A Study of Realized, Declared and Future EU-Accession Dates Using System Dynamics Modeling: The Case of Spain, Poland, Croatia and Turkey

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Abstract

In this study we propose an EU-Accession model that simulates the EU accession dates for the realized (Spain, Poland), declared (Croatia) and future (Turkey) accessions. The processualist approach is adopted and a System Dynamics model based on the EU's standards is developed from a technical and institutional perspective. The model consists of three balancing loops: political stability, economic stability and adopting the acquis. These negative feedback loops exhibit a goal-seeking behavior towards fulfilling the criteria set by the EU.

The flow variable 'fulfillment of membership criteria by the candidate' increases the 'total progress of the candidate'. As a candidate country fulfills the membership criteria, final approval of membership process begins, which is simply denoted by 'ratification' variable in the model. An acceptance percentage indicates that when the country reaches that threshold level, her membership is approved.

The simulation results correctly reproduced the accession date for Spain as January 1986 and for Poland as May 2004 with acceptance percentages of 85% and 80%, respectively. When the model is run for Croatia with the 85.6% acceptance level (very close to the value for Spain), the results reproduced the declared accession date for Croatia that is 1 July 2013. The possible accession dates for Turkey are forecasted as August 2012 for 80% acceptance level, July 2014 with 85%, and March 2018 with 90% acceptance level.

The key contribution of this article is the dynamic model which can be used to forecast the possible accession dates of EU candidates based on the country variables of each candidate. This is the first and only study which analyzes EU accession from a systems thinking perspective.

Keywords: EU accession date, Spain, Poland, Crotia, Turkey, System Dynamics modeling

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1. Introduction

In 2011, Europe faced major social, economic and environmental challenges with possible significant impacts on its future territorial development. Trends in key areas such as economic development, climate change, energy supply, demography, globalization, and agglomeration forces are claimed to have differentiated impacts on the EU territory (Davoudi and Dammers, 2010). EU enlargement is definitely expected to impact this process, as in 2005, the potential accession of Turkey had claimed most media attention (Evers, 2010).

One of the three classes of strategic planner identified by Van der Heijden (1996; cited in Lyons, 2005) is **processualists**, who recognize the uncertainty of the future, but also hold that it is not entirely unpredictable. The processualist recognizes the political processes at work in the formation of strategy, but also accepts the value of analytical and rational techniques (e.g. simulations) in helping to structure the political debate. Models are developed to improve strategy development, but model-building should not be seen as an end in itself, but as part of a wider decision-making process, which is essentially social in nature, involving negotiation and debate (Lyons, 2005).

EU accession is a **complex** and **dynamic** issue involving multiple **processes** most of which are non-linear. Furthermore, existing member countries face difficulties in assessing the impact on the union of the timing of a new member accession. We propose that the first step in assessing the impacts of EU accession of a candidate country is assessing the possible accession dates, or date interval.

EU membership process is complex because of the vast amount of requirements a candidate country should fulfill and because of the multilateral relationships between the candidate country and the existing EU members. It is dynamic because each factor affecting this accession process is time-dependent. Their values change continuously (Ugur, 2010). Non-linearity comes from the fact that each and every factor in this complex issue is interrelated, slightly or strongly correlated and interconnected with other factors. For example, political factors affect economic factors, and the reverse is also true. Also, the cause and effect relations are not dyadic, but multilateral.

From a technical and institutional point of view, EU has standard requirements that a country should fulfill and the progress of the candidate is monitored closely by the European Commission (EC) through regular reports. As a response to regular reports, the candidate country prepares her national programs and makes reforms necessary to harmonize her legislation with the EU *acquis* (Grabbe, 2002).

In this paper, the **processualist approach** is adopted and a System Dynamics model based on the EU's standards is developed from a technical and institutional perspective. The political decisions that may affect the accession date are incorporated in the model with the "**acceptance level percentage**" parameter. Policymakers can enter parameter values (e.g., political stability, economic stability and etc.) of the candidate country into the proposed System Dynamics model; run the simulation and then produce possible dates of accession for that country. As a policymaker selects a date from this date interval based on her/his preference and experience, s/he can begin to analyze the impacts of accession according to this date. We name this model as '**EU Accession Model**'.

EU Accession Model has a systems thinking perspective which is useful in understanding complex and dynamic issues through a holistic approach. Hjorth and Bagheri (2006) suggested that "*classical science has focused on isolation of elements of the observed universe. However, to create understanding, it is not enough to just study parts or processes in isolation*". Although there are several methods of examining impacts of any integration, each method has strengths in one dimension. For example, one method can produce successful results when examining the trade effects (Nahuis, 2004; Nakos et al., 2001) and another method can focus on changes in economic returns (Baldwin et al., 1997). System Dynamics is not exclusive to any one dimension. On the contrary, it is designed to include effects of multiple factors into one single model.

The paper is structured as follows. In Section 2 articles about *Integration Theories*, *EU accession* and *EU enlargement* are examined and the essential dynamics of EU accession is discussed. In Section 3, an overview of accession process is summarized. In Section 4 our methodology is introduced. In Section 5, the dynamic model is constructed from causal loop diagrams. System Dynamics model is simulated and the results are given in Section 6. Sensitivity analysis is carried out in Section 6 where policy implications, contribution of the study and future work are discussed. The study and the results are interpreted in Section 7.

2. Literature Review

2.1. Scope of Review

We have reviewed articles on Integration Theories, EU accession of a single country or EU enlargement where multiple countries became an EU member in the same year, and the EU accession process. Integration Theories are important because the question of where the European project will or should evolve is a matter of debate among EU members which certainly has effects beyond the candidate countries and their possible accession dates.

In articles where the topic is EU accession or enlargement, mostly a single effect (e.g. trade effects, FDI, and etc.) is chosen and analyzed, or impacts are forecasted by applying a predefined model with little or no modifications to existing models –in particular general equilibrium model– in the literature. In contrast to this approach, we assert that since all the effects are interrelated and correlated, it is better to include all relevant factors in a single and holistic model. Our main assertion is that possible accession dates should be forecasted first with a systemic approach and then by using this forecast, a new and holistic model can be developed more realistically using a single system dynamic model.

The EU accession process and negotiations are examined in order to determine the main dynamics of the accession. The essential dynamics for accession process involves the EU criteria which are composed of **economic**, **political** criteria (Schimmelfennig, 2003) and the candidate countries' adaptation to **EU acquis** (Grabbe, 2002). We used these three factors as our main variables (stocks) and simulated their trend during an accession.

2.2. Prior Literature

It was Victor Hugo who, on 21 August 1849, at the French National Assembly, first voiced the idea of a 'United States of Europe' by suggesting that a day will come when people in France, Russia, Italy, England and Germany will be merged closely within a higher unit and will form the European brotherhood (Ferrand, 2004). This idea evolved and in 2009 the discussion was directed towards "how Europe should unite". In this sense, Integration Theories need to be understood in order to understand this larger debate on the European Union.

O'Neill (1996) proposes a dialectic between two contrasting viewpoints (**state-centric** vs. **supranational)** on the integration prospectus. McCormick (2005) criticizes **realist** theory for not explaining the rising tide of cooperation that followed the Second World War as it only considers self-interests of states as motivating factor and focuses on competition and conflict.

