trajectory of F^* and incomes ($N_0^1 = 30, N_0^2 = 40, \gamma_1 = \gamma_2 = 0.01$)	28
Figure 2: Trajectory of F^* and incomes ($N_0^1 = 30, N_0^2 = 40, \gamma_1 = \gamma_2 = 0.005$)	29
Figure 3: Trajectory of F^* and incomes ($N_0^1 = 10, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.01$)	38
Figure 4: Trajectory of F^* and incomes ($N_0^1 = 5, N_0^2 = 10, \gamma_1 = \gamma_2 = 0.01$)	39
Figure 5: Trajectory of F^* and incomes ($N_0^1 = 10, N_0^2 = 80, \gamma_1 = \gamma_2 = 0.01$)	40
Figure 6: Trajectory of F^* and incomes ($N_0^1 = 30, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.01$)	41
Figure 7: Trajectory of F^* and incomes ($N_0^1 = 40, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.005$)	42
Figure 8: Trajectory of F^* and incomes ($N_0^1 = 60, N_0^2 = 80, \gamma_1 = \gamma_2 = 0.005$)	43
Figure 9: Trajectory of F^* and incomes ($N_0^1 = 10, N_0^2 = 80, \gamma_1 = \gamma_2 = 0.005$)	44
Figure 10: Trajectory of F^* and incomes ($N_0^1 = 30, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.005$)	45
Figure 11: Trajectory of F^* and incomes ($N_0^1 = 10, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.005$)	46
Figure 12: Trajectory of F^* with different levels of α ($N_0^1 = 30, N_0^2 = 40, F_0 = 10, \gamma_1 = \gamma_2 = 0.005$)	48
Figure 13: Trajectory of F^* with different levels of α ($N_0^1 = 10, N_0^2 = 60, F_0 = 10, \gamma_1 = \gamma_2 = 0.01$)	49

CHAPTER 1

INTRODUCTION

Social scientists mostly agree that institutions are key factors of economic development and growth. Institutions can be categorized as formal and informal institutions. Formal institutions are laws, rules and regulations that define the organizational characteristics, while informal institutions are considered as business ethics, norms, customs and traditions.

A newly emerging field of economic literature that may be called new development economics (NDE)¹, focuses on the relationship between economic development and institutions. NDE is based on two fundamental approaches of institutional economics: collective action and transaction cost theories. Collective action (CA) theory which is developed by Olson (1965 and 1982) provides a dynamical framework for institutional change and analyzes the circumstances under which powerful interest groups that may affect the process of institutional change are formed and become effective. On the other hand, transaction cost (TC) theory, developed by Coase (1960), Williamson (1985) and North (1990), argues that institutions adapt to economic development to reduce transaction costs. According to this theory, changes in the productive factors and production relations give way to new types of

¹ See Neyaptı (2010b) who uses this term to name a new strand of development economics that combines new institutional economics with collective action theory.

transaction costs or changes in existing transaction costs; these changes are considered as the main factors that trigger the need for institutional change. However, transaction cost theory appears inadequate in explaining institutional dynamics. In light of these, both Nabli and Nugent (1989) and Neyaptı (2010b) view CA and TC theories as complementary to each other.

Synthesizing the arguments of CA and TC theories provides a deeper understanding of the nature of institutional evolution. As technological and economic developments occur, production relations and preferences change. Hence, the need for new institutional structure arises. Next, the process via which this need turns into action that affects institutional change requires explanation. Often, the existing interest groups show resistance against institutional change while economic and technological developments may lead to the formation of new interest groups that support change. The interplay of different interest groups motivated by their expected losses and benefits, determines the path of institutional evolution.

Baumgartner and Jones (1993) shed light on the evolutionary path of institutions in the political science literature, inspired by the hypothesis of *punctuated equilibrium* which originally belongs to biology. They show that policies are generally sticky and policy changes show themselves in the form of sudden changes instead of continuous progression. Since formal institutions are kind of regulatory policies, several studies in the recent literature discuss that their evolution can be analyzed in a punctuated equilibrium framework. However, the existing literature mentions about punctuated nature of institutional evolution in a descriptive way rather proposing a formal model.

The concepts of game theory are also commonly referred to in the context of institutional evolution. However, according to Neyaptı (2010a), although game

theory is a useful tool for understanding institutions, it is not fully sufficient to explain institutional evolution. She states that game theoretic approach to institutional evolution focuses on the effects of individual choices without considering societal forces which have important impact on shaping the institutional structure in society. In game-theory models, evolution of institutions is seen as transition from one equilibrium to another.

Acemoglu (2006) is the first that propose a formal political economy model which explains the effect of various groups on the evolution of institutions, where the interactions and decisions of these groups are modeled as a dynamic game. However, this model does not make a distinction between formal and informal institutions and also does not discuss the punctuated nature of institutional evolution.

Neyaptı (2010b)'s dynamic model of institutional evolution analyzes the evolution of both formal and informal institutions and show that formal institutions exhibits a punctuated evolutionary path. In this study, we modify and extend this study by explicitly incorporating the effects of evolving interest groups. The aim of this study is to propose an original political economy model of institutional evolution which replicates the evidence regarding institutional change that is of a punctuated nature.

In what follows, chapter 2 gives brief information about some studies related to institutional change, chapter 3 presents our formal model, simulation results and their interpretations, chapter 4 concludes.

CHAPTER 2

RELATED LITERATURE

This section gives information about some important works related to institutional evolution. Sections 2.1 and 2.2 provides detailed explanation of collective action and transaction cost theories respectively, section 2.3 discusses punctuated equilibrium concept and section 2.4 presents some formal models of institutional evolution.

2.1) Collective Action Theory

Development Economics literature has increasingly been concerned with explaining the question of institutional evolution. Collective Action (CA) theory which is developed by Olson (1965 and 1982) brings a dynamical approach for institutional evolution. CA theory focuses on the circumstances under which powerful special interest groups (SIGs) are formed and become effective. According to this theory, these powerful interest groups have a large impact on institutional change by affecting the government's policy decisions. Olson (1965) categorizes interest groups into two types. The first one is *narrow special-interest groups* which are small and homogeneous groups that can easily be organized. The other one is *encompassing special-interest groups* which have large number of members and more heterogeneous as compared to narrow interest groups. Olson argues that

encompassing special interest groups can not be organized easily due to their size and heterogeneity.

According to Olson (1982), narrow special interest groups may be harmful to society by preventing socio-economic development. He argues that these interest groups divert resources for their own sakes although this action may create a large burden for the whole society. Since narrow interest groups are small and constitute a little portion of a society, their share from the overall burden is very small. In other words, they do not face with the entire cost resulting from their actions. Hence, the benefit that they obtain from diverting resources to themselves is greater than the cost they pay. In this sense, there are net gains for narrow interest groups from collective action.

In contrast to narrow special interest groups, Olson (1982 and 1995) argues that encompassing special interest groups are not harmful to society. The reason behind this argument is that, since encompassing SIGs are large groups, they must bear a large share of the cost that accrues to society. Hence, they can not gain from any policy which is costly or harmful to society. Olson (1995) states that it is rational for encompassing SIGs to support policies which minimize social costs or the most efficient methods of redistribution rather than supporting policies which will maximize their narrow benefits. For this reason, encompassing interest groups have an important effect on institutional change. During the post World War II period, like in many other countries, there were great macroeconomic instabilities in Germany, Sweden, Norway and Austria. Olson (1995) argues that, in these countries, large fraction of the society supported the idea of institutional change and as a result, encompassing labor unions and employers' federations are established. The

economic policy and structure of institutions was motivated by these groups. The newly formed institutions which helped to achieve economic success are called *best practice institutions*. Neyapti (2010a) also states that the current financial crisis in the U.S is an example that collects wide ranging support for reform in regulatory financial institutions.

According to Olson (1995), encompassing special interest groups may also devolve into powerful narrow special interest groups in stable economies. Moreover, these newly formed SIGs may resist again beneficial institutional reforms for society and can be successful in this way as a result of their influence on government's policies. Olson uses the term "*institutional sclerosis*" to describe this situation. He argues that the reason of stagnation in Sweden and Germany during the 1980s can be explained via this phenomena. The devolution of early established encompassing labor unions into narrow SIGs that engaged into monopolistic lobbying activities, led to sclerotic institutions and thus economic inefficiencies. This special case of institutional sclerosis is named as "*Eurosclerosis*" by Olson. According to Neyapti (2010a), Olson's institutional sclerosis idea implies that institutional change tend to occur slowly as compared to economic progress.

2.2) New Institutional Economics (NIE)

The International Society of New Institutional Economics (ISNIE) defines NIE as

An interdisciplinary enterprise combining economics, law, organization theory, political science, sociology and anthropology to understand the institutions of social, political and commercial life. It borrows liberally from various social-science disciplines, but its primary language is economics. Its

goal is to explain what institutions are, how they arise, what purposes they serve, how they change and how-if at all-they should be reformed.

(www.isne.org)

NIE literature mainly built on the arguments of transaction cost theory which is developed by Coase (1960), Williamson (1985) and North (1990).

North (1990) defines institutions as the humanly devised constraints that shape human interaction. These are made up of formal constraints, which can be rules, laws, constitutions and regulations; and informal constraints, such as norms of behavior, conventions and self imposed codes of conduct and their enforcement characteristics. North (1990) argues that institutions and technology together determine the transaction and transformation costs and hence the incentive structure of societies and economies, via affecting factors such as profitability and feasibility of engaging in an economic activity. Furthermore, institutions emerge and exist in order to reduce these transaction costs. Hence, by reducing transaction costs, institutions lead to more efficient markets.

According to North (1990), the main driving force of institutional evolution is the interaction between institutions and organizations. In this sense, institutions are considered as rules of the game, whose players are organizations and entrepreneurs. Organizations are the entities formed by a group of people who have common objectives. Hence, creators of an organization aim to maximize wealth, income or want to obtain a gain from other kind of opportunities provided by the institutional structure in the society. Moreover, institutional structure determines the direction of the acquisition of knowledge and skills for the members of organizations, which have important implications for the long-run development of the society.

North (1990) argues that maximizing behavior of the organization is not only limited with making choices within the existing constraints, but also there may be opportunity to alter the constraints. In other words, rather than investing in skills and knowledge that will pay off, an organization or a firm can use its resources for the purpose of changing institutional structure. When the gains from changing the institutions is higher than the gains from investing in existing constraints, powerful organizations want to alter the institutional structure. Moreover, these kinds of organizations motivate the society investing in skills and knowledge that will increase their profitability indirectly.

Transaction cost theory considers *adaptive efficiency* as crucial factor for institutional evolution. North (2005) defines adaptive efficiency as the ability of a society to flexibly adjust in the face of shocks and adopt institutions which can deal with altered conditions successfully. North (1990) states that, in societies with high level of adaptive efficiency, people maximize their efforts in order to explore alternative ways of solving problems.

North (1990) argues that, the process of institutional change is highly incremental through marginal adjustments to the complex of norms, rules and enforcement mechanisms which are members of institutional structure. Furthermore he states that, the main sources of institutional change are: changes in the relative prices such as changes in the ratio of factor prices, changes in the cost of information and changes in technology. More explicitly, when relative prices change, one or both parties who trade with each other perceive that altering the agreement or contract will be more profitable for them. At least one of the parties will make an attempt to change the contract. On the other hand, since contracts are embedded in higher set of rules,

renegotiation may not be possible. Therefore, parties may devote all their resources to change rules at higher level. In addition to formal set of rules, informal constraints such as norms of behavior or customs which have important role in guiding the exchange process will be slowly modified or destroyed. According to North (1990), the main role of the informal institutions is to supplement, extend or modify formal institutions. He considers formal and informal institutions as a package, thus a change in one of these institutions will lead to disequilibrium which implies new transaction costs. In his framework, new informal rules evolve gradually after a change in formal rules.

As Olson (1982), North (1990) also discusses persistence of inefficient institutions. He extends Arthur (1988)'s arguments, which are about adoption of inefficient technologies, to the institutional framework. Arthur (1988) argues that the main factors that cause the adoption of inefficient technologies are: (i) multiple equilibria: indeterminate outcome as a result of more than one solutions (ii) possible inefficiencies: an efficient technology may die out due to its bad luck in gaining popularity (iii) lock in: once a solution is reached it may be impossible to exit (iv) path dependence: the strong effects of the past decisions on the present and future. Since the technology that Arthur (1988) deals with exhibits increasing returns like institutions, North generalizes Arthur's ideas to explain the nature of institutional persistence. Although he thinks that all four factors have a role on the persistence of institutions, he mostly focuses on the effects of path dependence and discusses the factors that shape the path in a detailed manner. North (1990) argues that, increasing returns characteristics of institutions and imperfect markets with high transaction costs are the two main forces that shape the path of institutional evolution. In the presence of imperfect markets with high transaction costs, information feedback is

insufficient and thus agents modify their subjective models based on imperfect information and insufficient feedback. The subjectively derived models together with the ideology shape the path. Furthermore, historically derived perceptions of the agents also affect their choices. Combination of all these factors leads to inefficient paths. Path dependence limits the choices of economic agents and links decision makings over time. According to North (1990), unproductive or inefficient paths persist when the increasing returns characteristics of initial set of institutions do not provide incentives or provide disincentives to productive activities. In such a case, some organizations and interest groups that benefit from existing institutional structure will emerge and shape the polity according to their benefits. On the other hand, societies with high level of adaptive efficiency may avoid unproductive paths by allowing for a maximum number of choices under uncertainty and encourages trial of various paths, which helps to eliminate inefficient choices.

