

THE DYNAMICS OF CIRCULAR MIGRATION IN SOUTHERN EUROPE  
by

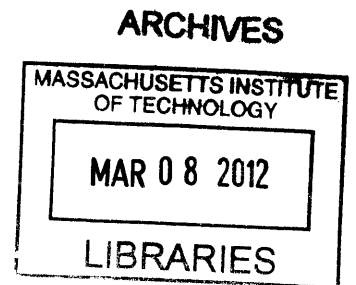
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Submitted to the System Design and Management Program  
in Partial Fulfillment of Requirements for the Degrees of  
Master of Science in Engineering & Management  
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**Dedicated to**

**my future wife Anna Vinogradova for believing in all my ambitious projects**

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Rafael Marañón-Abreu

Submitted to the System Design & Management Program and the Engineering Systems Division on May 18, 2010 in Partial Fulfillment of Requirements for the Degrees of Master of Science in Engineering & Management

## ABSTRACT

During economic crises, governments establish policies that facilitate the creation of jobs, goods and services that make their economies more resilient. Often this requires innovative social programs that match global migratory trends to local labor demand. The implementation of such programs requires a significant degree of innovation that requires models that can capture the complexity involved. To explore this phenomenon, we provide a multi-disciplinary view of innovative social programs that shed light on the dynamic characteristics of the political, social, technological and economic aspects of circular migration.

Our focus is a case study of the European Union-funded circular migration program to support the strawberry harvest in the province of Huelva in Spain. Covering the time period of 2002-2011, this thesis provides a system dynamics model to represent the key elements that led to the success of circular migration from the standpoint of economic and labor supply management. The model helps explain the essential factors that make the program robust not only under recent economic crisis conditions but also under policy constraints. Based on a qualitative analytical approach, the model demonstrates how adaptive policies can enable macroeconomic equilibrium in environments where circular migration can be implemented. We also show that circular migration is not an impediment to economic recovery; in fact, it helps stabilize the labor supply in times of high uncertainty.

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## ABREVIATIONS

ANAPEC	L'Agence Nationale de Promotion de l'Emploi et des Compétences
CLD	Causal Loop Diagram
COMI	Comisión Onubense de Municipios con Inmigración
EU	European Union
FUTEH	Fundación para Trabajadores Extranjeros en Huelva
GDP	Gross Domestic Product

## 1 INTRODUCTION<sup>1</sup>

Countries and regions react differently to economic turbulence. Typically, citizens propose immediate and sometimes drastic solutions to government. Social pressure is sometimes effective in driving decision makers to execute emergency policies that absorb the impact of the crisis and stimulate the economy in the short term. In Spain, during the crisis in 2008, one of the implemented policies was the promotion of the Sustainable Economy Law [Economic strategy of Spain, 2009] through the Plan E (Spanish Plan for Economic Stimulus and Employment)<sup>2</sup>. A second reaction was the reinforcement of social dialogue between industry, labor unions, employment offices and regional governments at a national [Abellán, 2008] and regional level [Gualda, 2009]. That dialogue focused mainly on encouraging businesses to hire local unemployed workers. A third reaction was to suddenly stop issuing guest worker visas for labor-intensive jobs such as fruit harvesting. This policy was intended to help the local economy in the short term. But, as we will demonstrate in this thesis, the result was much more complex.

In order to meet the demands of labor-intensive jobs such as those in agriculture, it is sometimes necessary to use undocumented workers. There are two reasons for this: the lower wages associated with such jobs and the lack of interest of local Spanish workers in taking on blue-collar jobs with low social status. In a proactive attempt to not utilize undocumented workers, the European Union has emphasized immigration policies to combat illegal immigration by establishing a voluntary return policy for seasonal workers by creating circular migration and co-development policies [EU Immigration Policy, 2008].

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<sup>1</sup> Part of this thesis is the result of a multidisciplinary, strong and very fruitful collaboration between the University of Huelva and MIT. Our research team was constituted by Estrella Gualda, Professor of Sociology at University of Huelva; Ricardo Valerdi, Research Associate at MIT and me. Not only because universities of Spain and the United States aim efforts to solve migration problems that affect both countries, but also because it is infrequent that two fields of study such as sociology and engineering work together to better understand human behavior. This collaboration with Estrella and Ricardo has been formalized in a paper for a journal that we wrote together in fall 2010, which is under review at the time of the publication of this thesis [Maranon, Gualda, Valerdi 2011].