European Integration theories [e.g., Stone Sweet and Sandholtz, 1997) use **functionalism** and **neo-functionalism** as two different sets of explanations. Functionalism considers common interests and shared needs of states as a motivating factor for regional integration and focus on cooperation. Functionalism is based on the ideas of Mitrany (1966) who defines this approach as an '*authority to a specific activity, to break away from the traditional link between authority and a definite territory*'. An international organization can be brought under one of the three categories (Mitrany, 1944):

1. A general and fairly loose association, like the League of Nations and the United Nations
2. A Federal System
3. Functional Arrangements

Neo-functionalism proposes *spillover* effects which indicate cooperation in one area creates new needs and problems to cooperate in another area. Establishing European Coal and Steel Community, cooperation in one sector, initiated cooperation in other economic sectors is an example for a spillover effect. Supranationalism has been influenced by neofunctionalist theory which asserts that power in international area is possessed by the supranational institutions in contrast with intergovernmentalism where power is possessed by the states. Debates have long raged about whether the EU is **intergovernmental** or **supranational**, or a combination of the two (McCormick, 2005; Stone Sweet and Sandholtz, 1997).

There is a comprehensive debate on Europe about her essential nature. According to Dervis et al. (2004), the passion and intensity with which future Turkish membership in the EU is debated in the countries of the European Union are to a great extent due to the much larger debate on the essential nature of the European project which portrays three visions of Europe:

1. Emergence of a 'European super-state' with a **supranational** level of government as a clear 'federal' center of authority.
2. Community of traditional nation states, having formed a common economic market, but retaining **sovereignty at the national level** in most domains.

3. Union as a set of overlapping circles, with a **multi-level system of governance**. Within the overall framework of the EU with some well-defined competencies, there would be flexible forms of enhanced cooperation, with some member countries going further in integration various policies than others.

A convincing explanation for the political basis of support for European Integration is provided by Sánchez-Cuenca (2000) as the higher citizens' opinion of the functioning of supranational institutions and the lower citizens' opinion of the functioning of national institutions, lead to greater support for integration.

Propensity for regional integration is studied by Efird and Genna (2002) who found that '*integration is most likely when there is an asymmetric distribution of power between countries and when they are jointly satisfied after a power transition has occurred*'. In one study, dynamic effects of economic Integration in six Integration Schemes (EEC, EFTA, LAFTA, CACM, EACM and CMEA) are examined: '*Unlike static gains from integration, whose theoretical treatment is well established, the dynamic effects of integration are generally presented as a series of separate and often unrelated phenomena not easily captured by a single model*'[3] (Brada and Mendez, 1988).

The economic effects of the Central European Countries on the EU were studied by Brown et al. (1995) by using a specially constructed version of the University of Michigan Computational General Equilibrium (CGE) Trade Model. Their results suggest that '*economic welfare of the Central European Countries (CEC) would be increased by the Central European Free Trade Agreement (CEFTA), and that integration with the EU would bring even greater welfare benefits*'. Their study did focus on single macro variable, namely economic impacts, but did not take into account other macro variables such as political, socio-cultural, and technological, and their interactions.

The economic costs and benefits of the enlargement for East and West were analyzed by Baldwin et al. (1997) using simulations in a global applied general equilibrium model. Their estimates show that '*EU membership will be enormously beneficial to the CEEC economies. Even without considering transfers, and even limiting ourselves to the conservative scenarios, membership will raise CEEC real incomes by 1992 ECU 2.5 billion.*' By analyzing the Eastern enlargement from a German perspective based on a dynamic general equilibrium model, Keuschnigg and Kohler (1999) sought to answer the question '*is EU enlargement worth its price for Germany?*', and they concluded that '*contrary to widespread concern, Eastern enlargement is beneficial in overall welfare terms for the German economy. Furthermore, the expected expansion of the overall economy swells the tax bases to an extent that enlargement may be largely self-financing*'.

The effects of Turkey's accession were discussed by Tocci (2001) linking Turkey's economic instability and imbalances with political instability. The study recognizes the potential of accession to initiate virtuous trends in Turkey's political economy.[4] Similarly, Breuss (2001) concentrated on macroeconomic impacts of EU enlargement for old and new members by simulating a world macro model, the Oxford Economic

[3] We agree with this view and for this reason we propose System Dynamics as a methodology to combine the related factors in a single model.

[4] The change in the behavior of a system from a vicious to virtuous (or vice a versa) is similar to what is named as 'loop dominance' in SD. Thus, this change which occurs in complex and dynamic systems can be modeled with SD.

Forecasting EOF World Macroeconomic Model, and found that '*on average the CEEC – measured in terms of real GDP – will gain around ten times more from enlargement than the EU. On average, enlargement is a win-win game*.'

Concentrating on the candidate's cost of membership, Wallner (2003) suggests that '*EU-specific anticipatory investments of private firms lower the governments' outside option. The EU takes advantage of the applicants' increased dependency and extracts more surpluses through entrance conditions that benefit it and impose net costs on applicants*.'[5]

Chumacero and Schmidt-Hebbel (2005) assert that general equilibrium theory and modeling have proved to be relevant and useful for understanding economic interactions between markets and agents in complex modern economies and the determination of prices and quantities as a result of the latter interactions.

Studies have examined the impacts of previous enlargements rather than trying to forecast the future enlargements. For example Nakos et al. (2001) analyzed the impacts of Portugal's accession by examining the trade data for the first seven years following her accession based on the OECD data.

2.3. Assessment of Accessed Literature

Among the articles we traced, none has examined comprehensively the relationship between the candidate countries variables such as macroeconomic stability, political stability, and level of conformity with EU Acquis with the possible accession date of that country.

As a candidate country applies to membership, the discussions about the impacts of the accession begin immediately by the applicant country, members of EU, and other countries as well. These discussions are held in public, in universities, in scientific publications, by academicians, by politicians, by journalists, by lawyers, and by the institutions of EU. Different opinions and vast number of perspectives for membership emerge as the discussions continue. At the same time, applicant country prepares for membership by adopting the acquis. Although each country creates specific issues, opportunities and threats to EU are similar, the accession criteria and the accession process for each country are the same.

Although the impacts of accession are multifaceted, most of the discussions in the literature focus on only one or two dimensions. For example, one study focuses on the trade effects of accession, while another study focuses on migration. However, no study tries to combine several variables and analyze their joint effects. Thus, the studies related to EU membership neglect the interconnectedness of all dimensions and lack the holistic view.

[5] In EU Accession Model, EU is expected to conform to the initial conditions of the negotiations and the possibility of her taking advantage of the applicants' increased dependency is not modeled. However, the acceptance level variable in the model can be used to show why some countries became an EU member earlier than other candidate countries.

3. Brief Overview of the Accession Process

The process of Accession Negotiations is a complex process where EU institutions, candidate countries and member states are involved to facilitate the implementation of the acquis in the candidate countries by carrying out bilateral and multilateral meetings. The negotiations are not about accepting the acquis or not, but about the time frame of adopting and implementing the acquis. However, there may be time-limited transition periods or derogations for special cases of the candidate country (Grabbe, 2002).

Accession Negotiations begin with the adoption of a negotiating framework which is composed of the principles of negotiations. After the negotiations are started, the screening process, which is the first state of accession negotiations, is initiated by the decision of the Intergovernmental Conference (IGC). Screening process consists of a detailed analytical examination of the EU Acquis and compliance level of countries legislative instruments with the Acquis.

There are two screening stages. The first one is called analytical screening stage, or explanatory phase. In this phase, the Commission explains the Acquis to candidate countries. This is a multilateral screening where European officials inform authorities of all candidate countries about the EU Acquis. The second stage which is usually conducted one month later than the analytical stage is called detailed screening. Detailed screening is a bilateral screening in which candidate explains her laws, and her compliance to the related chapter.