North's framework about persistence of inefficient institutions has some common points with the Olson's institutional sclerosis idea. In both of the cases, some powerful groups (North prefers to use the term organization) benefits from existing institutional structure and do not allow for institutional reform by affecting government's decisions. However, while explaining the institutional reforms or persistence of institutions Olson provides a clearer dynamical framework than North in terms of interest group dynamics. He explicitly discusses the formation or devolution process of interest groups whereas North generally makes his analysis with a given set of organizations. On the other hand, Olson does not make a strong discrimination between formal and informal institutions as North. Both of their ideas support and reinforce the hypothesis of *punctuated equilibrium* which we now turn to in order to describe the evolutionary pattern of institutions.

2.3) Punctuated Equilibrium

Punctuated equilibrium hypothesis originally belongs to evolutionary biology and is developed by Elridge and Gould (1972). In contrast to Darwin's framework, which describes evolution as continuous and slow process, authors argue that evolution is characterized by long periods of stability, punctuated by short and revolutionary jumps that yield to extinction of current species and emergence of new forms of life. This idea gave inspiration to political scientist to describe the policy changes. Baumgartner and Jones (1993) are the first to adopt the idea of punctuated equilibrium to political science. They describe the policy process in U.S by using the punctuated equilibrium hypothesis. Baumgartner and Jones (1993:251) state that "...our government can best be understood as a series of institutionally enforced stabilities, periodically punctuated by a dramatic change." The authors use the term "policy monopolies" to describe a group of decision makers with a monopolistic power on specific policy issues and institutional structure. Policy monopolies limit access to policy making process, thus restrict the change. These monopolies come into existence as a result of enthusiastic mobilization (the authors use the term "Downsian mobilization") wherein policymakers are supported for the policy changes and institutional reforms. Once a policy monopoly is created through Downsian mobilization, it becomes a dominant power over some policy issues and limits the discussions about policy changes. According to Baumgartner and Jones (1993), policy changes occur when the existing policy monopolies corrupt. This corruption occurs as a result of second type of mobilization which they explain as "it often stems from the efforts of opponents of status quo to expand the scope of conflict." In light of these facts, the authors characterize the policy changes in U.S

and reach the conclusion that most of the policies perform punctuated type of equilibrium over time.

The arguments of Baumgartner and Jones (1993) about policy change are closely related with the Olson's "institutional sclerosis" idea. While explaining the process of institutional evolution, Olson argues that sclerotic institutions, which are supported by narrow interest groups, continue to exist until a large fraction of the society oppose to these institutions and support institutional reform due to the cost resulting from the inefficiencies that these institutions generate. In this sense, policy monopolies which are created through Downsian mobilization can be considered as powerful narrow special interest groups that lead to persistence of inefficient institutions. On the other hand, emergence of encompassing interest groups that support beneficial institutional reforms can be interpreted as second type of mobilization that lead to corruption of existing policy monopolies which limit policy changes.

There are also some other works that try to explain or show the punctuated patterns of institutional evolution. Roland (2004) makes an analogy between institutional change and earthquakes. He argues that slow changes in informal institutions are like increasing tectonic pressures which triggers earthquakes, namely sudden changes in formal institutions. Neyaptı (2010a) argues that this analogy of Roland (2004) is a good way of describing punctuated equilibrium pattern of institutions. Additionally, it is possible to observe some empirical works that measure the quality of formal institutions depict patterns of institutional evolution that exhibit punctuated type equilibrium. (See, for example Dinçer and Neyaptı (2008), and Cukierman et al., (2002))

2.4) Formal Models of Institutional Evolution

Based on the arguments of CA theory, TC theory and punctuated equilibrium hypothesis, Neyaptı (2010b) formally models the evolution of formal and informal institutions. According to Neyaptı (2010b), evolution of informal institutions follows learning by doing, which implies that the quality of these institutions increases with the capital stock. Hence, the progression of informal institutions is modeled as a positive function of capital stock and existing informal institutions. On the other hand, formal institutions are optimally chosen by government in order to maximize the total output. Neyaptı (2010b) argues that, when production factors change as a result of continuous technological improvements, informal institutions which represent production relations adapt to these changes easily. In contrast to informal institutions, higher organization levels of production, which are regulated by laws, may show resistance against change and become inconsistent with other components of production. Formal institutions represent these aspects of production and only change when the cost of such inconsistencies exceeds the cost of institutional persistence. In this model, formal institutions lag behind the informal institutions and exhibit punctuated type of equilibria over time. While explaining the dynamics of institutional change, Neyaptı (2010b) models technology as a function of formal and informal institutions. She also states that, due to the effect of powerful interest groups and governmental processes, formal institutions evolve more slowly than informal institutions. This model, however, does not incorporate the evolution of interest groups or the aspect of political economy explicitly.

Acemoğlu (2006) also discusses the emergence and persistence of inefficient institutions by proposing a political economy model. According to Acemoğlu (2006), inefficient institutions emerge and persist when there exists some powerful groups

which prefer inefficient (non growth enhancing) policies that these institutions generate and when there is no social arrangement that can restrict these powerful groups. His model has three types of groups: middle class producers, elite producers and workers. Elite class producers and middle class producers have an access to investment opportunities with different level of productivity. Acemoğlu (2006) also categorizes institutions as *economic institutions* and *political institutions*. Political institutions govern the allocation of “de jure” political power in the society (“de jure” political power is power that is allocated by laws) and economic institutions are related with the economic constraints and rules governing economic interactions such as enforcement of property rights, regulation of technology and taxation and redistribution.

The political economy model of Acemoğlu (2006) discusses and models the main sources of inefficient policies which arise as a result of elite’s desire to extract rents from the rest of the society. The main sources of inefficient policies are revenue extraction, factor price manipulation and political consolidation activities of elite producers. The author states that, since institutions determine the framework for policy determination, inefficient policies translate into inefficient institutions; hence, the forces that lead to inefficient policy choices also encourage the elite to choose inefficient economic institutions. By choosing inefficient institutions, the elite can prevent the enforcement of property rights for middle class producers or can block technology adoption by middle class producers. Similarly, in order to preserve their “de jure” political power, the elite do not support for the change in political institutions which can alter their political power.

Finally, Acemoğlu (2006) analyzes the changes in political institutions. The groups without “de jure” political power can organize and put pressure on elite class producers to change current institutional structure. Acemoğlu uses the term “de facto” political power to describe the power of the organized groups. With sufficient “de facto” political power, these groups can successfully change the institutions although the elite show resistance to change.

In modeling his arguments, Acemoğlu (2006) considers an infinite horizon economy populated by a continuum of three types of agents. In that model, the only mission of the workers is to supply their labor force inelastically. On the other hand, the elite and middle class producers have an access to production opportunities with different levels of productivity. Hence, productivity and capital stocks of these groups are taken as different in respective production functions. According to the model, the only policy instrument is taxation of the elite and middle class producers. In addition to taxes, the government also obtains revenues from natural resources which are taken as exogenous. Tax revenues and rents from natural resources are redistributed as lump sum transfers to each group.

Elite and middle class producers take wages as given and maximize their profits. According to model, the three mechanisms² that lead to inefficient policies arise from different policies regarding the taxation of the middle class producers. The elite initially hold political power and decide on taxation policies. In revenue extraction case, the elite optimally choose tax rates on middle class producers in order to maximize their revenues from transfer payments. In this case, the elite never tax themselves and redistribute all the government revenues to them. In factor price

² These mechanisms are: revenue extraction, factor price manipulation and political consolidation which are already mentioned in the previous page.

manipulation case, the elite set high taxes on middle class producers in order to reduce labor demand and thus profitability of the middle class. The elite producers face with the lower wages as a result of reduced labor demand. In political consolidation case, Acemoğlu assumes that there is a probability p such that political power shifts from elite to middle class. This probability is modeled as a positive function of income level of the middle class producers. To find the optimal taxation, he solves the utility maximization problem of the elite producer recursively where bellman equation is also a function of p .

In order to model institutional change and persistence, he assumes that the middle class obtains enough de facto political power, with some exogenous probability, such that they can end the domination of the elite class. Furthermore he assumes that there is a cost of changing existing regime for middle class which is also taken as exogenous. Acemoğlu (2006) defines states with the information about the group in power, and the level of threat against their political power. He models the process of institutional change as a dynamic game between the middle class and the elite producers and solves for the Markov-perfect equilibria in order to derive the conditions for institutional change. He also assumes that the state at which middle class producers are in power is an absorbing state, which implies that institutions will never change again once the middle class becomes dominant group.

Although Acemoglu (2006) explains the persistence and evolution of institutions in a formal way, he doesn't mention about the punctuated nature of institutional evolution; in addition, he neither differentiates between formal and informal institutions nor models the evolution of interest groups explicitly.

The concepts of game theory are widely used in the literature to explain institutional evolution. Since institutions are considered as humanly devised rules that govern the economic interactions between the agents and agents are players of the game, the decisions of agents together with their interactions are modeled in a game theoretic perspective. Desierto (2005), for example, proposes a model where economic growth depends on co-evolution of institutions and technology. In this paper, she modifies the Romer (1990) model by incorporating institutional and technological evolution in order to explain the transitional dynamics. Desierto (2005) considers institutions as an accumulating environment-specific knowledge and as a factor in the innovation process. She employs as an evolutionary game whereby boundedly-rational firms decide the allocation of their resources between institutional spending and research expenditures.

Yao (2004) also studies institutional change in a game theory framework and argues that institutional change is sensitive to the distribution of welfare and sticky with respect to economic environment. As Acemoğlu (2006), both Desierto (2005) and Yao (2004) model institutional change without making distinction between formal and informal institutions. Furthermore their models do not incorporate evolution of interest groups. The next chapter explains how the current study attempts to close the gaps in the literature on institutional evolution.

CHAPTER 3

THE MODEL AND SIMULATIONS

The models which I briefly explained in chapter 2 try to investigate specific aspects of institutional change. The political economy model of Acemoğlu (2006) analyzes the persistence and evolution of institutions without making distinction between formal and informal institutions. It also does not argue or predict the punctuated nature of the process of institutional evolution.

Neyaptı (2010b) provides a model that explains the dynamics of formal and informal institutional changes and predicts the punctuated equilibria. However, political economy part has not been incorporated explicitly into the model. Desierto (2005) and Yao (2004) also analyze institutional change dynamically without taking the effects of interest groups into account and investigating the interactions between the formal and informal institutions.

Currently, to our best knowledge, there exists no study in the literature which models formal and informal institutional change by considering the effects of interest groups. In this study, we extend and modify Neyaptı (2010b) paper by explicitly incorporating interest groups into the model. This presents an original formal model for the political economy of institutional evolution in relation with economic development. This chapter is organized as follows: section 3.1 discusses the main

features and solution of the model and section 3.2 provides the simulation results of the model under different parameter values.

3.1) The Model

This section provides the characterization and the solution of the model in subsections 3.1.1 and 3.1.2 respectively.

3.1.1) Features of the Model

Our model includes two sectors, say the traditional sector and the modern sector. The representatives of these sectors can be seen as two different interest groups. At the beginning, capital stock of the members in the modern sector will be higher than of the members in the traditional sector. We can think of the members in the same interest group as identical to each other. The per capita production function of group j is defined as:

$$y^j = A(F, N^j) \cdot f(k^j), \text{ where } A'_{1,2} > 0 \text{ and } A''_{1,2} < 0 \text{ and } f' > 0 \text{ and } f'' < 0 \quad (1)$$

Where y^j is the output, A represents the level of technology, F represents the level of formal institutions, k^j represents the per capita level of capital stock and N^j stands for the level of informal institutions for group $j \in \{1, 2\}$ (1 represents the traditional sector and 2 represents the modern sector). As in Neyapti (2010b), we enter the technology in the production function as a function of institutions that define production relations; higher levels of institutional quality imply lower transaction costs and greater efficiency in production. Furthermore, we assume that, for simplicity, both groups produce the same type of consumption good and consume only their own product. Hence, we normalize the price of the goods to 1.

The initial level of informal institutions, which represent the business ethics, way of doing business or the level of technological know-how, differs for each group. In the simulation part of the model, we assume that the initial level of informal institutions of the modern sector is higher than of the ones in traditional sector. As in Neyapti (2010b), informal institutions evolve continuously with the capital stock as a result of learning by doing that can be shown by the following processes for the two sectors:

$$N_t^1 = N_{t-1}^1 + g(k_t^1) , \text{ where } g'(k_t^1) > 0 ; g''(k_t^1) < 0 \quad (2)$$

$$N_t^2 = N_{t-1}^2 + h(k_t^2) , \text{ where } h'(k_t^2) > 0 ; h''(k_t^2) < 0 \quad (3)$$

The functions g and h are sector specific and determine the evolution patterns of informal institutions.³ On the other hand, the level of formal institutions is the same for all groups, because formal institutions, which are considered as rules, laws, regulations that define the organizational characteristics of production, are set by the government.