<sup>2</sup> Spain's equivalent to the "New Deal", a plan developed by U.S. President Franklin D. Roosevelt devised in response to The Great Depression in the 1930s.

Such policies introduce other economic effects that mediate the interaction between labor forecasting and social programs. These multi-dimensional interactions quickly approach a level of complexity that requires more disciplined modeling and rigorous analysis to be fully understood. Our objective is to shed light on such a scenario and provide a mechanism for understanding its effects over time so that policy makers can avoid pitfalls by making more informed decisions about circular migration policies.

## 1.1 Theoretical Concepts Related to Immigration

The notion of migration has been an important global phenomenon for generations. The physical movement of humans from one geographic region to another – both voluntarily and involuntarily – has played an important role in the identity of countries and cultures, economic trends, civil wars, world wars, spread of disease, and the development of technological innovation.

The specific connection between migration and economics has been highlighted by scholars across a variety of disciplines. Some have tried to identify the factors driving international migratory flows and the settlement of immigrants in different societies [Portes, 1985, 1995; Massey, 1993; Blanco, 1999; Arango, 2000; Solé, 2002; Pena, 2003]. Some of the more popular orientations concerning migrations in the social and human sciences are based on a neo-classical growth model [Todaro, 1976; Borjas, 1990], and human capital theories [Shultz, 1981; Becker, 1983]. These focus on long-run macro-level effects aimed at maximizing economic value. Other investigators have focused on social and institutional factors, the importance of power, and phenomena and processes such as migratory chains, social capital and social networks [Piore, 1979; Gordon, 1995; Portes, 1995, 2006; Massey, 1997, Mendoza, 2000].

Approaches based on neoclassical and human capital theories are insufficient for understanding the micro-level complexities of migratory flows and processes of integration in receiving societies. In particular, they fail to address the fact that the decisions to migrate and settle are strongly motivated by personal, family and social contexts not influenced directly by markets or by supply and demand. These types of decisions are also strongly affected by migratory policies,

especially the regulation of borders and policies for the integration of immigrants [Portes, 1995; Mendoza, 2000].

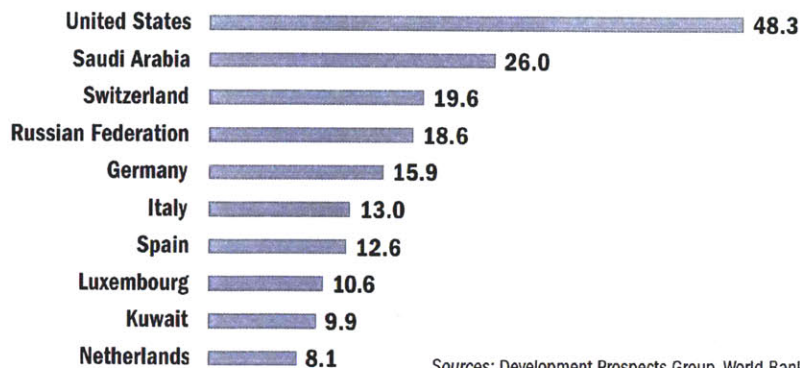
Some authors stress not only the role of the governments and states in the design of migratory policies, but also the role of employers and their organizations in influencing the process of worker recruitment in achieving a stable work supply, reducing costs and even promoting future investment to remain competitive in a global economy [Sassen, 1988; Gordon, 1995; Mendoza, 2000; Blanes, 2004]. This complementary approach to exploring the micro-level complexities of circular migration exposes important issues that explain the success and failure of circular migration programs. We do not suggest that the macroeconomic theories are incorrect; instead we suggest that they do not account for important microeconomic foundations that are the cornerstone of successful circular migration policies.

Spain is a particularly interesting country to study because of its geographic proximity to Africa and the paradox that exists between the need to hire more local workers at higher wages in the presence of a labor supply of migrant workers willing to work for lower wages.