Candidate countries are expected to prepare negotiating positions which consist of documents where the candidate country states her opinion on the compliance with the Acquis for chapters, and planned activities to ensure compliance and implementation. Negotiating positions are important because the arguments given determine whether the candidate is granted transition periods and derogations or not. Transition periods can be granted to a candidate country in the areas where candidate can not comply with the Acquis on the anticipated date of accession. Transition period should be limited in time and scope. There are two types of derogations; permanent or temporary. In permanent derogation there are no time limits, whereas in temporary derogation country avoids applying a section of the Acquis for a limited time. The difference between transition period and temporary derogation is country does not have to present compliance agenda in the latter.

After preparing the negotiating positions, the candidate country presents her negotiating positions to the Member State holding the Presidency of EU, which communicates the documents to all of the Member States and to the Commission. Draft Common Position is prepared by the EU Commission, and after it has been approved by the Council, it becomes 'EU Common Position'.

After the negotiations are opened, they are conducted at two levels. During the IGC, in which ministers of Member States and candidate countries meet, political and strategic decisions are taken. Decisions about the start of the negotiation process, the opening and provisional closure of the negotiation chapters are considered at the IGC. The actual negotiations that are at the technical level are handled between the Committee of Permanent Representatives of EU Member States (COREPER) and the negotiation teams of the candidate country.

After Commission considers that candidates' compliance for a chapter is sufficient, Commission proposes the opening of the negotiations for the corresponding chapter. Negotiations are usually first opened in relatively easy chapters. Economic Development Foundation has published a book about the guidance on accession negotiations with EU,[6] which analyzes this process for the ten central and eastern European countries that became a member in 2004 and arrived at a conclusion that the majority of the candidates face difficulties in the same sections, thus it is important to examine previous experiences.

4. Methodology

Many articles in the literature discuss simulation in general, system dynamics modeling in particular in order either to start discussion on possible futures and/or to predict the future.

Rausch and Catanzano (2009) use the word futuring, rather than forecasting, to clarify the role of simulation and gaming in looking at potential futures. Simulation-gaming can help bring to attention a rich and varied range of possible specific changes that may occur in an existing or imaginary scenario, and explore what repercussions might result.

Systems Dynamics (SD) modeling provides a common language which can be communicated through stock and flow diagrams. This increases the readability of the arguments without sacrificing the holistic view and it is an appropriate way to show multi-dimensional and complex relations in diagrams. SD modeling is based on systems thinking.

Systems thinking has an holistic view and it can be used to solve complex, interrelated, and multi-disciplinary problems. It is a concept that enables us to see the whole picture in any kind of problem and analyze the impacts of the system by having a thorough understanding about the components and their interactions within the system. Senge (1999) suggests that the discipline of systems thinking lies in a shift of mind: '*Seeing interrelationships rather than linear cause-effect chains and seeing processes of change rather than snapshots*.'

In order to develop an SD model, one needs to know the causal relationships between variables, and to be able to indicate feedbacks to draw causal-loop diagrams (CLD). The most important features of a CLD are negative and positive feedbacks. Martin (1997) suggests that '*The two types of feedback, positive and negative, combine to create all of the behavior observed in complex systems. Positive feedback drives growth and change. Negative feedback negates change and stabilizes systems. Negative feedback exhibits goal-seeking behavior.*' If one cannot figure out the feedbacks then the model is not an SD model because the dynamic movement of the system is caused only by feedback loops.

After developing the CLD, the Stock and Flow Diagram (SFD) is drawn with the help of rates (flows) and stocks (levels). 'Stocks' represent variables that accumulate during the selected time interval. They increase and decrease only with flow (rate)

[6] Economic Development Foundation, Avrupa Birliği ile Katılım Müzakereleri Rehberi. İstanbul:İktisadi Kalkınma Vakfı Yayınları, 2005, no: 184.

variables. A causal loop diagram is shown in Figure 1 and an example of a stock and flow diagram is shown in Figure 2.

Figure 1. Causal Loop Diagram

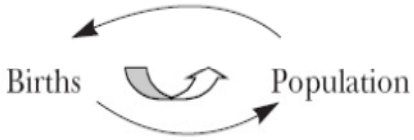
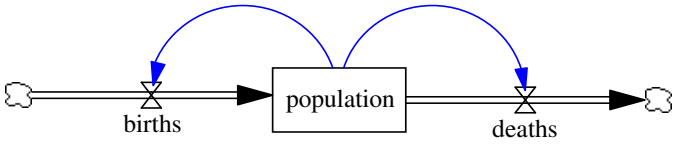


Figure 2. Stock and Flow Diagram



Based on the SFD, mathematical relationships and equations are defined and then the model is ready for a computer simulation. Simulations provide us the opportunity to run sensitivity analysis and 'what if' simulations so that we can learn how the variables interact with each other and how the overall system changes.

5. Proposed Dynamic Model

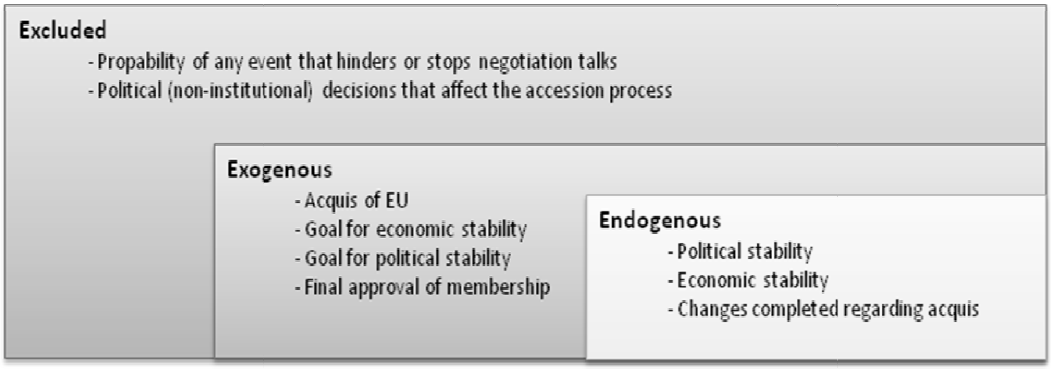
The issues that are important to the model are treated endogenously, issues that are of secondary importance are inserted into the model as exogenous variables, and variables that are irrelevant with the problem are excluded. The proposed EU Accession Model is based on the institutional structure and decision making of EU, and any other probabilistic event that can hinder or stop negotiation talks, or political (non-institutional) decisions (e.g., as discussed by Uğur, 2010) are excluded from the model boundary chart as shown in Figure 3.

In systems thinking, it is often said, 'structure determines behavior' and the structure of a system is defined as 'the totality of the relationships that exist between system variables'. The structure of relationships during an accession to EU needs to be analyzed and understood by policymakers in EU and the candidate countries. SD provides us the tools to analyze these relationships.

The EU Accession Model aims to be a tool for analyzing future accessions to EU due to 'transferability of structures' feature of an SD model. Albin (1996) asserts that generic structures are simple structures that recur in many diverse situations, and show that the models of radioactive decay and a population death system share the same basic structure.

The EU Commission announces Regular Reports for the candidate country. Each Regular Report describes the relations between the candidate and the Union and comprehends the candidate's situation in terms of political and economic criteria for membership and reviews the candidate's capacity to assume the obligations of membership, that is, the Acquis expressed in the Treaties, the secondary legislation and the policies of the Union.