The resource constraint for sector j , which is in per capita terms, is expressed as:

$$c_t^j + I_t^j + \psi(\Delta F, F_t / N_t^j, y_t^j) = y_t^j \quad (4)$$

Where c stands for consumption, I stands for investment; and the function ψ represents the cost that has to be paid by group j proportional to income level. In addition to income level, the cost depends on the amount of change in the level of formal institutions and inconsistencies between formal and informal institutions. The details of the cost function will be explained further on.

In this model, the saving rate is assumed to be constant and identical across all members of the society. Investment equation for each group is defined as:

³ The explicit forms of these equations are provided in the simulations part.

$$I_t^j = s.y_t^j \quad (5)$$

Hence, next period's capital stock will be the following:

$$I_t^j + (1 - \delta).k_t = k_{t+1} \quad (6)$$

The cost function ψ is defined in the following way:

$$\psi(\Delta F, F_t / N_t^j, y_t^j) = \gamma_1 [(F_t - F_{t-1})] y_t^j + \gamma_2 (1 - \frac{F_t}{N_t^j}) y_t^j \quad (7)$$

As can be observed from the above equation, we divide the cost function into two terms. The first term of the cost function is considered as administrative cost of changing the formal institutions that accrues to group j . This component can be considered as a tax that is collected from the members of the group j , which are in turn used by the government to finance the institutional reform. The cost of changing formal institutions is proportional to the amount of change which implies that large scale reforms are more costly to the both groups. When there is no institutional reform in a given period, the interest groups do not pay any cost.

The second term of the cost function stands to measure economic inefficiency, accruing to each group, resulting from inconsistencies between formal and informal institutions. The greater the inconsistencies between these institutions, the higher the resulting losses. We use the ratio of $\frac{F_t}{N_t^j}$ as an indicator of inconsistency.

Furthermore, it is assumed that for each group, the level of formal institutions is smaller than the informal ones. Hence, the higher the ratio of F to N , the more consistent the institutional structure. In light of these, this portion of the cost function is interpreted as the cost of maintaining, or operating, current period's formal institutions faced by the group j . It can be observed from the above equation that, if

the formal and informal institutions are fully consistent with each other namely, if F to N ratio is equal to 1, then, this portion of the cost function is equal to 0.

Combining equations (4), (5) and (7), per capita consumption levels for each group can be written in the following form:

$$c_t^j = \left(1 - s - \gamma_1 [(F_t - F_{t-1})] - \gamma_2 \left[1 - \frac{F_t}{N_t^j} \right] \right) \cdot y_t^j \quad (8)$$

In this model, the government chooses current period's level of formal institutions (F_t) in order to maximize the weighted sum of the utilities. We assume that the weights are equal. The government's optimization problem is defined as:

$$\max_{F_t} \quad \frac{1}{2} u(c_t^1) + \frac{1}{2} u(c_t^2) \quad (9)$$

Where the utility functions are in logarithmic forms for both of the groups:

$$u(c_t^j) = \ln(c_t^j) \quad (10)$$

As different from a social planner problem, our government does the maximization period by period, rather than intertemporally. In other words, the government cares only about the present time. In democratic systems, governments always face with the probability of loosing the next elections. Hence, we assume that, in order to increase the chance of reelection, governments focus on the current benefits of interest groups rather than thinking about long run. By accommodating the current demands of interest groups, governments believe that they can get the support of these groups and save the day. Based on these, we assume that the government chooses F_t each period optimally according to the joint preferences of the interest groups. We also assume that even tough the government is replaced with another one,

the new government also solves the same problem. This assumption helps us to make analysis over the long time periods.

Per capita output of group j , which is defined implicitly by equation (1), is expressed explicitly in the following way:

$$y_t^j = (F_t \cdot N_t^j)^\theta (k_t^j)^\alpha \quad (11)$$

Using equations (9), (10) and (11), utility function of an agent j will be the following:

$$u(c_t^j) = \ln \left((F_t \cdot N_t^j)^\theta \cdot (k_t^j)^\alpha \cdot \left(1 - s - \gamma_1 [F_t - F_{t-1}] - \gamma_2 \left[1 - \frac{F_t}{N_t^j} \right] \right) \right) \quad (12)$$

Then, in a more explicit form, the objective function of the government becomes:

$$\begin{aligned} \max_{F_t} \quad & \frac{1}{2} \cdot \ln \left((F_t \cdot N_t^1)^\theta \cdot (k_t^1)^\alpha \cdot \left(1 - s - \gamma_1 [F_t - F_{t-1}] - \gamma_2 \left[1 - \frac{F_t}{N_t^1} \right] \right) \right) \\ & + \frac{1}{2} \cdot \ln \left((F_t \cdot N_t^2)^\theta \cdot (k_t^2)^\alpha \cdot \left(1 - s - \gamma_1 [F_t - F_{t-1}] - \gamma_2 \left[1 - \frac{F_t}{N_t^2} \right] \right) \right) \end{aligned} \quad (13)$$

We also impose the following admissibility constraints on F_t :

- i) $\left(1 - s - \gamma_1 [F_t - F_{t-1}] - \gamma_2 \left[1 - \frac{F_t}{N_t^1} \right] \right) < 0$ and $\left(1 - s - \gamma_1 [F_t - F_{t-1}] - \gamma_2 \left[1 - \frac{F_t}{N_t^2} \right] \right) < 0$
- ii) $F_t \geq F_{t-1}$
- iii) $F_t \leq \min(N_t^1, N_t^2)$

The first constraint implies that consumption shares of the income can not be negative. The second constraint tells that institutional reform should increase the quality of formal institutions. Finally, the third constraint determines the upper limit

for F_t which indicates that the current level of formal institutions can not exceed the level of informal institutions for both of the groups. If one of the above constraints is violated by the candidate F_t , which maximizes the objective function of the government, then the level of formal institutions are not changed. In other words, optimal level of formal institutions at time t is equal to the level of formal institutions at time $t-1$.

The dynamics of the model can be summarized briefly as follows:

- a) Previous period's savings together with the undepreciated portion of the k_{t-1} defines k_t .
- b) The evolution of N_t^j depends on k_t^j and N_{t-1}^j .
- c) Given the above constraints, N_t^j and k_t^j , the government chooses F_t optimally in order to maximize the weighted utilities of the interest groups.

3.1.2) Solution of the Model

Now we turn to the solution of the maximization problem. In order to simplify the solution of the problem, we used the following identity:

$$\frac{1}{2} \cdot \ln(c_t^1) + \frac{1}{2} \cdot \ln(c_t^2) = \ln[(c_t^1)^{1/2} \cdot (c_t^2)^{1/2}]$$

Furthermore, the term $(c_t^1)^{1/2} \cdot (c_t^2)^{1/2}$ is expressed as:

$$(c_t^1 \cdot c_t^2)^{1/2} =$$

$$\left(1 - s - \gamma_1[F_t - F_{t-1}] - \gamma_2 \left[1 - \frac{F_t}{N_t^1} \right] \right)^{1/2} \cdot \left(1 - s - \gamma_1[F_t - F_{t-1}] - \gamma_2 \left[1 - \frac{F_t}{N_t^2} \right] \right)^{1/2} \cdot (F_t)^\theta$$

$$[\text{ }]$$

$$x_1$$

$$\frac{(N_t^1)^{\theta/2} \cdot (N_t^2)^{\theta/2} \cdot (k_t^1)^{\alpha/2} \cdot (k_t^2)^{\alpha/2}}{[x_2]} \quad (14)$$

x_2

Since the components of x_2 are determined at time $t-1$, the maximizing F_t of the above equation, which is denoted by F_t^m can be expressed as:

$$F_t^m = \arg \max \{\ln(x_1) + \ln(x_2)\} = \arg \max \{\ln(x_1)\} \quad (15)$$

Hence, from equation (14) and (15), F_t^m maximizes the following expression:

$$\begin{aligned} & \frac{1}{2} \cdot \ln \left(1 - s - \gamma_1 \cdot [F_t - F_{t-1}] - \gamma_2 \cdot \left[1 - \frac{F_t}{N_t^1} \right] \right) + \\ & \frac{1}{2} \cdot \ln \left(1 - s - \gamma_1 \cdot [F_t - F_{t-1}] - \gamma_2 \cdot \left[1 - \frac{F_t}{N_t^2} \right] \right) + \theta \cdot \ln(F_t) \end{aligned} \quad (16)$$

The first order condition with respect to F_t yields the following expression:

$$\begin{aligned} & \frac{1}{2} \cdot \left[\frac{(\gamma_1 - \frac{\gamma_2}{N_t^1})}{\left(1 - s - \gamma_1 \cdot [F_t - F_{t-1}] - \gamma_2 \cdot \left[1 - \frac{F_t}{N_t^1} \right] \right)} \right] + \frac{1}{2} \cdot \left[\frac{(\gamma_1 - \frac{\gamma_2}{N_t^2})}{\left(1 - s - \gamma_1 \cdot [F_t - F_{t-1}] - \gamma_2 \cdot \left[1 - \frac{F_t}{N_t^2} \right] \right)} \right] \\ & = \frac{\theta}{F_t} \end{aligned} \quad (17)$$

The second derivative test, which proves that the solution of the above equation is a local maximizer, is provided in Appendix A3. However, as we mentioned before, although F_t^m satisfies the first order condition, it is not chosen by the government if it violates one of the constraints that we imposed on F_t . In such a case, optimal F_t , which is denoted by F_t^* is equal to the previous period's formal institutions.

3.2) Simulations

This section is organized as follows: section 3.2.1 describes the methodology followed in simulating the model and section 3.2.2 discusses the results of the simulations and its interpretations.

3.2.1) Methodology

In order to simulate the model, I wrote a matlab code which replicates the properties of the model discussed in section 3.1. To find the optimal F_t , the program solves the first order condition given in Equation (17). Although this equation has two roots, we saw that one root always violates the first constraint; in other words, we have a single root that satisfies the non-negativity of the consumption. The matlab code also checks for the remaining constraints. We observe that the root that satisfies the first constraint not always satisfies the remaining two constraints.⁴ If one of the constraints is violated, then the government chooses $F_t^* = F_{t-1}$. Namely, the level of previous period's informal institutions is preserved. The code makes simulations over 200 periods and keeps track of the variables such as capital stocks, level of informal institutions, consumptions and incomes of the interest groups over time. The derivatives of the optimal F with respect to model parameters are also simulated.

3.2.2) Simulation Results

We observe the evolution pattern of formal institutions under different scenarios, defined by different initial values of F , N^J and k^J and the model parameters. Given the values of the parameters and variables at $t=0$, the government starts to make optimization from $t=1$ and onwards.

⁴ See section 3.1.1.

Although our simulations give reasonable results for other functional forms that define the evolution of informal institutions, we assume the following explicit forms:

$$N_t^1 = N_{t-1}^1 + (k_t^1)^{0.2} / 5$$

$$N_t^2 = N_{t-1}^2 + (k_t^2)^{0.02} / 10$$

The above equations imply that N^1 grows faster than N^2 resulting from higher effect of capital stock. Throughout the simulations, initial value of the informal institutions and capital stocks of the group 2 is set to be higher than of the group 1. However, since N^1 grows faster than N^2 , we observe that informal institutions of group 1 usually catch up and exceed the informal institutions of group 2. Moreover, since informal institutions have an effect on capital accumulation and income, we observe that k^1 and y^1 may eventually exceed k^2 and y^2 , respectively, over time.

Table 1 shows the initial values of the capital stocks and parameters that we use in the simulations.⁵ Using these values, we simulate our model for different initial levels of formal and informal institutions, where the level of these institutions is a measurable index that is on a positive scale, and for different values of the cost parameters γ_1 and γ_2 . Throughout the simulations, we took $\gamma_1 = \gamma_2$ for simplicity.

Table 1: Initial Values of the Parameters and Capital Stocks

k_0^1	k_0^2	δ	α	θ	s
1	2	0.1	0.3	0.4	0.1

⁵ Depreciation rate (δ) is taken 0.1 which is consistent with Nadiri and Prucha (1996) where they estimate it between 0.059 and 0.12. Additionally, Mankiw et al, (1995) show that the income share of the capital (α) is equal to 0.3 for U.S. θ is taken as in Neyaptı (2010b). The saving rate is selected to be a relatively low one, although higher rates also lead to similar findings.