The last 20 years have been a transformational period in Spain from a region of emigrants leaving for other countries in search of higher wages to one in which immigrants make up 14 percent of the population-- 6.9 million foreigners were registered in 2010 [INE, 2010; World Bank, 2010]. Figure 1 and Figure 2 show the position of Spain among in-migration countries.

### Top Remittance-Sending Countries , 2009

US\$ billions

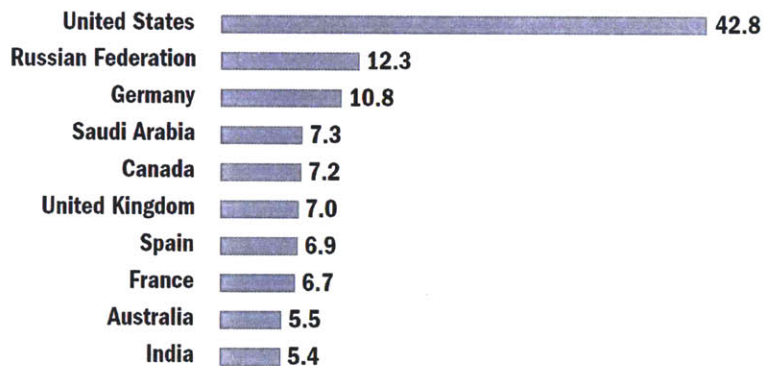


Sources: Development Prospects Group, World Bank

Figure 1: Top Remittances-Sending Countries [World Bank, 2009]

### Top Immigration Countries , 2010

number of immigrants, millions



Sources: Development Prospects Group, World Bank

Figure 2: Top Migration Countries [World Bank, 2010]

The driving forces behind this change have been higher standards of education, greater employment aspirations among young people, and rapid economic growth in the construction and service industries, prompted by Spain's entry into the European Union in 1986.

In Andalusia, a region in southern Spain, growth in the agricultural sector raised concerns about a labor shortfall. To address this problem, the local government adopted a circular migration program which has been cited by other countries as an exemplar due to its resounding success in

terms of labor supply management. Measuring this success, however, becomes an interesting activity resulting in a variety of outcomes based on points of view. This issue, along with the challenge of modeling such phenomena, will be explored in the remainder of the thesis.

### 1.2 Circular migration programs as social innovation

Circular migration is defined as a form of migration that is managed in a way that allows some degree of legal mobility between two countries [AENEAS, 2007]. Some refer to it as the fluid movement of people between countries that are dependent on seasonal conditions and performed only during part of the year [UN Migrant Workers Convention, 2010]. This alone is not an innovative concept, but what introduces social innovation is the ability to control the supply of migration to match seasonal demand in industries like agriculture. Even though the Spain-Morocco migration corridor (0.7 million migrants in 2011 [INE, 2011]) is not on the list of those having the most traffic, as illustrated in Figure 3, it is unique in the innovative way in which flows have been managed in response to labor requirements.

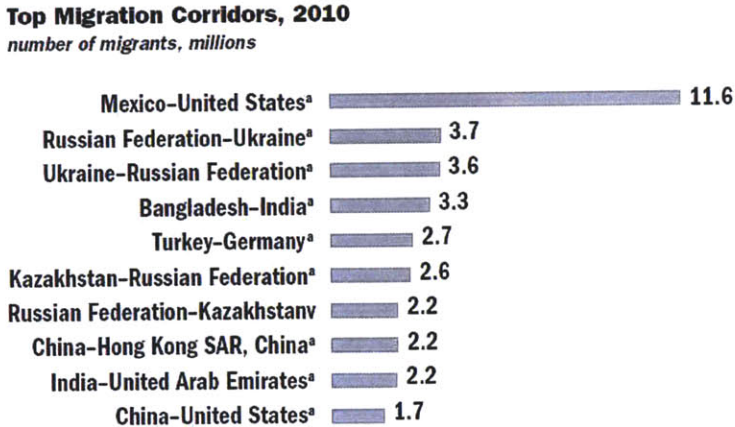


Figure 3: Top Migration Corridors 2010 [World Bank]

This particular way of hiring temporary workers for the strawberry harvest in Spain is analogous to concepts of just-in-time logistics [Hirano, 2006]. Regulating the supply of workers so that they arrive at the precise moment the strawberries are ready to be picked requires the type of



extensive forecasting common to the management of technical systems but less so in social systems.