Figure 3. Model Boundary Chart for Accession Model



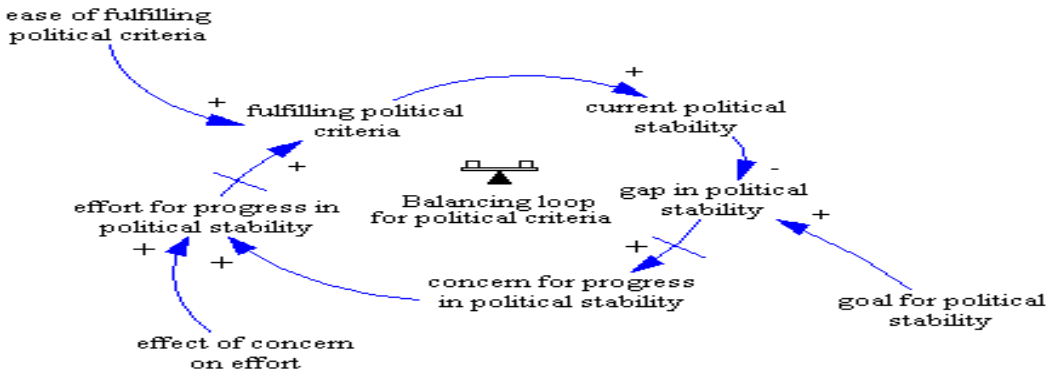
From a System Dynamics perspective, the regular reports can be considered as a tool to take a snapshot of the value of the current situation (stock in terms of SD) that is named generally as 'fulfillment of membership criteria by the candidate country'. There are three main criteria that assess the degree of fulfillment: economic criteria, political criteria and ability to assume the obligations of membership.

5.1. Fulfilling Political Criteria

In order to fulfill the political criteria of membership, the candidate takes action and tries to decrease the gap in political stability. The instruments that facilitate this process are mainly the regular reports which provide the current status of the candidate (in an SD model, stocks show the current status) and financial pre-accession supports. 'Political stability' also influences 'ease of reforms for fulfilling economic criteria'.

Political Loop is depicted in Figure 4. The variable in the bottom left hand side of the figure is 'goal for political stability' represents the EU's criteria for political stability thus this is the goal of the candidate. The current situation in political stability is represented with 'current political stability' variable and the difference between these two variables constitutes 'gap in political stability'.

Figure 4. Political Loop



When the gap in political stability is large it means that the candidate is far away from the EU's expectation and the concern of the country for progress is positively affected and the 'concern for progress in political stability' variable gets higher. The line crossing the causal line from gap to concern variable indicates a time gap meaning that the concern is not immediately affected when the gap changes. For

example the gap can be high but due to time needed for evaluation and the time elapses between the data reaches decision makers the increase in concern gets delayed in time.

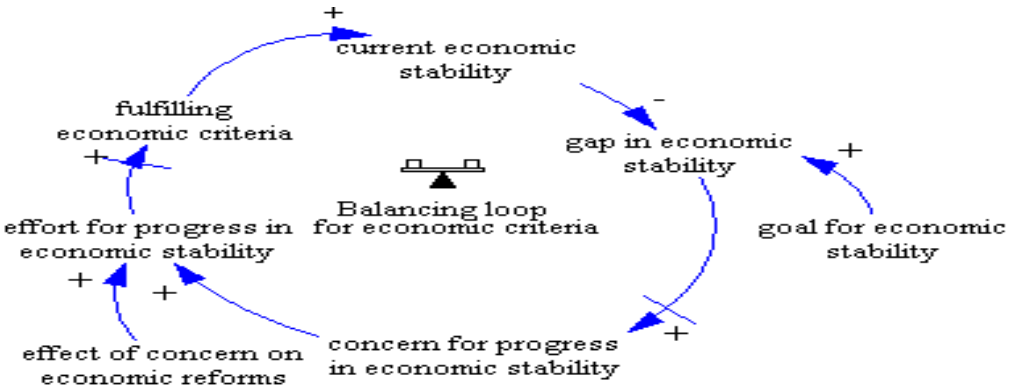
The concern does not always transform to effort with 100% efficiency. Thus, the variable 'effect of concern on effort' enters into the equation and together with concern effects the 'effort for progress in political stability'. The ease of fulfilling political criteria differs from country to country and it together with effort determines the fulfilling political criteria variable which in turn increases current political criteria and the loop completes.

5.2. Fulfilling Economic Criteria

According to the Economic criteria of EU membership of the Union requires the existence of a functioning market economy, and the capacity to cope with competitive pressure and market forces within the Union. The 'current economic stability', 'goals set by EU', 'the gap in economic stability' variables determine 'the effort for progress in economic stability' which in turn affects 'the fulfilling economic criteria'.

Economic Loop is depicted in Figure 5. Similar to Political Loop, there exists a balancing loop. The candidate has a goal of economic stability determined by the EU, thus it is an exogenous variable, and the difference between this goal and the candidate's current economic stability determines the gap in economic stability variable.

Figure 5. Economic Loop



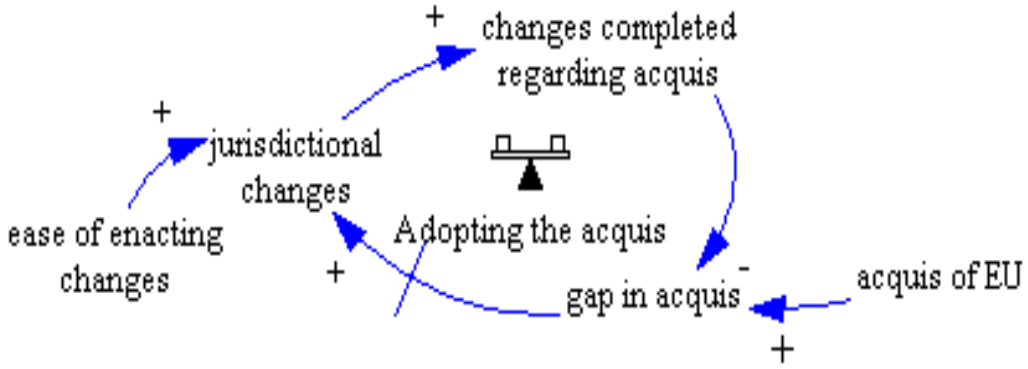
When the gap is higher the concern for progress increases and together with the effect of concern on economic reforms it determines effort for progress in economic stability which in turn causes fulfilling economic criteria. As the economic criteria is fulfilled current economic stability increases and the candidate converges to economic criteria of EU.

5.3. Adopting the Acquis

The principal condition of EU membership is the candidate's total acceptance of the acquis. The variable 'gap in acquis' means that there is a difference between the acquis of EU and the current level of the candidate. As the candidate accepts the acquis by enacting legislative changes, this gap decreases, and when the gap in acquis

equals to zero, this means that candidate country made reforms and harmonized institutional infrastructures to implement the acquis. This loop is shown in Figure 6.