Figure 1: Trajectory of F^* and incomes ($N_0^1 = 30, N_0^2 = 40, \gamma_1 = \gamma_2 = 0.01$)

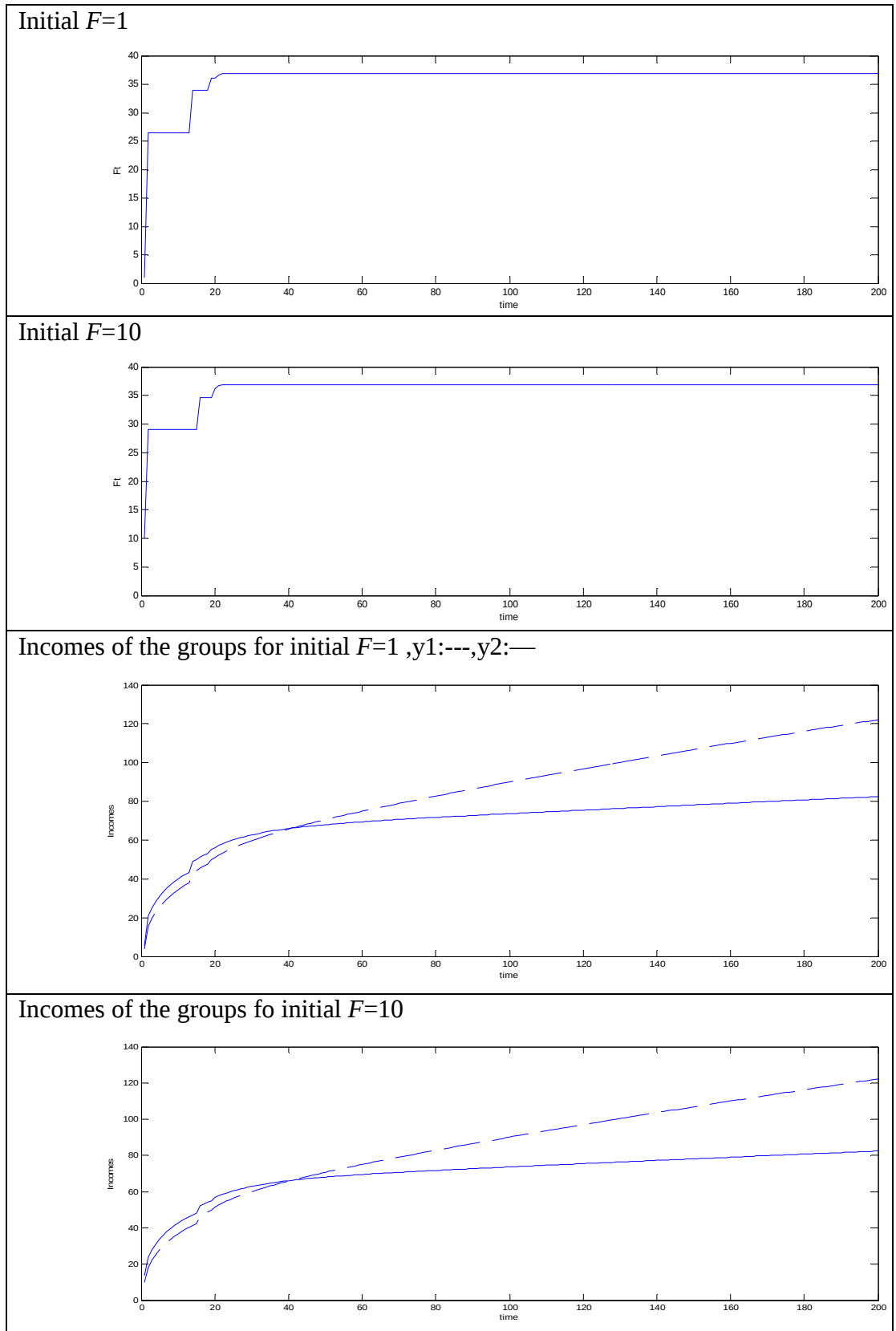


Figure 2: Trajectory of F^* and incomes ($N_0^1 = 30, N_0^2 = 40, \gamma_1 = \gamma_2 = 0.005$)

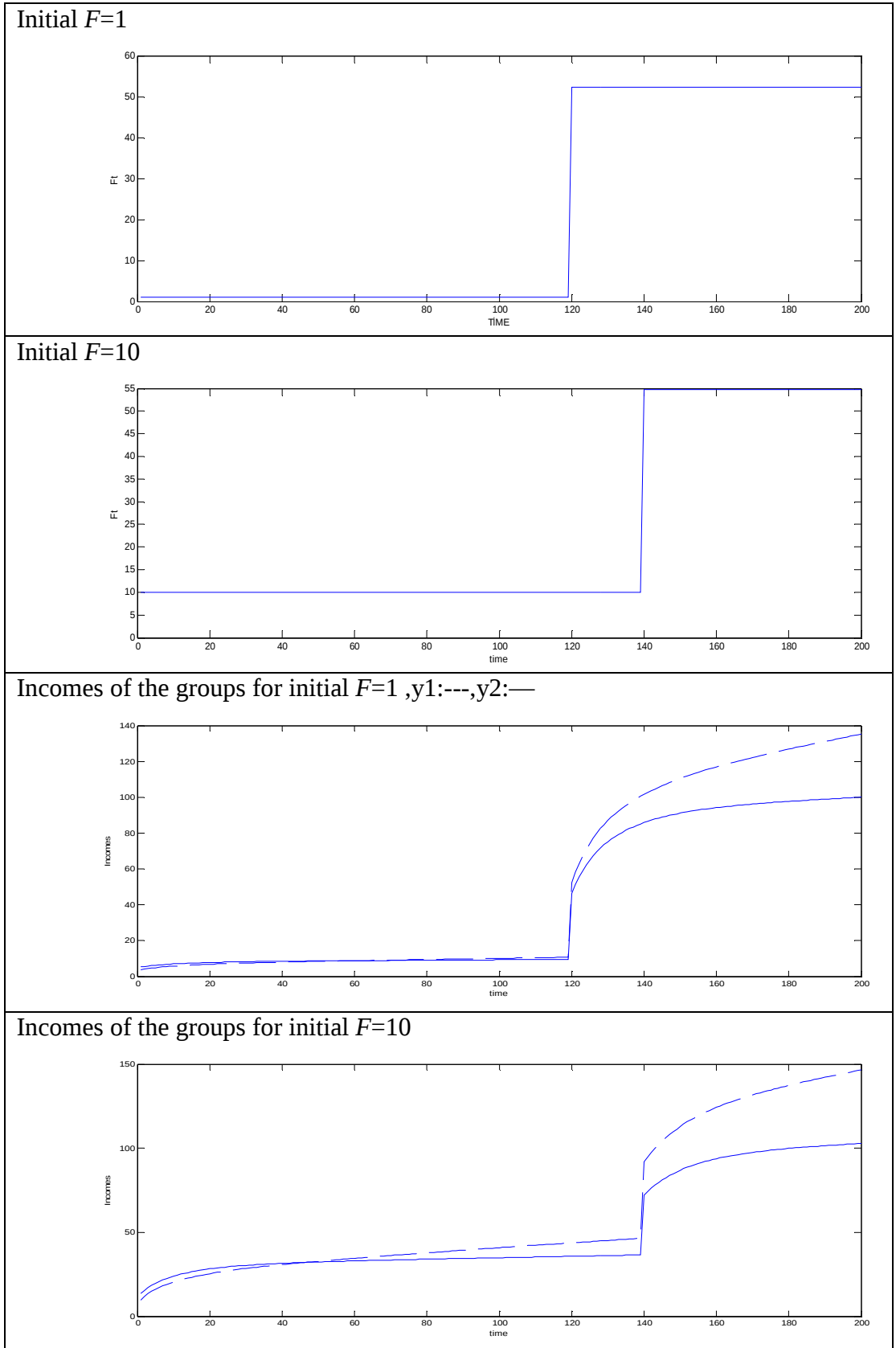


Figure 1 and figure 2 imply that, as cost parameter decreases, F^* persists over longer periods. This comes from the fact that smaller cost parameter yields to higher level of F^* values that satisfies the first order condition given in equation (17). However, high values of F^* violate the third constraint which tells that the level of formal institutions can not exceed the level of informal institutions. Since this constraint is violated, the level of formal institutions is not changed. Hence, F^* only changes when the level of informal institutions becomes high enough so that F^* does not violate the constraint. We also observe that although smaller cost parameter leads to longer periods of persistence, the amount of change in F^* and the final level of F^* are higher when the cost parameter is small.

We also made additional simulations, which are provided in Appendix A. In all simulations, we observed that initial level of F^* does not have a significant effect on its final value. The difference between the final values of F^* when we start from different initial levels is negligibly small.

The figures that we provide in Appendix A, show that initial level of informal institutions plays an important role on the persistence of formal institutions. Initial value of N^1 , which is assumed to be smaller than the initial value of N^2 in all simulations, determines the persistence of F^* . For the same cost parameter, we observe that as initial N^1 becomes smaller, F^* persists over longer periods.

In addition to the persistence of F^* , initial level of informal institutions may also affect the final value of F^* . However, it is not possible to observe systematic relationship between the initial level of informal institutions and the final value of F^* . The economy described by figure 4 implies that when both initial N^1 and N^2 is relatively small, the final value of F^* is also smaller as compared to the economies

with higher initial level of informal institutions.⁶ Additionally, we observe that the economy depicted by figure 2 ends up with the smaller level of F^* as compared to the economies with the same cost parameter. In this economy, we see that initial N^2 is smaller than of the other economies'. On the other hand, we also observe that different initial level of informal institutions may also lead to same level of F^* . This can be observed from Figures 1, 3, 5 and 6. Similar findings can be obtained by analyzing Figures 7, 8, 9, 10 and 11 together.

In all simulations, except the economies described by Figures 5 and 9, we see that the income of group 1, which is assumed to be initially smaller than of group 2 throughout the simulations, catches up and exceeds the income of group 2 over time. The timing of catch up depends on the dispersion between the initial levels of informal institutions. According to simulations, when dispersion between the initial levels of informal institutions is greater, the income of group 2 catches up the income of group 1 later.

We also analyzed the response of optimal F (denoted by F^*) to the changes in the underlying model parameters. Writing a Matlab subroutine, we checked the derivatives for the following ranges of the model parameters: $0.1 < \theta < 1$; $0.005 < \gamma < 0.1$; $0.05 < s < 0.4$. Doing this gives us information about how changes in parameters affect F^* . The following table summarizes the partial derivatives. Since we take $\gamma_1 = \gamma_2$ throughout the simulations, we use the term γ instead of using two different symbols.

⁶ We made our comparisons between the economies which have same cost parameter.

Table 2: Partial Derivates of F^*

	$dF^*/d\theta$	$dF^*/d\gamma$	dF^*/ds
sign	+	-	-

Table 3: Second Derivatives and Cross Derivatives of F^*

	$\frac{\partial^2 F^*}{\partial \theta^2}$	$\frac{\partial^2 F^*}{\partial \gamma^2}$	$\frac{\partial^2 F^*}{\partial s^2}$	$\frac{\partial F^*}{\partial \theta \gamma}$	$\frac{\partial F^*}{\partial \theta s}$	$\frac{\partial F^*}{\partial \gamma s}$
sign	-	+	0	-	-	+

Tables 2 and 3 imply that, an increase in the income share of the institutions, namely θ , leads to an increase in F^* . However, F^* increases with θ at a decreasing rate. We also observe that, the cost parameter γ has a negative effect on F^* which can also be observed from simulation results. As can be seen from table 3, F^* decreases with γ at an increasing rate. In addition to γ , the saving rate, which is denoted by s , has also negative impact on F^* .

Simulations also reveal that the income share of the capital, namely α , does not have an effect on the level of F^* , but it affects the timing of institutional change. As Appendix A2 shows, an increase in α is associated with shorter durations before a change in F^* takes place.

CHAPTER 4

CONCLUSION

In this study, we modify and extend Neyapti (2010)'s dynamic model of institutional evolution into a political economy framework where preferences of two income groups shape the path of institutional evolution. This study proposes an original political economy model which describes the co-evolution of formal and informal institutions. While modeling institutional change, we consider a government that optimally chooses the level of formal institutions by maximizing the sum of the utilities of the two groups period by period. Informal institutions are group-specific and evolving continuously as a positive function of the respective groups' capital stocks.

The evolution of formal institutions exhibits punctuations over time instead of continuous progression. The main findings of model simulations reveal that initially smaller levels of informal institutions leads to slower evolution whereas higher income share of the capital appear to speed the process of institutional change. We also observe that, as the cost parameter decreases, the final level of formal institutions increases although they persist over longer periods.

As the current study is an original attempt to model the evolution of formal and informal institutions from political economy perspective, it bears a rich potential of

future extensions. For instance, this study can be extended by solving the problem of social planner over infinite horizon in addition to the government's optimization problem. In another extension, the weights in the government's objective function can be taken proportional to income levels of the interest groups, rather than taking them equal. Also, different saving rates among the interest groups can be considered for further simulations. Finally, our approach to the evolution of formal and informal institutions may be extended to a wider framework. Because, it is possible to observe that evolution of informal institutions may also perform punctuations and formal institutions may evolve continuously. In this sense, this model can be developed in order to include these aspects of institutional evolution.

BIBLIOGRAPHY

- Acemoglu, Daron. 2006. "A Simple Model of Inefficient Institutions," *Scandinavian Journal of Economics* 108(4): 515-546.
- Arthur, Brian. 1988. "Self-Reinforcing Mechanisms in Economics." In K.J Arrow, and P. Anderson, eds., *The Economy as an Evolving Complex System*. New York: Wiley, 9-33.
- Baumgartner, Frank and Bryan Jones. 1993. *Agendas and Instability in American Politics*. Chicago: University of Chicago Press.
- Coase, Ronald. 1960. "The Problem of Social Cost," *Journal of Law and Economics* 3: 1-44.
- Cukierman, Alex, Geoffrey Miller and Bilin Neyaptı. 2002. "Measuring the Independence of Central Banks and Its Policy Outcomes," *Journal of Monetary Economics* 49(2):237-264.
- Desierto, Desiree. 2005. "The Co-evolution of Institutions and Technology," *Cambridge Working Papers in Economics* No.0558
- Dinçer, Nergis and Bilin Neyaptı. 2008. "What Affects the Quality of Bank Regulation and Supervision," *Contemporary Economic Policy* 26: 607-622.
- Eldridge, Niles and Stephen Gould. 1972. "Punctuated Equilibria: An Alternative to Phyletic Gradualism." In T.J Schopf, eds., *Models in Paleobiology*. San Francisco: Freeman, Cooper&Co, 82-115.
- ISNIE, "About ISNIE", available at <http://www.isnie.org/about.html>.
- Mankiw, Gregory.N, David Romer and David Weill. 1992. "A Contribution to the Emprics of Growth," *Quarterly Journal of Economics* 107:407-437
- Nabli, Mustapha, K and Jeffrey Nugent. 1989. *The New Institutional Economics and Development: Theory and Applications to Tunisia*. New York: North Holland.
- Neyaptı, Bilin. 2010a. *Macroeconomic Institutions and Development*. Massachusetts: Edward Elgar.