The act of regulating a social system has its share of logistical difficulties as well as economic, social and political ones. For example, all of the processes of issuing employment contracts and immigration visas must be flawlessly orchestrated to respond to uncertainties in related processes. Climate can be one of the most significant sources of variation in this process: while unseasonable frost may accelerate the need for workers in strawberry harvesting, it may delay their travel plans. The result is a complex system rich with interesting questions and opportunities for understanding the dynamics between social agents (politicians, entrepreneurs, etc.), countries (Spain and Morocco) and individual actors (employers and guest workers).

Our particular case study is focused on the strawberry harvest in the province of Huelva in Spain. Huelva is located east of Portugal and west of the Spanish city of Seville (see Figure 4). Its closest neighbor to the south is Morocco which is in the northwestern region of Africa (about 3 hours by car to Algeciras plus 35 minutes by ferry to Tangier). A group of municipalities of Huelva have a strong agricultural specialty, the intensive agricultural production of strawberries and citrus fruit. This province is the leading producer of strawberries and citrus fruit in Spain [MAPA, 2008] and a leading global producer [FAO, 2010]. This area and its labor needs have created a major flow of immigrants since the 1990s. Understanding the dynamics of such seasonal migration requires an approach that captures the multiple interactions representing cause and effect relationships. Such an approach is described below.

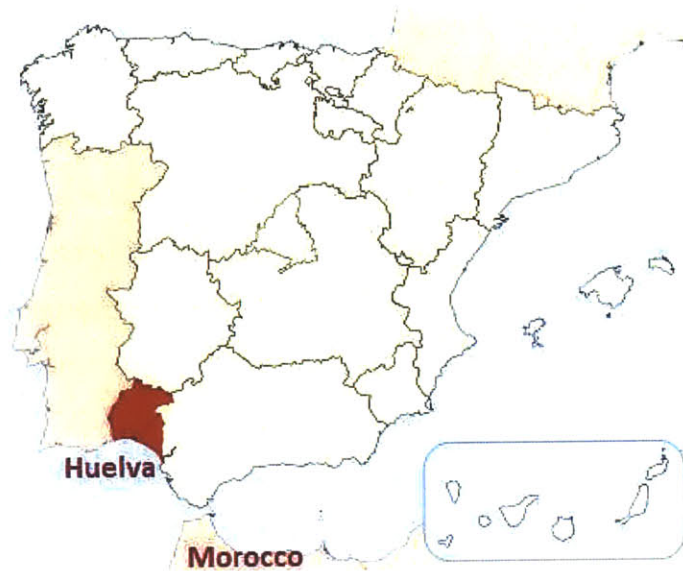


Figure 4: Map of Spain. The province of Huelva is highlighted in red

### 1.3 Modeling the dynamics of migrations flows

To analyze the implications of abrupt changes in this legal migration flow during periods of high unemployment and economic crisis, this thesis provides a model that helps to characterize the dynamics of labor supply management in the agriculture sector in Huelva.

It has been difficult to sustain the circular migration program in Huelva during economic crisis. However, all stakeholders agree that this labor management system benefits the community. It is able to contain illegal migration; sustain the growth of the agriculture sector while the local labor force shifts to other sectors and strengthen international relationships. Concurrently, the system has contributed to the development of other nations through remittances and knowledge transfer.

One important clarification needs to be made at this point: in this thesis, the implementation of circular migration programs in the province Huelva is considered a success story in terms of efficient labor supply management. There is a more complex discussion concerning the success of

these circular migration programs in terms of social or governmental policies<sup>3</sup>. However, in this research we do not approach these other aspects. Here, we focus on the regional benefits of using a management tool to provide a just-in-time labor supply independent of the local labor market.