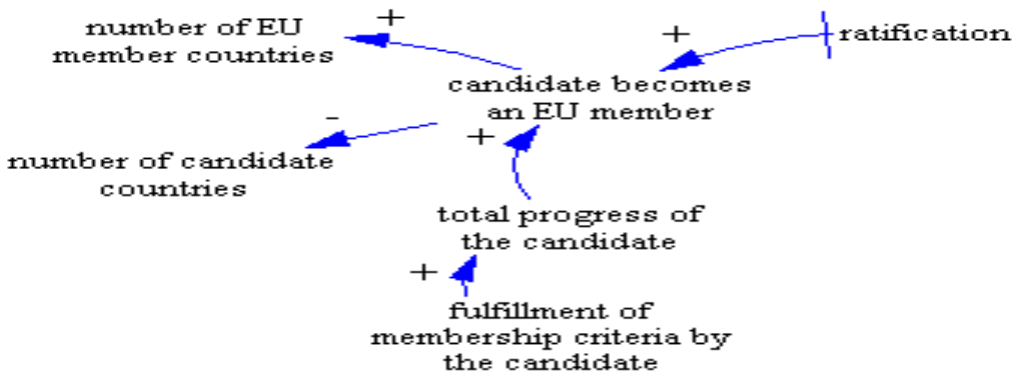
Figure 6. Acquis Loop



5.4. Membership

Candidate becomes an EU member when the total progress of the candidate is found satisfactory by the EU which is determined by the 'fulfillment of membership criteria by the candidate' and when its membership is ratified by the member countries (Figure 7).

Figure 7 Membership



The fulfillment of membership criteria by the candidate is being effected by three variables; 'fulfilling political criteria' of political loop, 'fulfilling economic criteria' of economic loop, and 'jurisdictional changes' variable of acquis loop.

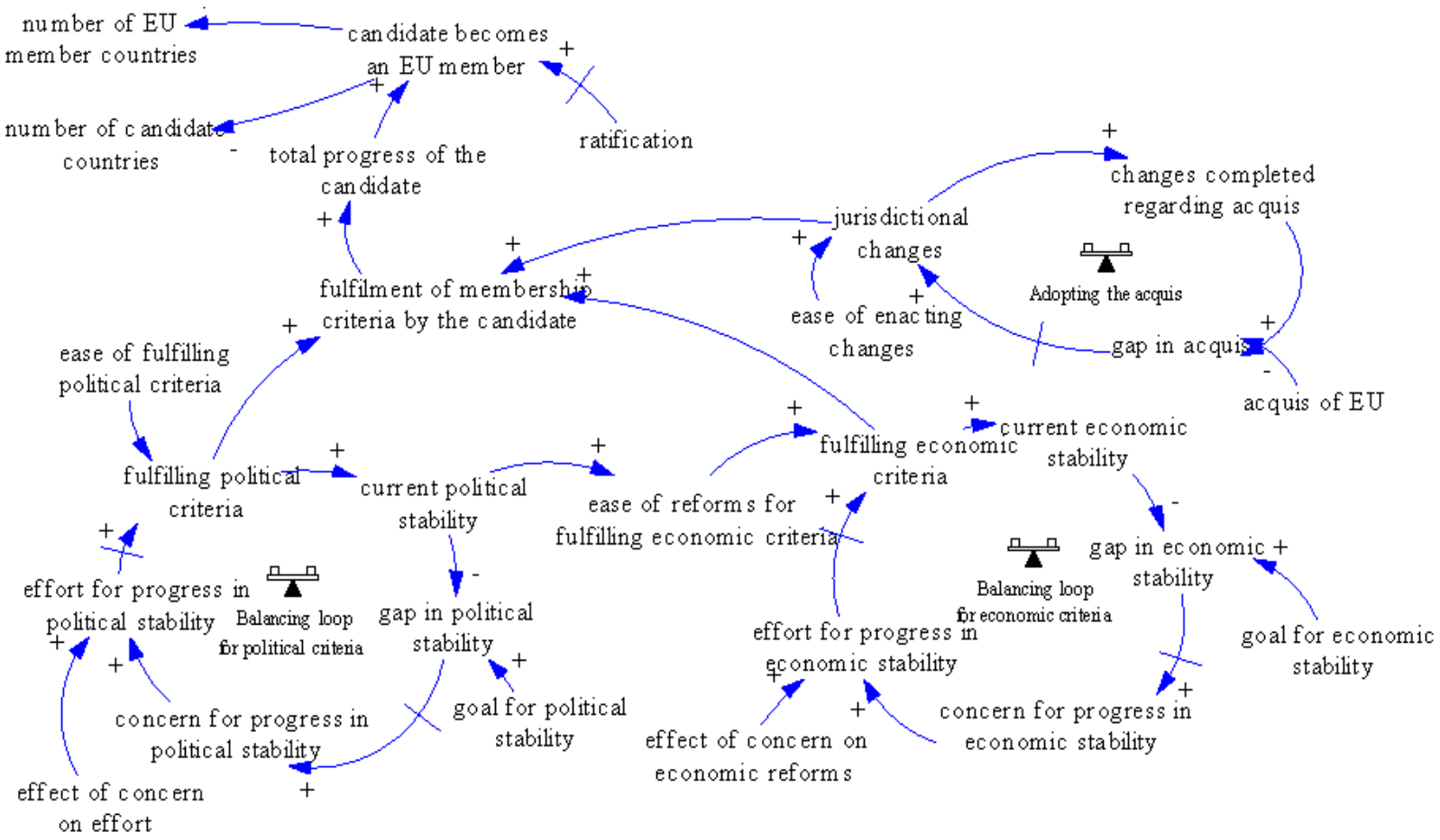
There is also a relationship between the political and economic variables. When the country has more political stability, making reforms for economic criteria is easier. This relationship is added to the complete model as shown in Figure 8. The causal loop diagram of Figure 8 forms when the relationships of the first four diagrams (Political Loop, Economic Loop, Adopting the Acquis and Membership) are combined. This is the holistic approach of systems thinking. SFD of the Accession Model is given in Appendix A.

Michalski (2006) asserts that '*in the first enlargements, the Commission concerned itself mainly with the socio-economic situation in the candidate countries, but with the widening of the EU's own policy scope and the formulation of the Copenhagen Criteria, the Commission has also analyzed the political situation, the state of the democracy, the robustness of the institutional infrastructure, the state of the economy, the candidate's position on the world state, and relations with neighboring countries'.*

Since the criteria of membership were different in the first enlargements, Accession Model fits better to enlargements after the fourth one. However, the model can also be applicable to previous enlargements. Michalski (2006) says that '*the fifth enlargement witnessed the introduction of a number of new procedures and reporting and monitoring instruments which changed the character of the negotiations substantially*'.

The flow which is called 'fulfillment of membership criteria by the candidate' increases the 'total progress of the candidate' and is determined by the level of the first three flows (political, economic and acquis). As candidate fulfills the membership criteria, final approval of membership process begins, which is simply denoted by 'ratification' variable in the model. Inside the ratification variable acceptance levels are inserted. An acceptance level indicates that when the country reaches that threshold level, her membership is approved.

Figure 8. Causal Loop Diagram for EU Accession



6. Results

In System Dynamics, after identifying the problem, the first step is to find out the causal relationships among critical variables which create the problem. This task is done with the use of causal loop diagrams. Following the causal loop diagrams, stock and flow diagrams and the underlying equations, parameters and mathematical equations are entered. In order to run the simulation, data are needed.

In models where either it is difficult to collect data or where the model is abstract, Kim (2000) proposes 'abstract simulation' in which all variables of the model are normalized between 0 and 1. Kim (2000) named this method as '*Normalized Unit Modeling By Elementary Relationships*' (NUMBER). In our Accession Model, there are some variables whose parameters are not easy to quantify such as **ease of reforms for fulfilling economic criteria**, **ease of reforms for fulfilling political criteria** or **ease of enacting changes** because they are subject to changes that are hard to predict and values of stock variables are also hard to quantify. For these reasons, we used Kim's (2000) NUMBER during the simulation model.