- Neyaptı, Bilin. 2010b. "Modeling Institutional Evolution," *Tüsiad-Koç University Economic Research Forum Working Paper* No.1012.
- Nadiri, Ishaq.M and Ingmar Purcha. 1996. "Estimation of the Depreciation Rate of Physical and R&D capital In the U.S. Total Manufacturing Sector," *Economic Inquiry* 34:43-56
- North, Douglass. 1990. *Institutions, Institutional Change and Economic Performance*. Massachusetts: Cambridge University Press.
- North, Douglass. 2005. *Understanding the Process of Economic Change*. Princeton: Princeton University Press.
- Olson, Mancur. 1965. *The Logic of Collective Action: Public Goods and The Theory of Groups*. Massachusetts: Harvard University Press.
- Olson, Mancur. 1982. *The Rise And Decline of Nations: Economic Growth, Stagflation, and Social Rigidities*. New Haven: Yale University Press.
- Olson, Mancur. 1995. "The Devolution of the Nordic and Teutonic Economies," *American Economic Review* 85(2):22-27.
- Roland, Gérard. 2004. "Understanding Institutional Change: Fast Moving and Slow Moving Institutions," *Studies in Comparative International Development* 38(4): 109-131.
- Romer, Paul. M. 1990. "Endogenous Technological Change," *Journal of Political Economy* 98(5): 71-102.
- Williamson, Oliver. M. 1985. *The Economic Institutions of Capitalism*. New York: The Free Press.
- Yao, Yang. 2004. "Political Process and Efficient Institutional Change," *Journal of Institutional and Theoretical Economics* 160: 439-453.

APPENDICES

APPENDIX A1

This section provides the trajectory of formal institutions (F) and incomes of the interest groups over time for different initial levels of informal institutions and cost parameters. Each figure is put on the separate page for the convenience of the reader.

Figure 3: Trajectory of F^* and incomes ($N_0^1 = 10, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.01$)

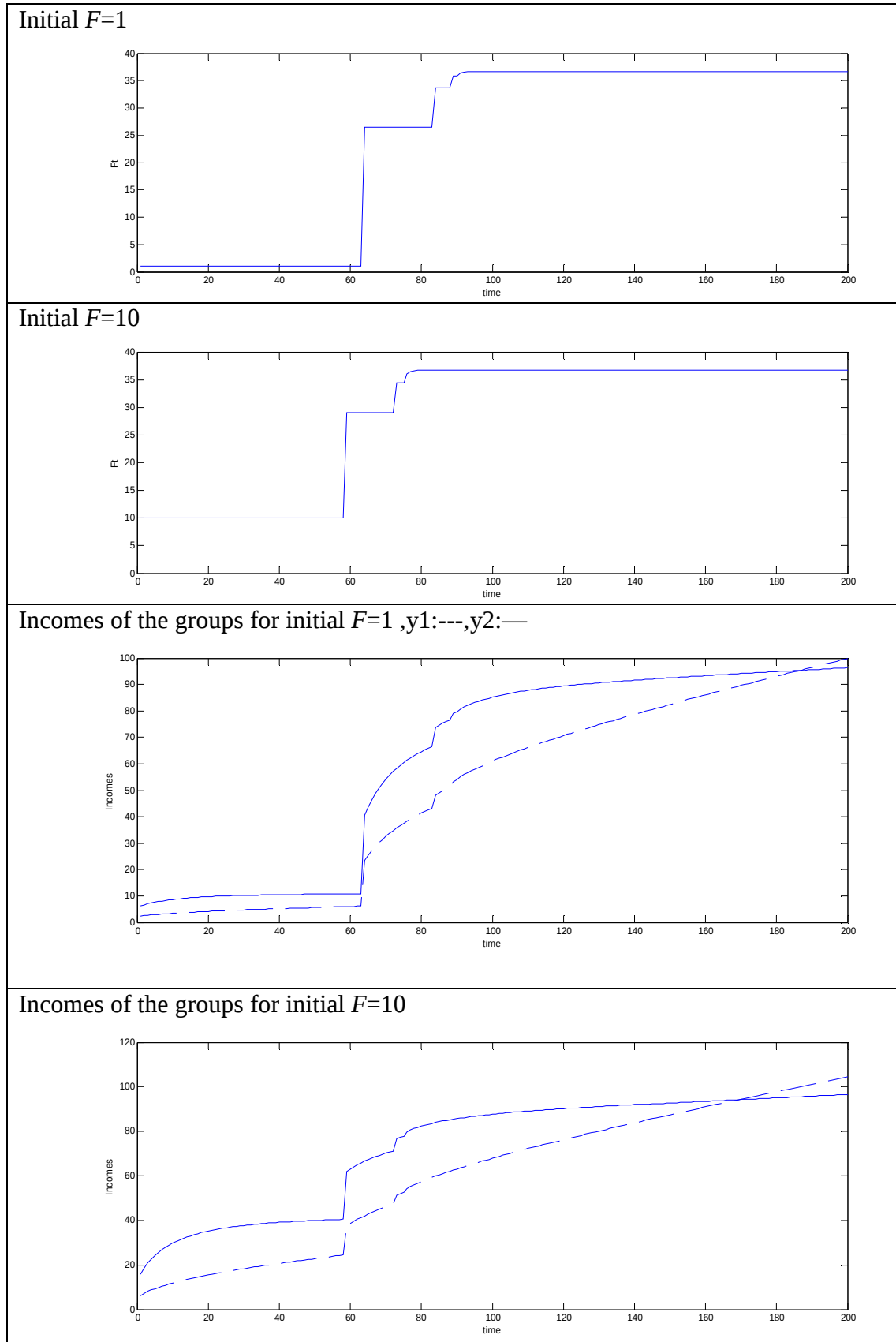
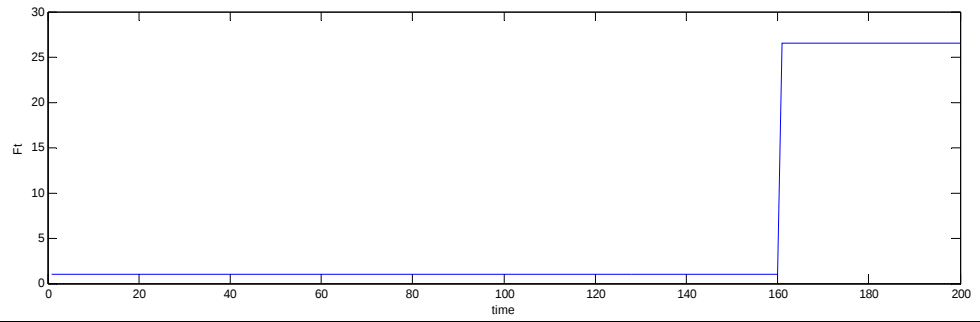
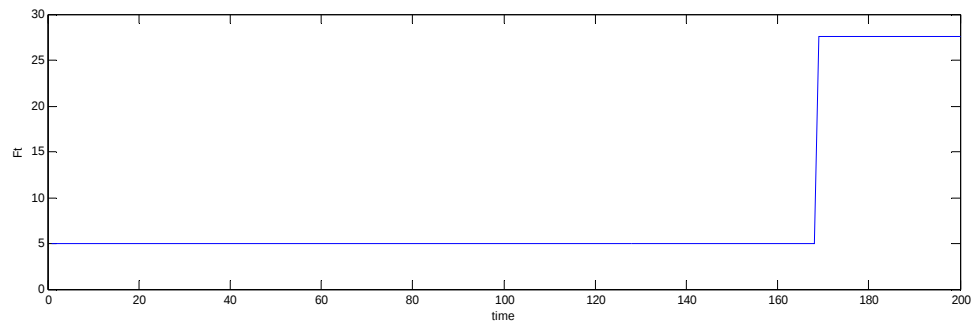


Figure 4: Trajectory of F^* and incomes ($N_0^1 = 5, N_0^2 = 10, \gamma_1 = \gamma_2 = 0.01$)

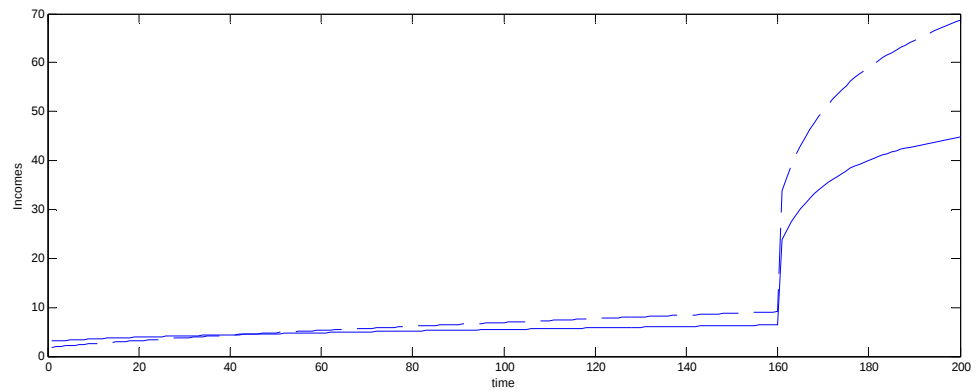
Initial $F=1$



Initial $F=5$



Incomes of the groups for initial $F=1$,y1:---,y2:—



Incomes of the groups for initial $F=10$

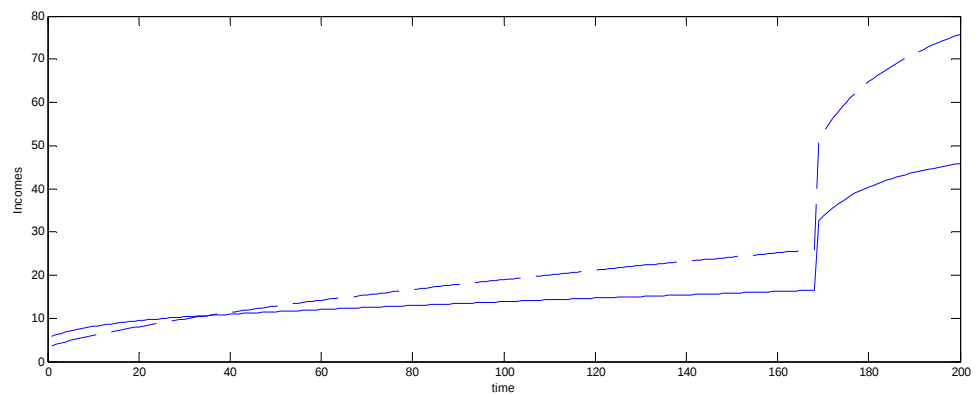
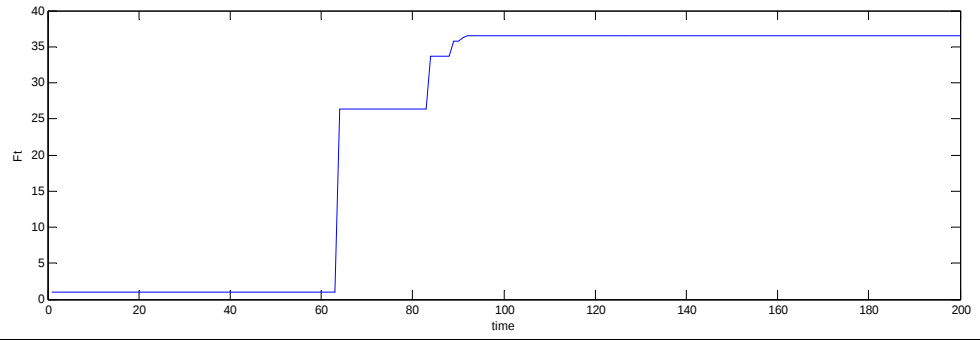
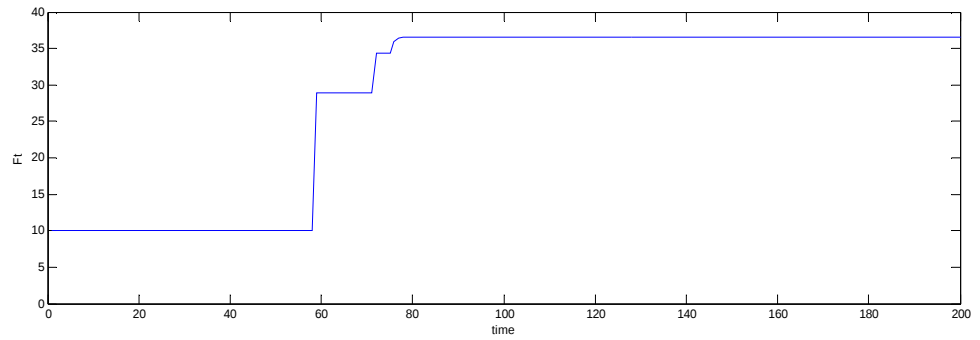