Prior to an explanation of the reference modes<sup>4</sup> of key economic variables that motivates this research, it is important to state the purpose of the system dynamics model:

**Purpose of the model:** This model will help policy makers better understand the complexity involved in implementing circular migration programs in their regions or countries. The simulation of the model will also illustrate how economic forces and over-aggressive policies can disrupt the normal and desirable state of affairs. Finally, analysis of the simulations will give governments wanting to initiate circular migration programs important insights into the ways that stakeholders' mental models can be augmented by a broader systemic perspective and help governments avoid unintended consequences of their policies.

**Limitations of the model:** This model will not be built to predict the future of labor shortfall in the agriculture sector in the province of Huelva. However, the model will be calibrated with real data to create approximate scenarios and provide better insights.

We must always keep in mind the often quoted modelers' axiom that *"Essentially, all models are wrong, but some are useful"* [Box, 2002]. With this caveat in mind, we will build a system dynamics model that will help stakeholders in the circular migrations programs better understand the different behaviors generated by a complex labor management system operating under economic and government policy constraints.

---

<sup>3</sup> Some stakeholders think that circular migration programs provide better conditions for guest workers who decide to participate in the harvesting in an organized way. They compare the present situation, in which housing, travel, health services and a legal contract are provided with the situation in the late 90's when the high rate of illegal immigration created serious problems for immigrants and the local population. Other stakeholders, however, think that much more should be done to improve migrant living conditions and social integration when managing population flows.

<sup>4</sup> Reference modes are time series graphs of important system variables that are behaving problematically or in a perplexing way (Radzicki, 2011).

One stimulus to developing a modeling methodology to investigate labor migration in the last decade in the province of Huelva was an article published in *The New York Times* on May 15, 2010 with the headline “Spain’s Jobless Find It Hard to Go Back to the Farm”. Before this date, our research focused basically on the study of labor migration in Huelva based on stakeholder’s analysis. However, the headline provided an important clue that research into this issue called for a new methodology that could model changes over time. A counterintuitive consequence of previous policies was to suggest a new way to explain the functioning of the labor system in Spain, and specifically in the province of Huelva.

This new methodology drove us to reconsider the reference modes of key economic and labor factors in the search for the right way to approach our research question. Figure 5 shows a reference mode of the economic growth in the province of Huelva. After 2002, the economy in Huelva grew rapidly for nearly 5 years creating new opportunities for the construction and service sectors. Many of the traditional local agricultural workers had, therefore, already experienced working in other sectors part time between harvest seasons.

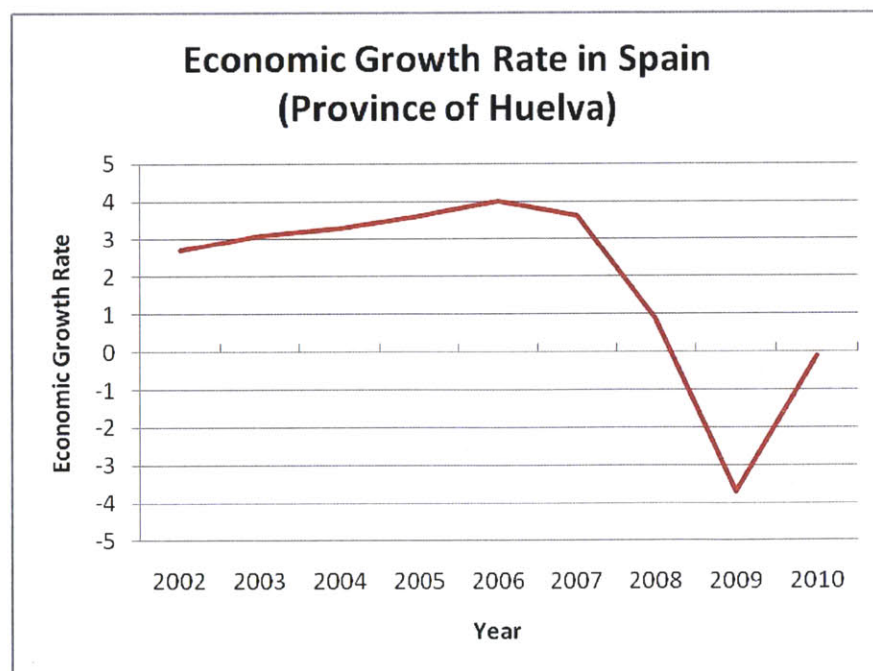


Figure 5: Economic growth rate in Spain in the province of Huelva during the last decade [INE, 2010]

In fact, after 2002 a considerable part of the working population in the province shifted completely from agriculture to construction and the service sector. Better wages and the displacement of occupational aspirations to other industries led workers to leave agricultural jobs.