The model is run for Turkey, Croatia, Poland and Spain. The initial stock values for '**political stability**' are retrieved from the data of Freedom House and used after being normalized.[7] Freedom House provides the Political Rights (PR) and Civil Liberties (CL) scores of the countries between years 1972 to 2007. The initial stock values for '**economic stability**' are retrieved from the country risk classifications of the OECD and used after being normalized.[8] Since ratings of country risk classification for the year 1978 does not exist, Spain value is being estimated and is assumed to be three (same with the value of Poland in 1998) during the simulations for Spain.

Based on the assumption that EU would not have opened accession negotiations if the ease of fulfilling economic, political and acquis requirements were less than 0.4, the minimum values for 'ease of fulfilling political criteria', 'ease of reforms for fulfilling economic criteria initial' and 'ease of enacting changes' are set to 0.4. And then based on the values of Population in the year of accession, GDP in the year of accession and Total Area of the Country, values of 'ease of enacting changes', 'ease of reforms for fulfilling economic criteria initial' and 'ease of fulfilling political criteria' are calculated respectively. It is assumed that if the population of the country is low, than it would be easier for that country to adopt the acquis, if the GDP of the country is low, than it would be difficult for that country to fulfill economic criteria, and if the geographic area of the country is small, it would be easier for the country to fulfill political criteria.

The simulation period begins in the year when accession negotiations began (2005 for Turkey and Croatia, 1998 for Poland, and 1978 for Spain). The changes completed regarding acquis was zero for all of the countries because the starting year of

[7] Scale is 0 – 5. We normalized the data by $y = 1 / (1+x)$

[8] Scale is 1 – 5. We normalized the data by $y = 1/x$

simulation is set to the year when accession negotiations began.[9] The goals are set to 1 for political, economic stability and adopting the acquis. It is assumed that when the total progress of the candidate is 90%, its membership is approved. The 10% margin is left for judging political or even economic issues subjectively.

Some of the EU members do not adhere to all of the economic criteria (Keskin, 2008), and *EU member states have at times failed to implement EU directives* (Mbaye, 2001) which justify the model's approval decision (of 90%). For example, in 2001 Greece, Spain, Ireland, Netherlands, and Portugal, were among the countries that did not adhere to the inflation target (Dilekli and Yesilkaya, 2008).

The time step for the model is chosen as 0.03125 so that it is not greater than one-eighth the value of the smallest time constant in the model, a widely-used assumption in SD modeling. The reliability of the time step is ensured by running the simulation with smaller time steps. Since smaller time steps did not change the simulation results, we stayed confident with the time step. Population, GDP and area of the countries are taken from EUROSTAT, OECD and CIA respectively. The delays are all taken to be one year. Parameters of Accession Model are given in Appendix B.

6.1. Simulation of EU Accession Dates for Croatia, Turkey, Spain and Poland

Economic criteria, political criteria and adopting acquis criteria increase until all of the goals are fulfilled. According to the model when three of these requirements are met, candidate becomes an EU member. But since the membership should be ratified by the member states and accession country and the influence of membership size on decision making speed (Zorn, 2007), two-year delay is inserted into the model and it is designated 'ratification' variable. The model is run for Turkey, Croatia, Spain and Poland with the parameters of Appendix B.

6.1.1. Poland and Spain

We experiment with the acceptance levels of Poland and Spain and observe that when the percentage levels are 80.7% and 85% respectively (as given in Table 1) the model produces the realized accession dates for Poland and Spain. The fact the acceptance level percentage for Poland is lower than the value for Spain shows that the access decision was more favorable for Poland than for Spain.

[9] Although Turkey has customs union agreement with EU, meaning that she already adopts some of the EU acquis, we set the 'changes completed regarding acquis' variable to zero to compensate some of the specific and political barriers against Turkey

Table 1. Acceptance Levels of Poland and Spain at the date of their EU Accession

Parameters	Poland	Spain
Acceptance level (for ratification)	80.7%	85.0%
Simulation Result for the Accession Year	May 2004	January 1986

6.1.2. Turkey

When the model is run for Turkey with different acceptance levels, we obtain the results given in Table 2 indicating that the possible accession dates for Turkey were forecast as August 2012 with 80%[10], July 2014 with 85%, and March 2018 with 90.0% acceptance level.

Table 2. Possible Accession Dates for Turkey according to Different Acceptance Levels

Acceptance level (of Turkey)	Turkey's forecasted year of accession
80.0 %	August 2012
85.0 %	July 2014
90.0 %	March 2018

Simulation result for Turkey indicates that Turkey can complete accession negotiations in 2012 and eventually be an EU member in 2014 with the acceptance level of 85% unless there is a sudden disruption or an unexpected external event.

6.1.3. Croatia

When the model is run for Croatia with different acceptance levels we obtain the results given in Table 3 indicating that the possible accession dates for Croatia are forecast as September 2011 with 80%, April 2013 with 85%, and May 2016 with an 90% acceptance level. The declared accession date for Croatia is 1 July 2013[11] which indicates an acceptance level of 85.6 % which is very close to the value for Spain that is 85.0%.

[10] Clearly, this is not expected to materialize.

[11] http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/824&type=HTML (accessed on July 16, 2011)

Table 3. Possible Accession Dates for Croatia according to Different Acceptance Levels

Acceptance level (of Croatia)	Croatia's forecasted/declared year of accession
80.0 %	September 2011
85.0 %	April 2013
85.6 %	**July 2013 (declared)**
90.0 %	May 2016

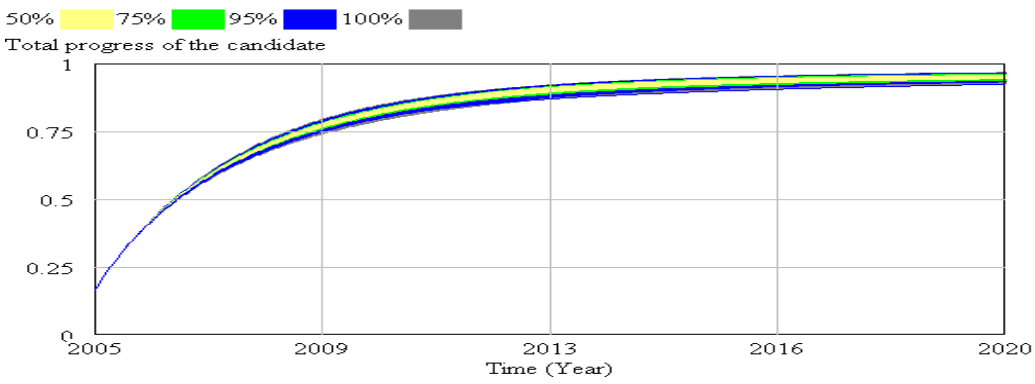
7. Discussion

Sensitivity analysis of SD is a good tool to analyze 'what if' scenarios and also creates further discussions. We made sensitivity analysis only for future accession case (Turkey) and interpret the results when the delay parameters change and more importantly the effects of domestic forces on the total progress of Turkey.

7.1. Effect of Delay Parameters on the Total Progress and Accession Date for Turkey

In order to analyze the effect of Economic, Political and Adoption of Acquis goals on the total progress of the candidate we run the sensitivity test by letting the delay parameters (DELAY A, DELAY E, and DELAY P) to change between 1 to 5 years where their normal value were one year. The simulation is done for Turkey and as seen in Figure 9, the pattern does not change for different parameters of delay.