Figure 5: Trajectory of F^* and incomes ($N_0^1 = 10, N_0^2 = 80, \gamma_1 = \gamma_2 = 0.01$)

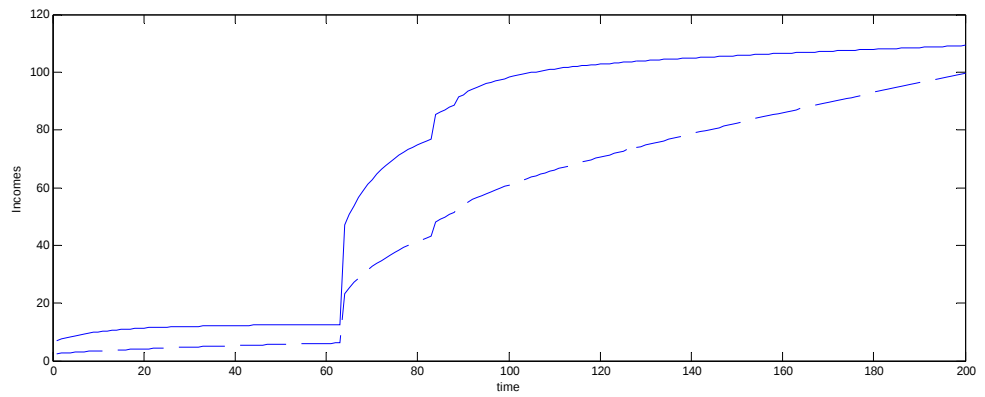
Initial $F=1$



Initial $F=10$



Incomes of the groups for initial $F=1$, $y1$:---, $y2$:—



Incomes of the groups for initial $F=10$

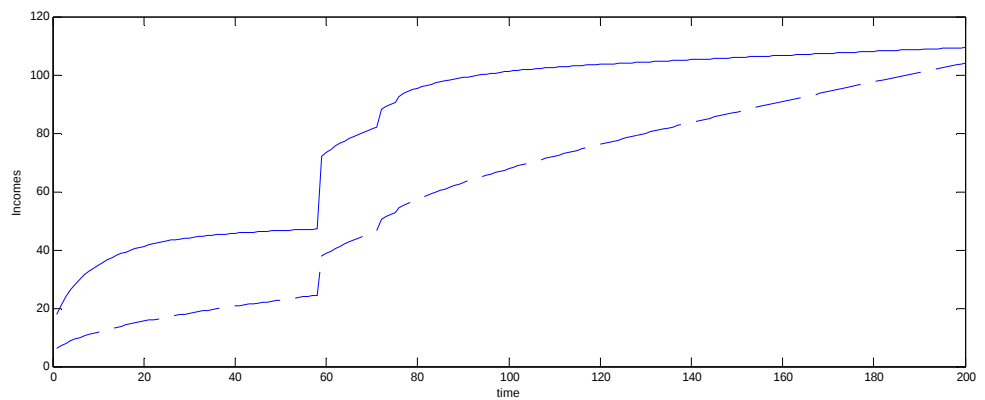
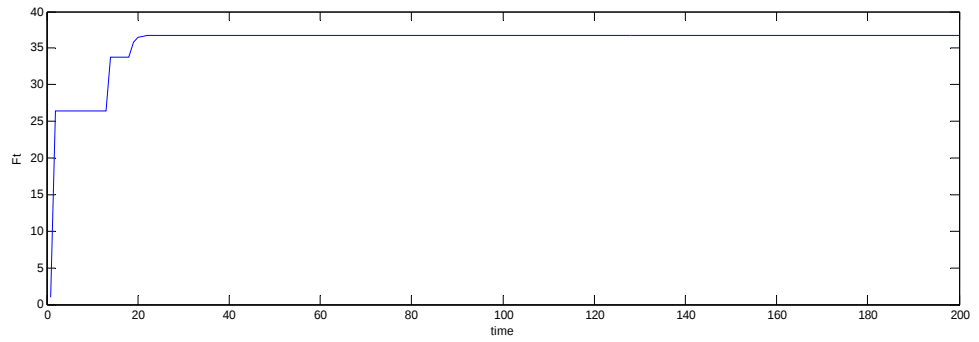
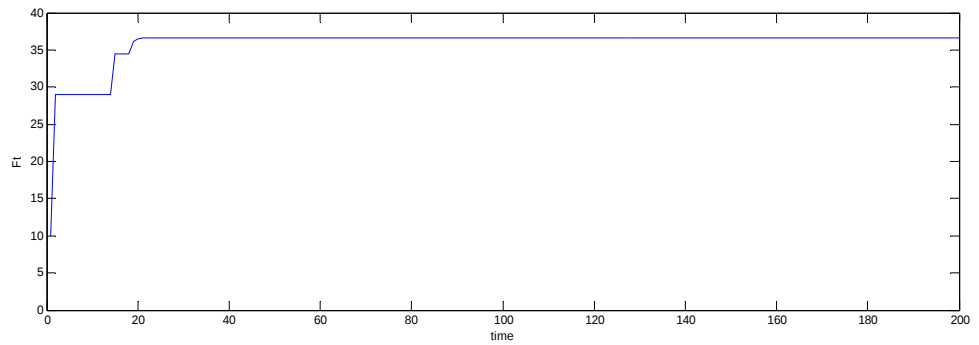


Figure 6: Trajectory of F^* and incomes ($N_0^1 = 30, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.01$)

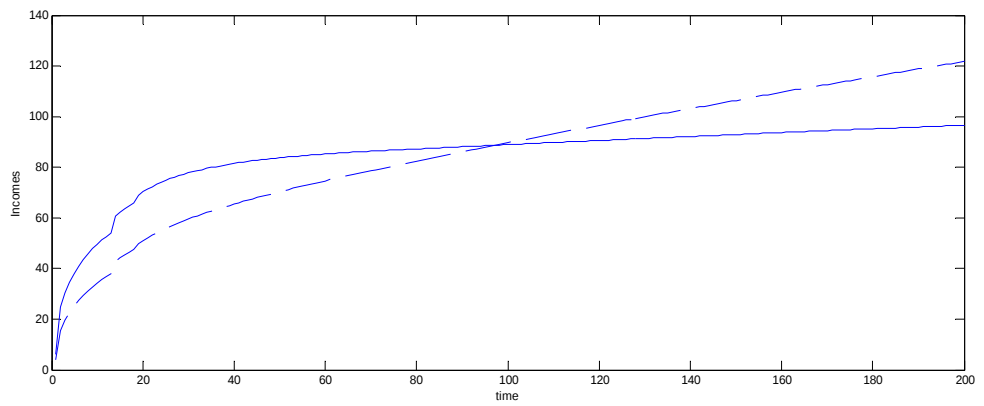
Initial $F=1$



Initial $F=10$



Incomes of the groups for initial $F=1$, y_1 :---, y_2 :—



Incomes of the groups for initial $F=10$

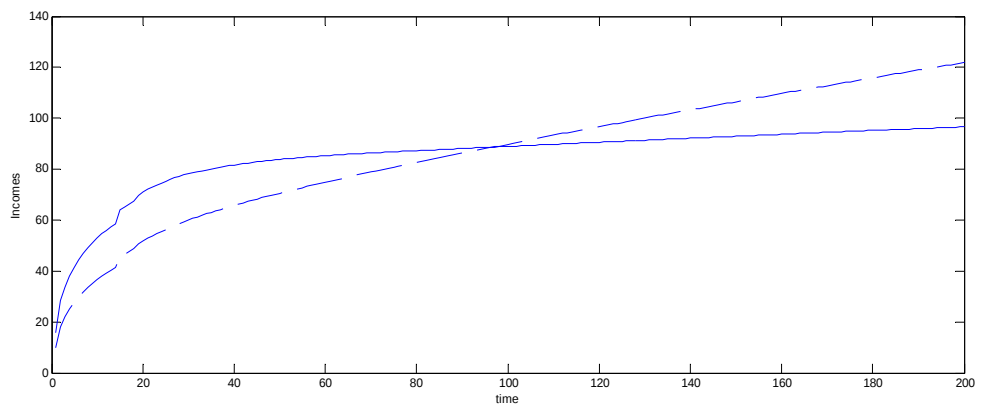


Figure 7: Trajectory of F^* and incomes ($N_0^1 = 40, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.005$)

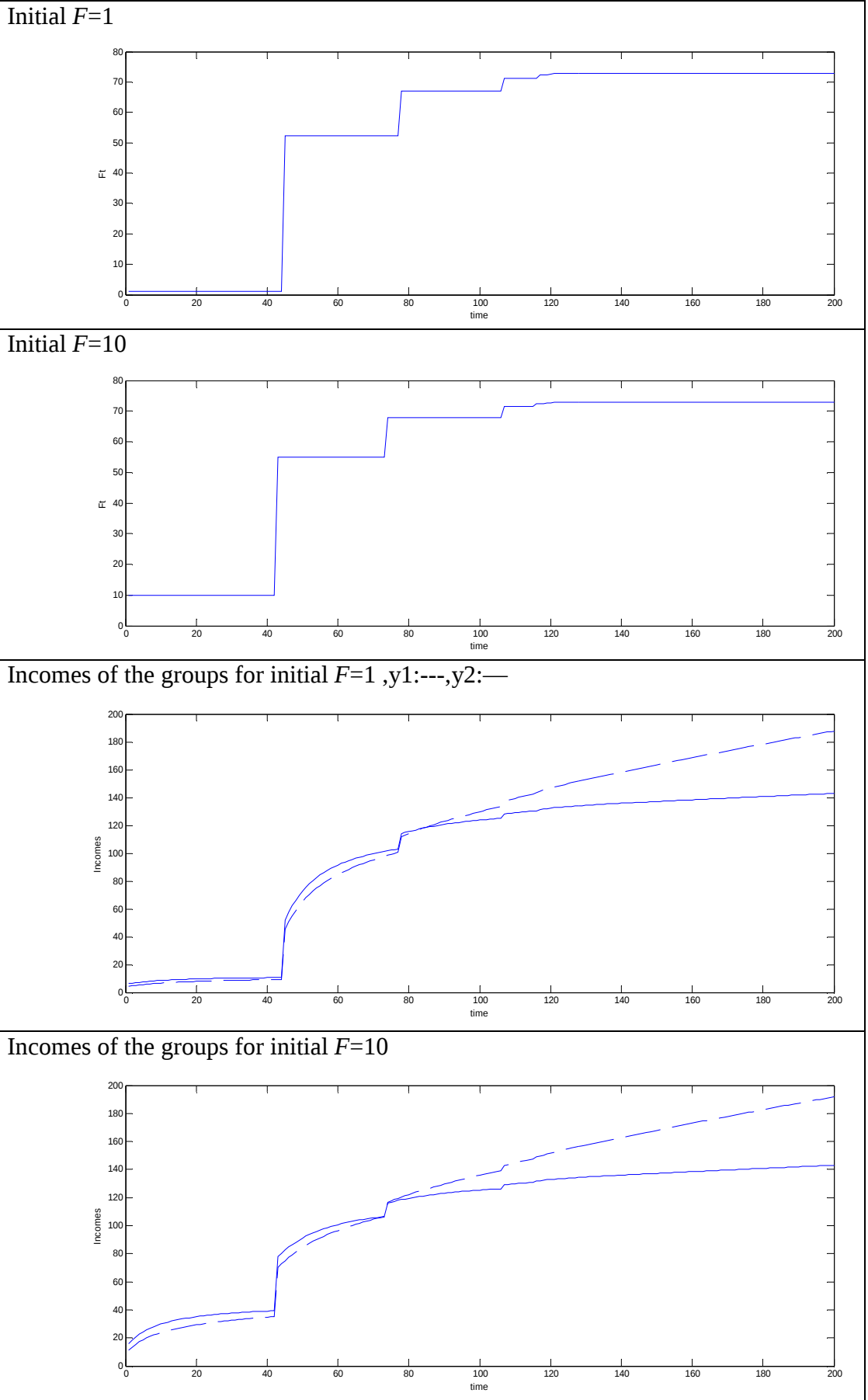
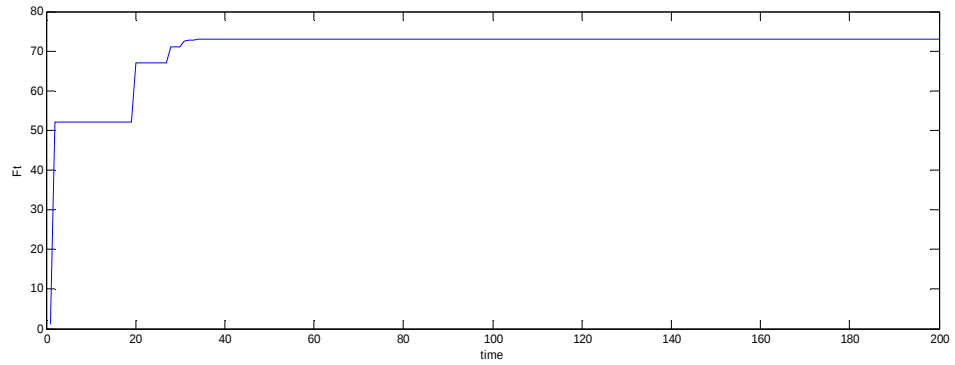
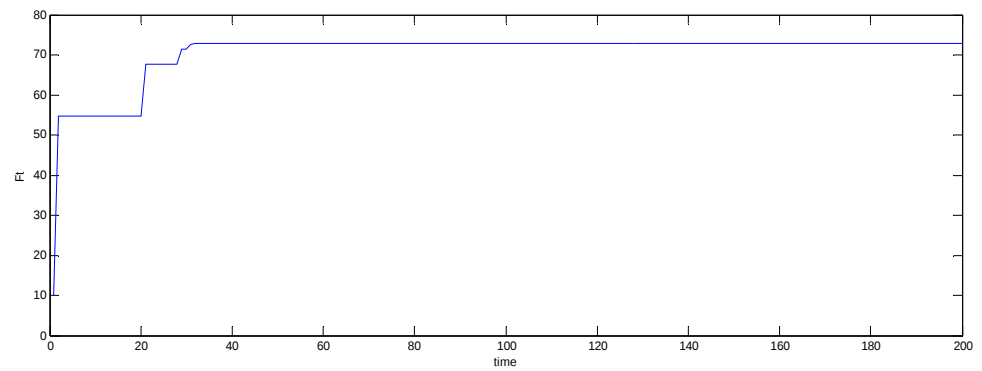