An agricultural labor shortfall ensued, leading employers to explore sources of labor from other countries. As we can see in Figure 6, the number of contracts with foreign workers under the circular migration program began to grow exponentially mirroring the speed at which the economy grew and local unemployment declined (Figure 7).

However, following 2007, the financial crisis affecting Spain was particularly acute given its dependence on a previously flourishing construction sector as economic recession and growing unemployment began to take their toll. In the province of Huelva, Spain's largest economic crisis in 30 years drove unemployment to 30%. In response, the government changed labor migration policies to facilitate a return to farms for the local unemployed. Figure 6 shows the consequent collapse in the number of contracts with foreign workers.

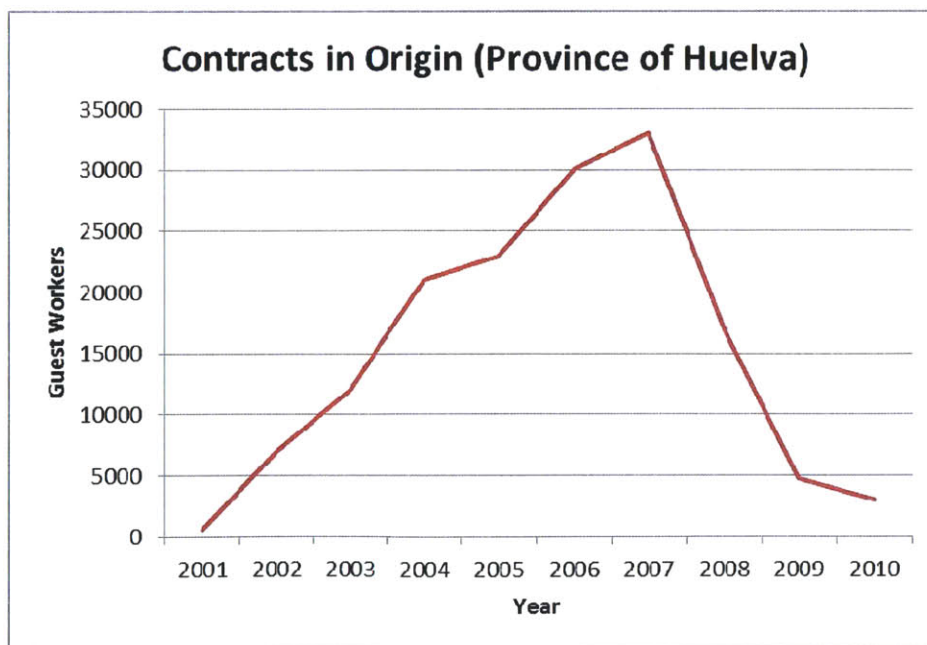


Figure 6: Number of temporary 'contracts in origin'.  
Compiled from [Gualda 2009, Bago 2007, Gordo 2009, Millán 2010, FUTEH 2010].