Figure 9. Effect of delay parameters on the total progress of the candidate



Emerson and Tocci (2004) assert that '*EU anchor is also portrayed as a mean to attain the objectives of reform, which are as, if not more, important than membership*

itself'. Result of sensitivity analysis confirms EU's being an anchor for providing stability. The result also clearly indicates that progress of the candidate during the early years is much faster than the later years. This is actually the case for Turkey who is being accused to slow down the reform process. However, it seems natural according to the dynamics of this process.

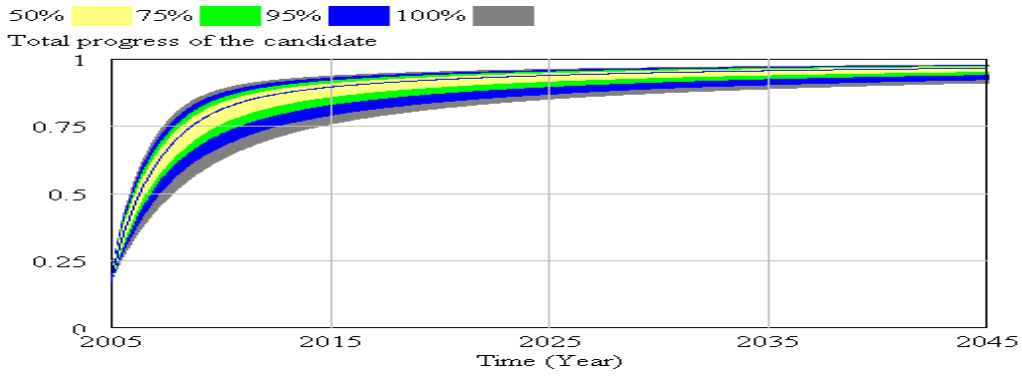
7.2. Effect of Domestic Forces on the Total Progress of Turkey

Ease of fulfilling political criteria, economic criteria and ease of enacting changes to implement reforms to adopt the acquis are important parameters of the Accession Model. These three parameters together show the internal conditions of the candidate country which we named as '**Domestic Forces**'. According to Lewin's (1951) Force Field Analysis, there are two opposing sets of forces, one seeking to promote change (driving forces), and second attempting to maintain the status quo (restraining forces). These forces altogether affect the easiness of making reforms.

The sensitivity analysis is run after setting the parameters to change between 0.3 and 0.9 for 'ease of enacting changes', 0.1 and 0.9 for 'ease of fulfilling political criteria' and 0.6 and 1.0 for 'ease of reforms for fulfilling economic criteria initial'. Their values were 0.6, 0.5 and 0.8 in the base simulation for Turkey.

The importance of these parameters is better understood in the sensitivity analysis. Figure 10 indicates that the changes in the domestic forces do not produce symmetric results. As the value of domestic forces increase, total progress increases even more. So when the support for EU in Turkey increases and the bureaucracy is effective, the process seems to be faster.

Figure 10. Effect of Domestic Forces on the total progress of the candidate

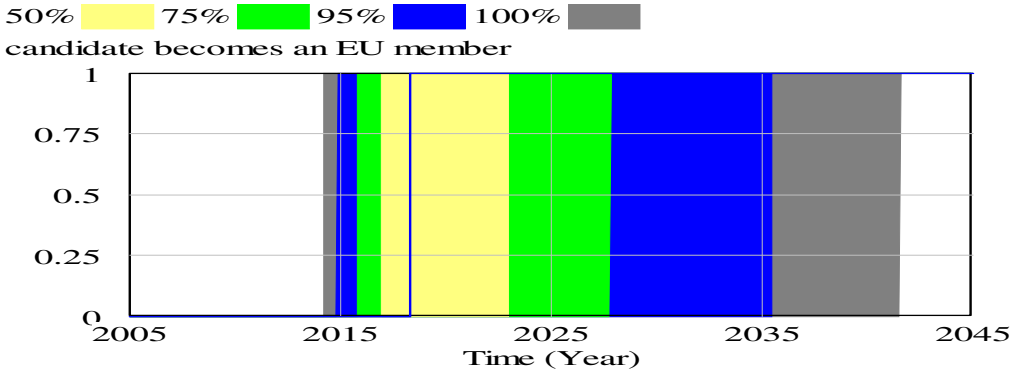


The simulation is run until 2045 in this sensitivity analysis because when the easiness level for the parameters change, the accession date for Turkey is expected to actualize in between 2014 and 2040 as shown in Figure 11. This result indicates a non-linear and disproportionate relationship between the driving and restraining forces. This means that **the linear view of Lewin** (1951) **stating that change is realized when the driving forces are more than restraining forces, is**

incomplete. We assert that, the level of change is non-linear and is highly sensitive to the difference between the driving forces and restraining forces. The change does not happen simply because driving forces are more than restraining forces, but the value of this difference also matter. If the difference is less, it is much difficult to implement the change than when the difference is more.

We conclude that the domestic forces determine the decisiveness and easiness of fulfilling requirements of membership criteria which also determines the total progress of the candidate significantly. Thus, authors who blame external factors to hinder Turkey's accession process (like opposing countries) should stop accusing external factors because according to the results of the sensitivity analysis it is seen that internal factors which we named as Domestic Factors seem to hinder the process much more than the external factors. When this conclusion is combined with the findings of Hille and Knill (2006), who assert that '*bureaucratic strength and effectiveness of a country positively influence its ability to adjust domestic arrangements to EU requirements*', the importance of the effectiveness of national bureaucracy is seen. Similarly, Toshkov (2008) emphasizes '*the strong positive impact of bureaucratic quality and administrative efficiency and the focal role the executive*' in the literature about the adoption of EU law.

Figure 11. Effect of Domestic Forces on the Accession Date Turkey



8. Conclusion

The general contribution of this paper is the holistic and systemic approach taken while analyzing complex, interrelated, and dynamic issues. In this research, EU Accession Model is designed, tested, run and analyzed with System Dynamic Modeling. We did not come across any study which examines these issues with SD and designs a dynamic model. We took critical factors/variables into consideration in our model which is based on the causal relations that are extracted from scientific journals and EC reports.

Our key contribution is that we have developed a dynamic model which can be used to forecast the possible accession dates of EU candidates based on the country variables of each candidate. This is the first and only study which analyzes EU accession from a systems thinking approach. The model constructed in this study may

inspire other researchers to continue with this subtle endeavor. The model may be extended by other researchers who adopt systems thinking approach and use System Dynamics methodology in analyzing complex problems in social sciences.

EU Accession process is a well-defined and standardized process after the fifth enlargement. Copenhagen criteria indicate the fundamentals of this process. Although the process is the same for each candidate country, the specific issues arise due to the specific problems related to the candidate country. For example, Turkey, as a country trying to become an EU member since 1959 and having intensive political, economic and trade relations with EU, is still in the process of negotiations for which different arguments are given.

We constructed the Accession Model in a general sense that can be applied to any candidate country and the model includes the variables that belong to the institutional and technical aspects of EU accession process, and we run the model for Turkey as a candidate country. However, we indirectly include the driving and restraining factors into the model by adding three external factors: 'ease of fulfilling political criteria', 'ease of reforms for fulfilling economic criteria initial' and 'ease of enacting changes' for adopting and implementing the acquis. We named these three factors as '**Domestic Factors**' which altogether determined the pace of change towards taking the necessary actions to be a member of EU. The sensitivity analysis showed that the Domestic Factors is an important factor which determines the accession period significantly. A remarkable insight is obtained from the results of sensitivity analysis on accession model. It showed that it is not only which factor is dominant (restraining or driving forces) as Lewin (1951) has asserted but the degree of difference between these forces which actually determine the success of change process is also crucial.