Figure 8: Trajectory of F^* and incomes ($N_0^1 = 60, N_0^2 = 80, \gamma_1 = \gamma_2 = 0.005$)

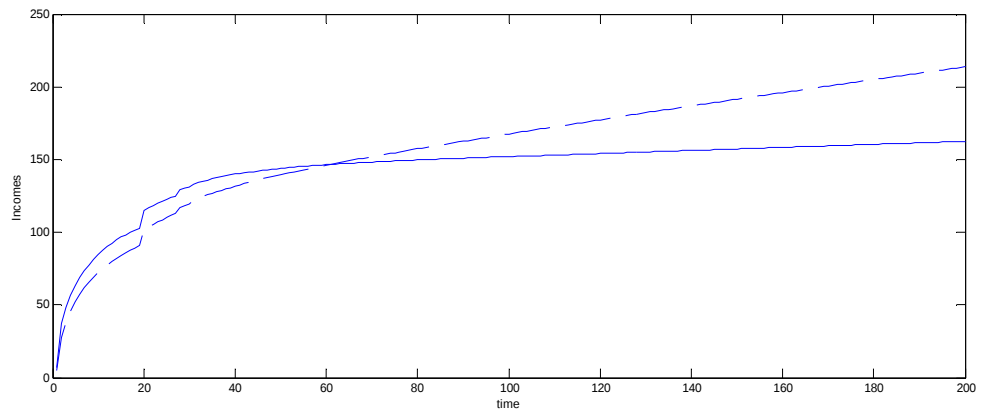
Initial $F=1$



Initial $F=10$



Incomes of the groups for initial $F=1$,y1:---,y2:—



Incomes of the groups for initial $F=10$

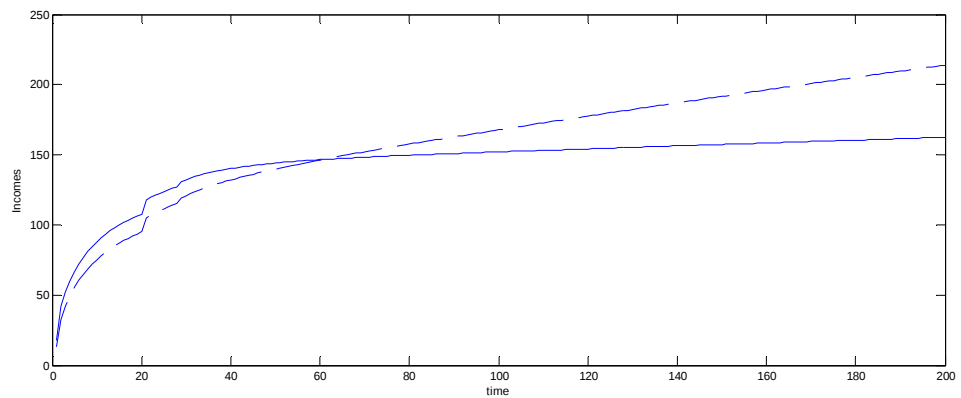


Figure 9: Trajectory of F^* and incomes ($N_0^1 = 10, N_0^2 = 80, \gamma_1 = \gamma_2 = 0.005$)

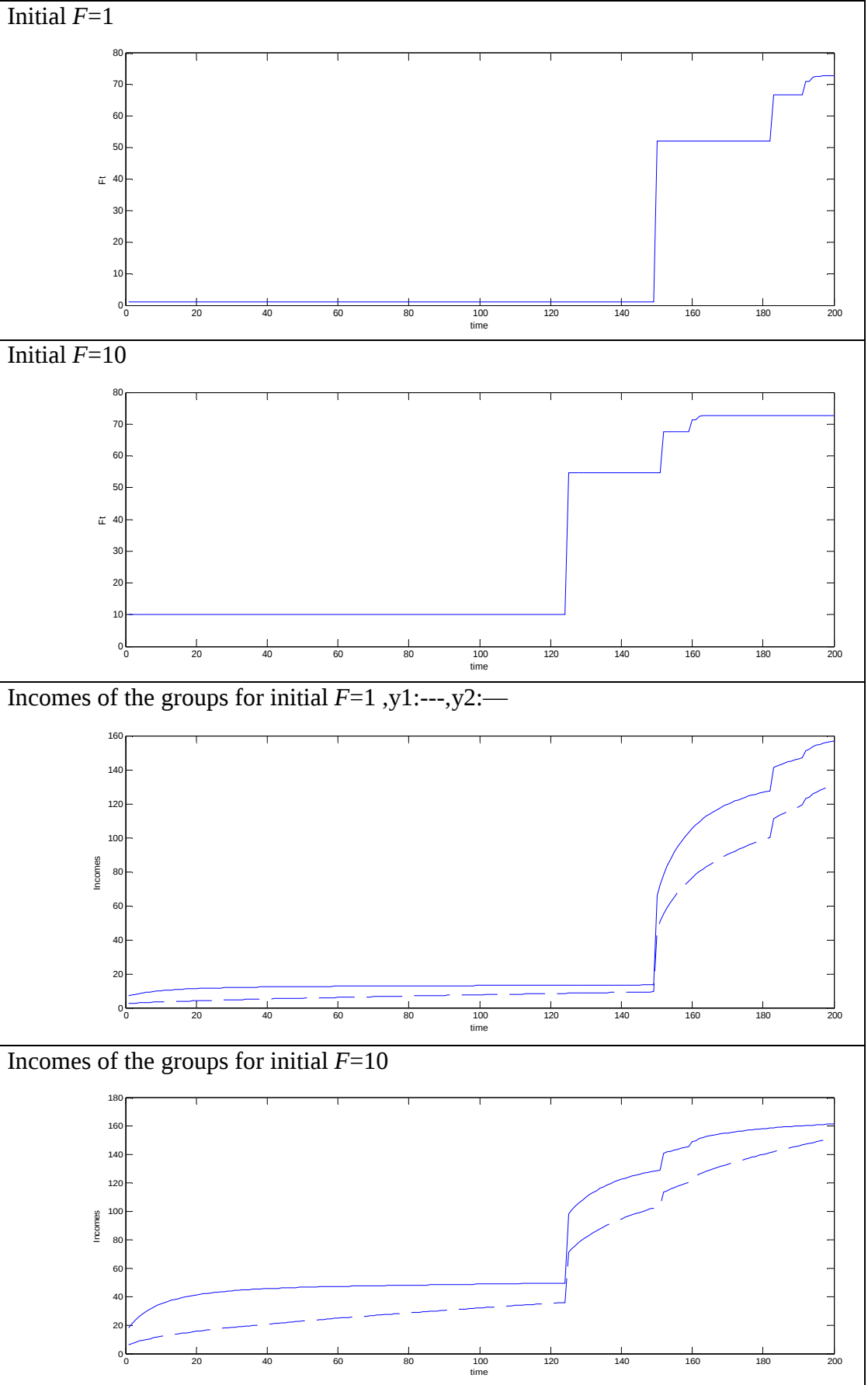
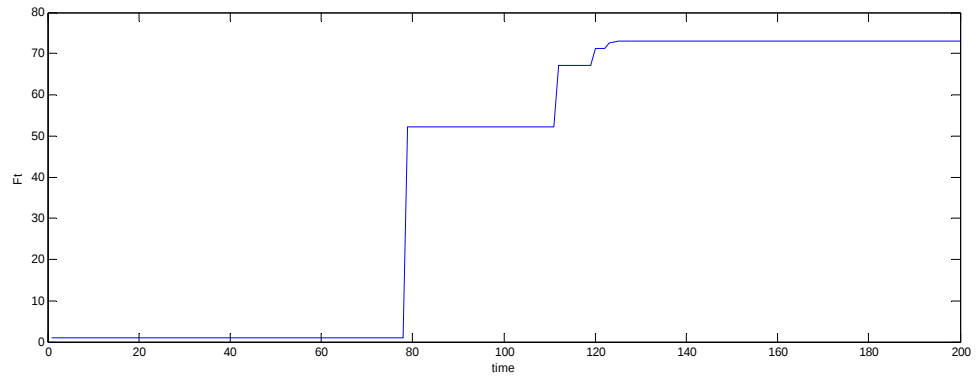
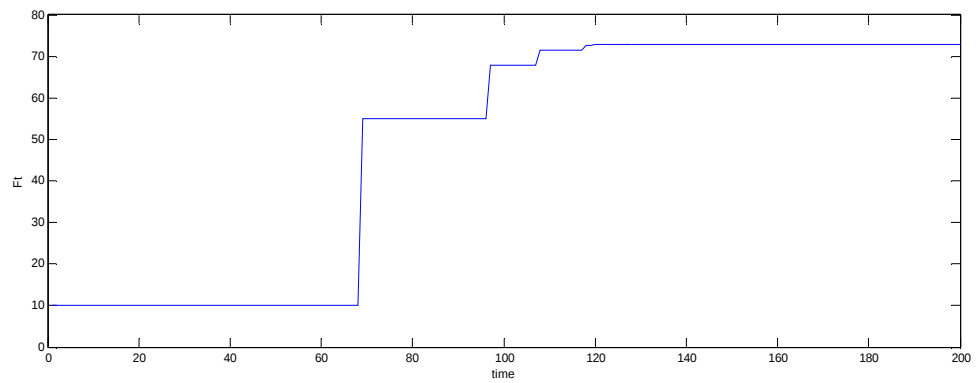


Figure 10: Trajectory of F^* and incomes ($N_0^1 = 30, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.005$)