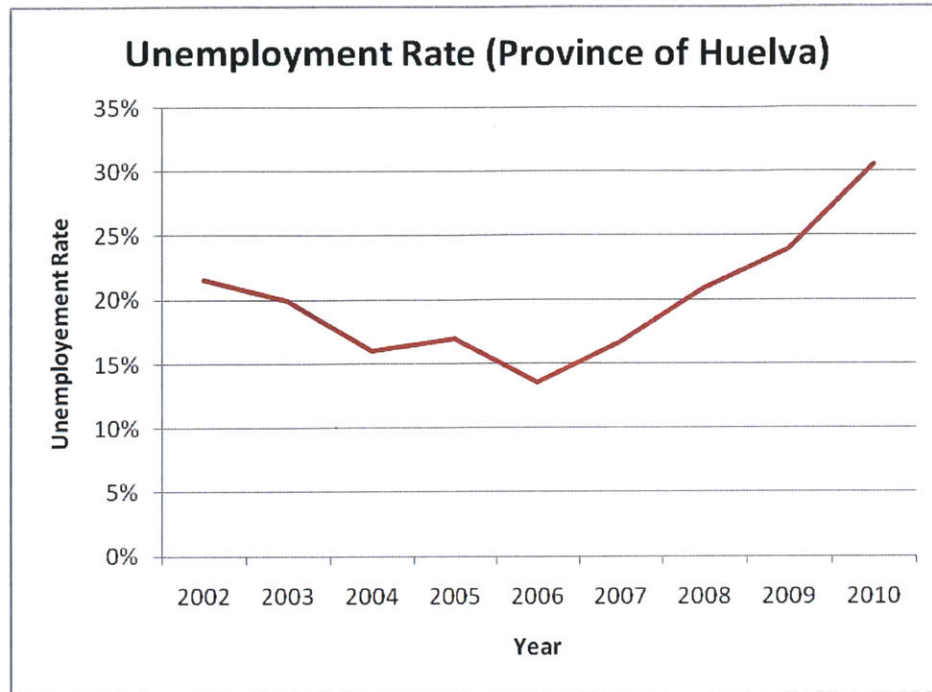


Figure 7: Unemployment rate in Huelva [INE]

The collapse of the authorizations for guest workers alarmed the circular migration program managers and local administrations. They worried that social pressure and overreaction by central government could endanger the sustainability of a program designed to support the economy of the province in times of economic stress. This dilemma leads us to the problem statement of this thesis, the dynamics hypothesis and the research question for this multidisciplinary research:

***Problem Statement:*** *Circular migration programs are designed to restrict illegal immigration and provide flexibility in labor supply management. However, during the last economic crisis, society and central government put at risk the sustainability of a particular implementation of a circular migration program in Southern Europe. They incorrectly thought that circular migration could be an impediment to economic recovery.*

With the reference modes described above (Figure 5-7) that represent the behavior of the economy and also the policies implemented to control the situation, and using the appropriate methodology we will explore the following hypothesis:

**Hypothesis:** *As the number of contracts available to foreign workers for agricultural harvesting is drastically reduced, the total number of unemployed workers increases over time.*

This hypothesis will allow us to explore the benefits of maintaining a labor migration program under conditions of economic stress. To this end, this thesis focuses on the following research question:

**Research Question:** *What elements were driving the management of circular migration policy in the province of Huelva before and during economic crisis?*

To address the aforementioned question, further issues will be analyzed, including:

- *Why the circular migration program in Huelva can serve as a model for economic change in the context of labor supply management; and*
- *What policies will allow the immigrant population to respond instantaneously to economic growth, recession and transition.*

The analysis will explore conditions in the years 2002-2011, a time that provides ample variation in economic and migratory trends to demonstrate the dynamics of circular migration.

## 1.4 Goal and objectives of the thesis

The goal of this thesis is to characterize circular migration by

- Identifying the key factors in a circular migration program;
- Illustrating a case study of circular migration in Southern Europe;
- Analyzing the conditions that make circular migration successful during an economic crisis in terms of consistency of labor supply; and
- Assessing the dynamics of circular migration and policies in the province of Huelva.

## 1.5 Organization of the thesis

Chapter 1 introduces the material that motivated this research effort along with the research question, dynamics hypothesis, goals and objectives.

Chapter 2 illustrates a case study in labor migration management in South Europe. It discusses in detail the concept of circular migration. An overview of the different stages during the last 20 years of the history and purpose of the idea is detailed. Different policies and social conflicts are also discussed, in order to describe the advantages and disadvantages of those programs in different contexts.

Chapter 3 explains the methodology used in this thesis. The modeling approach is designed and justified in detail in order to provide a good understanding of the dynamic nature of circular migration.

Chapter 4 provides the result and analysis of this research. A system dynamics model is used to describe the key factors and causality involved in this particular labor management program. Stakeholders are described, variables selected and causality among the main factors is mapped. Finally, in this chapter, four scenarios are simulated and analyzed in order to test the robustness of the model under economic constraints and extreme policies.