In the Accession Model the two important stocks, 'economic stability' and 'political stability' are composite values that may include several other endogenous loops. The factors affecting these variables can be traced from political science and economics. For example one study (Eaton and Turnovsky, 1983) examines the relation of political risks, exchange risks and macroeconomic equilibrium and emphasizes that exchange risk and political risk both diminish the mobility of capital which is important in macroeconomic analyses. However, we choose a higher level of aggregation and did not include the details of internal dynamics of economic and political stability in the accession model and stayed relevant with the purpose of the model. These dynamics can be elaborated in a future study by the authors of this article or any researchers are welcomed to elaborate this study.

We propose policymakers (politicians and bureaucrats) of candidate countries to use the SD model[12] based on their specific country variables, simulate the model, be aware of the possible accession dates and formulate their strategies based on these possible accession dates and manage the negotiation process accordingly.

[12] Interested readers may contact the authors for data and model equations.

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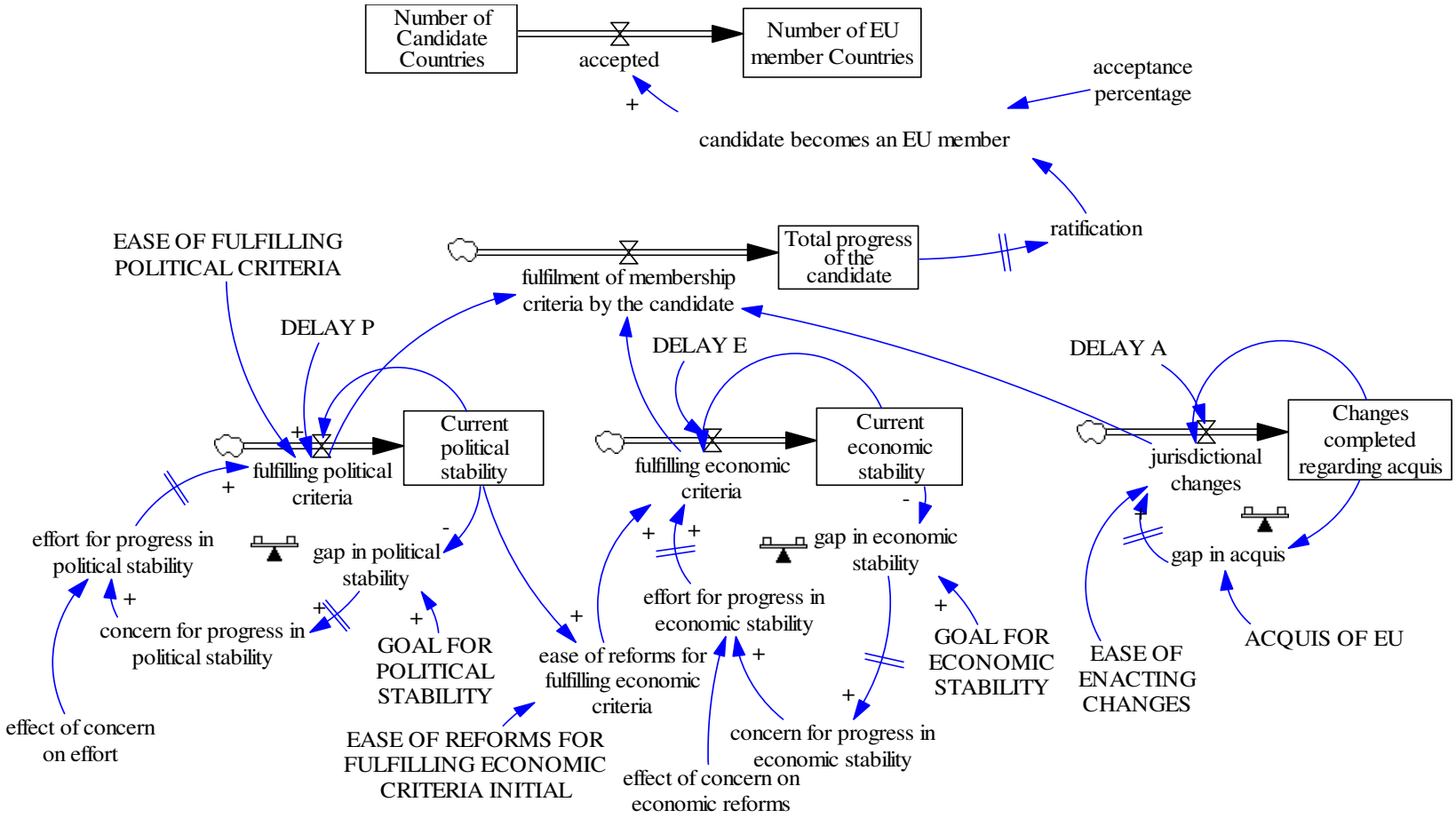
Appendix A. Stock and Flow Diagram for EU Accession SD Model



Appendix B. Parameters used during the simulations of Accession Model and Country Results

Parameters	**Turkey**	**Croatia**	**Poland**	**Spain**
Year when accession negotiations began	2005	2005	1998	1978
Accession Year (Realized/Declared)	**-**	**July 2013**	**May 2004**	**Jan 1986**
Realized/Declared Acceptance Level	**-**	**85.6%**	**80.7%**	**85.0%**
Simulation Result for the Accession Year	**Mar. 2018**	**May 2016**	**Oct. 2008**	**June 1989**
Simulation Acceptance Level (for ratification)	**90%**	**90%**	**90%**	**90%**
Mean Value of PR and CL in the year when accession negotiations began (FreedomHouse reports)	3	2	1.5	2.5
Normalized Value of PR and CL (initial value of political stability in the Accession Model)	0.33	0.5	0.66	0.40
Value of Economic Risk in the year when negotiations began (OECD Country Risk Classifications)	5	4	3	3
Normalized Value of Economic Risk (initial value of economic stability in the Accession Model)	0.16	0.2	0.25	0.25
Simulation Period	2005-2020	2005-2020	1998-2010	1977-1990
Changes completed regarding acquis (initial value)	0	0	0	0
Goal for political stability	1	1	1	1
Goal for economic stability	1	1	1	1
Delay for fulfilling Political Criteria	1	1	1	1
Delay for fulfilling Economic Criteria	1	1	1	1
Delay for adopting Acquis	1	1	1	1
Ease of fulfilling political criteria	0.5	0.9	0.8	0.6
Ease of reforms for fulfilling economic criteria initial	0.8	0.5	0.6	0.6
Ease of enacting changes	0.6	0.9	0.8	0.8
Time Step	0.03125	0.03125	0.03125	0.03125
Population when accession negotiations began	72.065.000	4.600.000	38.663.000	36.370.000

(Eurostat, 2008) (ease of enacting changes)	(2005)	(UNFPA 2005) [45]	(1998)	(1978)
GDP when accession negotiations began (OECD, US$, current prices, millions, 2008) (ease of fulfilling economic criteria)	747.326 (2005)	44.450 (Trading Economics 2005) [46]	362.522 (1998)	212.906 (1978)
Area (sq km) (CIA, 2008) (ease of fulfilling political criteria)	780.580	56.594	312.679	504.708
Delays (Delay A, Delay P and Delay E)	1	1	1	1