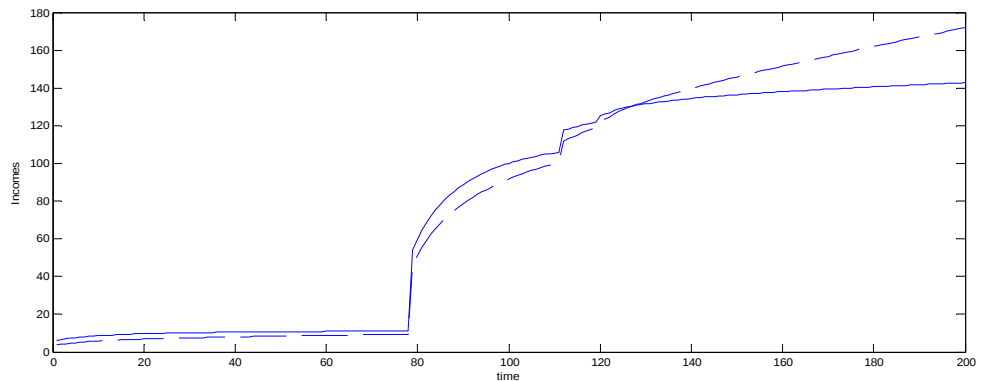
Initial $F=1$



Initial $F=10$



Incomes of the groups for initial $F=1$,y1:---,y2:—



Incomes of the groups for initial $F=10$

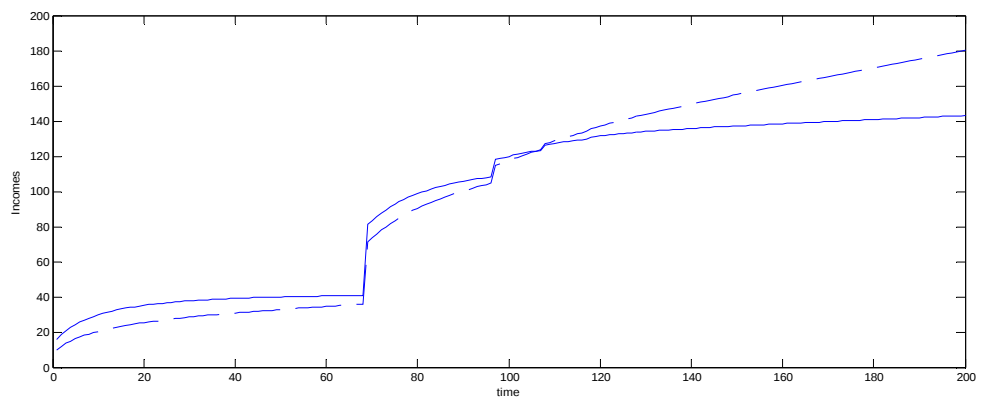
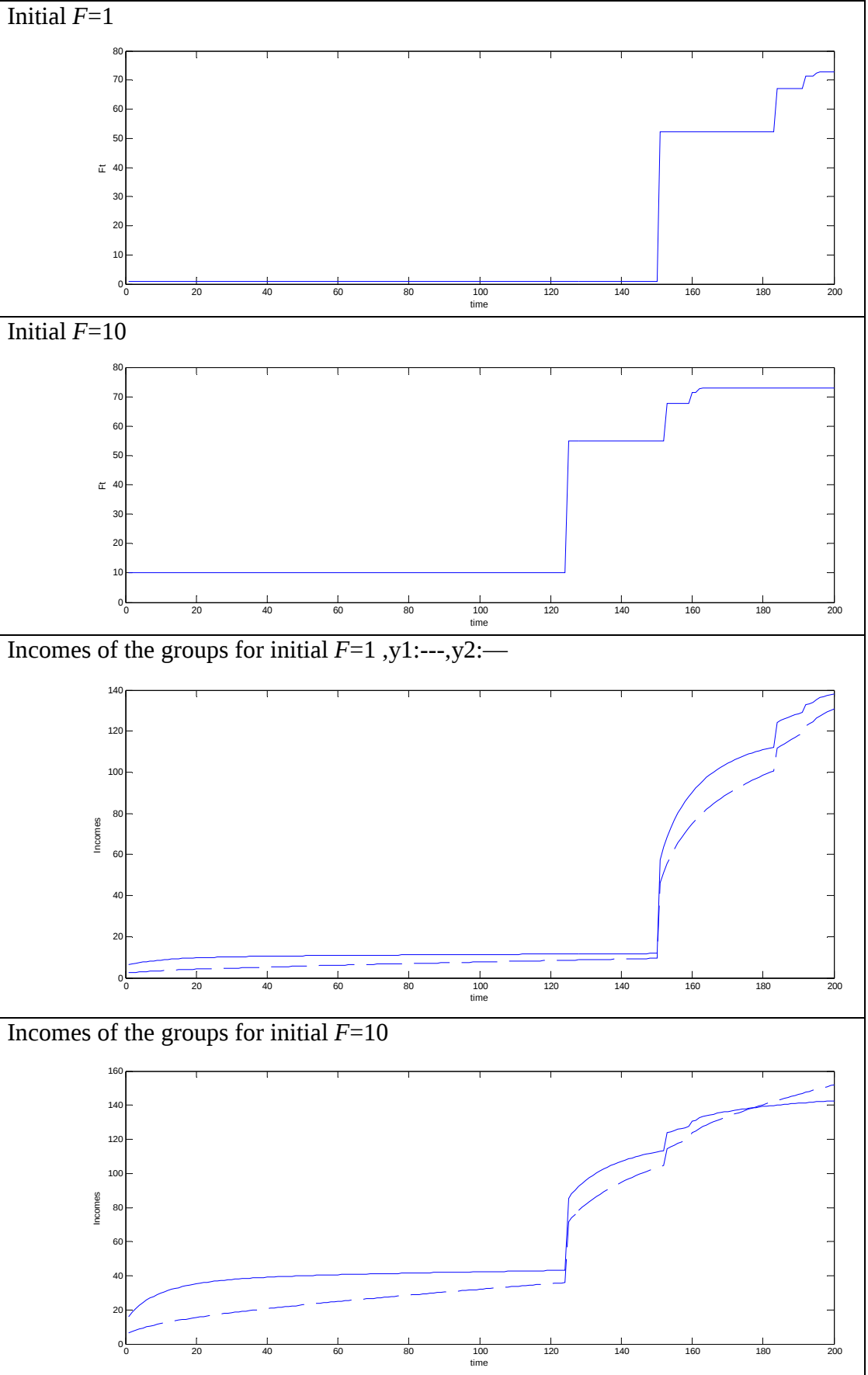


Figure 11: Trajectory of F^* and incomes ($N_0^1 = 10, N_0^2 = 60, \gamma_1 = \gamma_2 = 0.005$)



APPENDIX A2

The below graphs show that income share of the capital, namely α does not have an effect on the level of F^* , but affects the timing of institutional change.

Figure 12: Trajectories of F^* with different levels of α

($N_0^1 = 30, N_0^2 = 40, F_0 = 10, \gamma_1 = \gamma_2 = 0.005$)

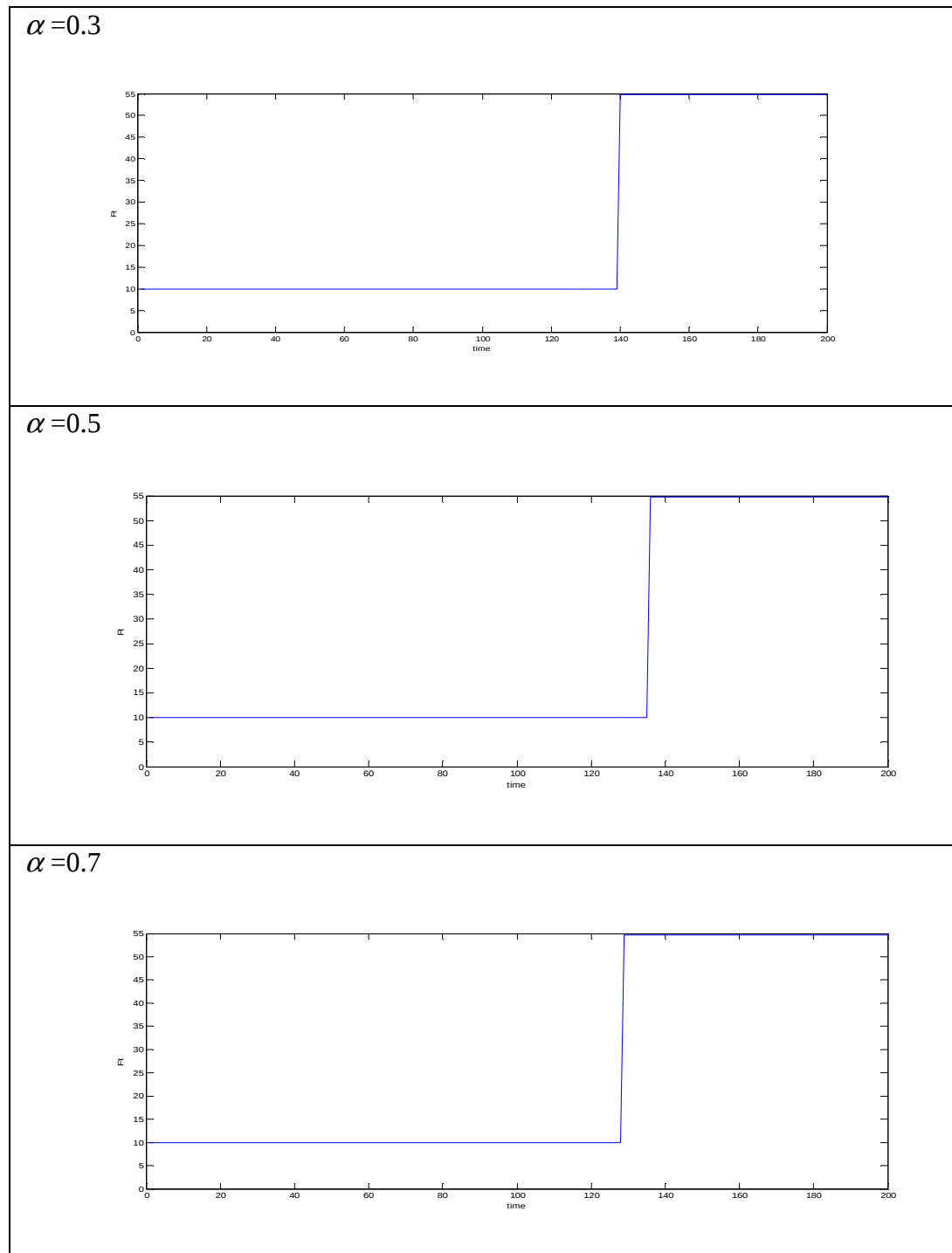
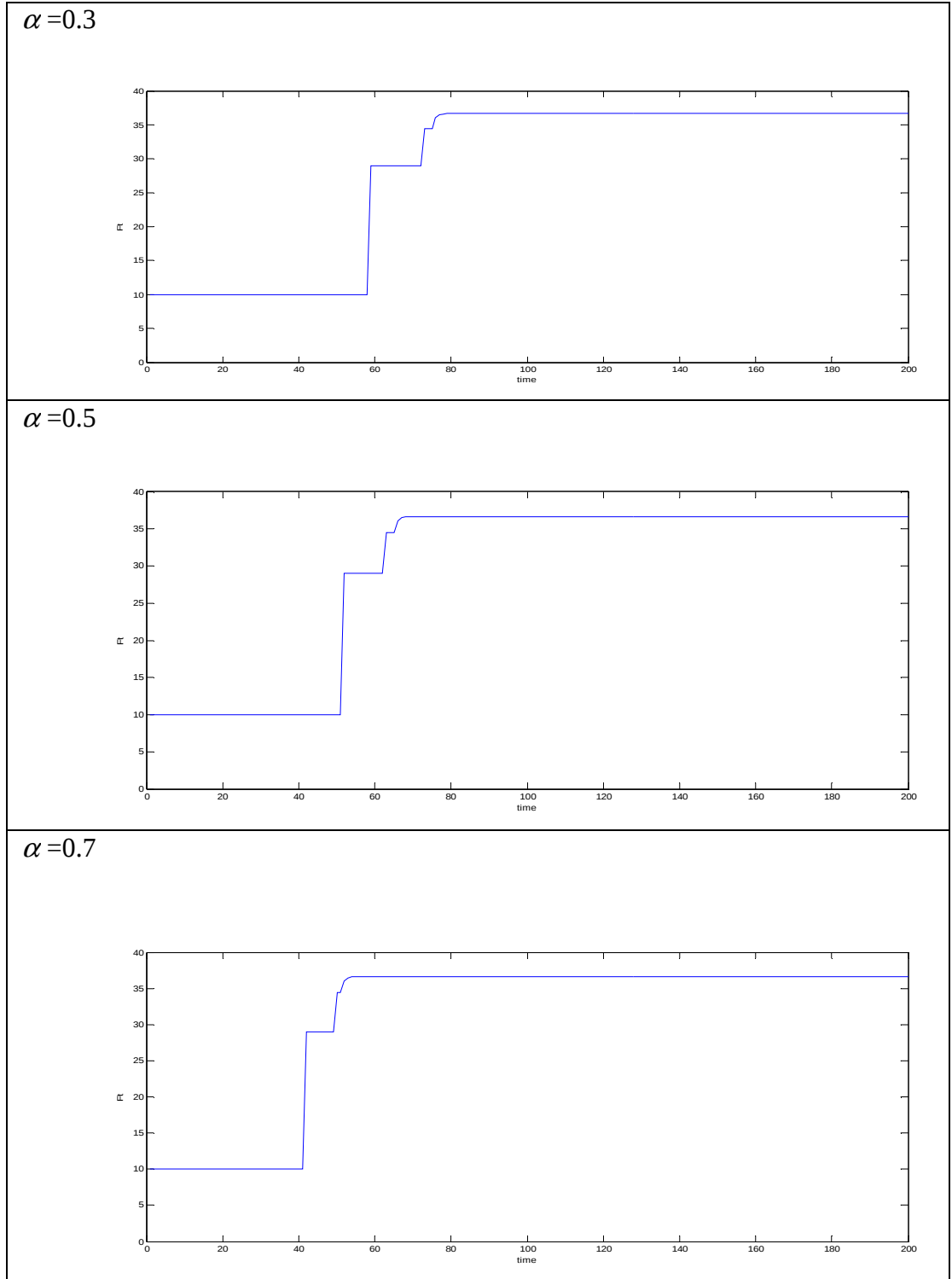


Figure 13: Trajectories of F^* with different levels of α
 $(N_0^1 = 10, N_0^2 = 60, F_0 = 10, \gamma_1 = \gamma_2 = 0.01)$



APPENDIX A3

In this section we prove that the solution of the first order condition defined by equation (17) is a local maximizer.

Proof: In order to show that the solution of equation (17) is a local maximizer, we need to check the sign of the second derivative of equation (16). Since we take $\gamma_1 = \gamma_2$ in our simulations, I am going to use the term γ instead of γ_1 and γ_2 .

Hence, the second derivative of equation (16) is equal to:

$$\begin{aligned} & \frac{1}{2} \cdot \frac{-\gamma^2 \cdot (1 - \frac{1}{N_t^1})^2}{\left[1 - s - \gamma \cdot \left([F_t - F_{t-1}] + (1 - \frac{F_t}{N_t^1})\right)\right]^2} + \frac{1}{2} \cdot \frac{-\gamma^2 \cdot (1 - \frac{1}{N_t^2})^2}{\left[1 - s - \gamma \cdot \left([F_t - F_{t-1}] + (1 - \frac{F_t}{N_t^2})\right)\right]^2} \\ & + \left(\frac{-\theta}{F_t^2}\right) < 0 \end{aligned}$$

Since the second derivative is negative, solution of the equation (17) is a local maximizer.