Chapter 5 discusses the results of the analysis. We review in depth the implications of the policies, the boundaries of the research and the importance of understanding the system as a whole.

Chapter 6 summarizes the answers to the research question and includes recommendations for future research.



## 2 CASE STUDY: HUELVA

To understand the dynamics of decision making in immigration labor management in the province of Huelva we will describe its different phases. Figure 8 illustrates several periods with important events highlighted:

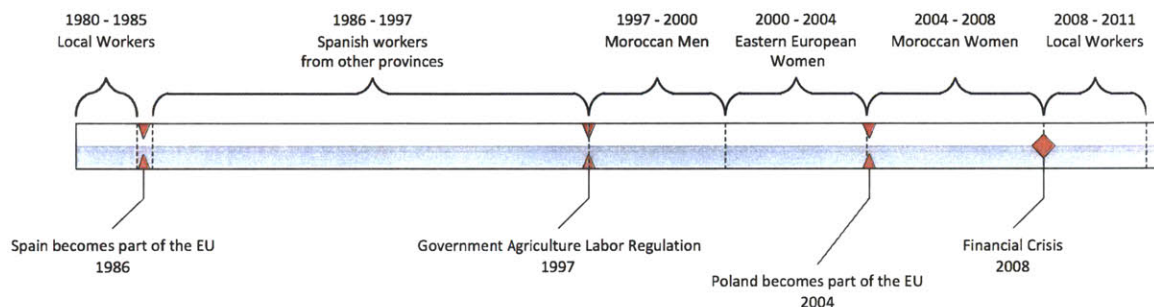


Figure 8: Time Line of immigration in Huelva

Every single event challenged the system, forcing it to respond with innovations from the farmers followed by government regulations and by local administration policies. To better understand the nature of those changes we have to consider the role of the government as the main driver of interventions. In addition, international agreements made the participation of specific countries possible. The shift in the gender of workers was led by farmers who found, in the circular migration selection process, a way to apply specific criteria that we will explain later in this chapter. Finally, the economic crisis drove one more change in the type of labor that created social conflict capable of threatening the sustainability of circular migration programs.

### 2.1 Agriculture labor shortfall

Until the late 1990s, local workers and Spanish migrants who moved from other municipalities of Huelva, Cadiz, Seville, Cordoba, Extremadura and even Portugal [Márquez, 2009] represented the majority of the strawberry and citrus fruit cultivation labor in Huelva. (See Figure 9 for the

location of the region.) However, the overall development of the Spanish economy, specifically new opportunities in the construction and services industries; the decline of social status of agricultural work; the increase of the educational level of young people and the displacement of occupational aspirations to other industries contributed to the growing need for foreign laborers in the strawberry and citrus fruit fields.



Figure 9: Andalusia region in south Spain and Portugal

## 2.2 Changing patterns of recruitment and dynamics of the migration system

The need for foreign workers to harvest strawberries in response to the attrition of local workers led entrepreneurs to innovate socially and economically in searching for and selecting laborers. As experimentation with contract workers began to gain momentum, the substitution of labor in the region led to significant changes in the sociological composition of the agricultural workforce. This transition has undergone various phases: from Spanish nationals to Moroccan men, from Moroccan men to Eastern European women, and from Eastern European women to African women. All three phases occurred within a period of approximately 20-30 years. Currently, we are entering a fourth phase in which ex-patriots are returning to Spain in search of employment.

Over time, one factor has remained constant: the instrumental need of employers to provide workers for an increasingly growing local agricultural industry. This need is driven by the abandonment of agricultural jobs by Spanish nationals, the entry of Poland into the European Union, difficulties with the arrival of Romanian workers, and an insufficient supply of Bulgarian workers. The perennial need for workers to process an extremely perishable product such as

strawberries drives the recruitment of just-in-time labor to respond to variability in the climate [Hirano, 2006]. In Figure 10 we can see images of the strawberry field, and women processing the fruit. This part of the process requires intensive coordination in order to deliver the fruit to the market on time.

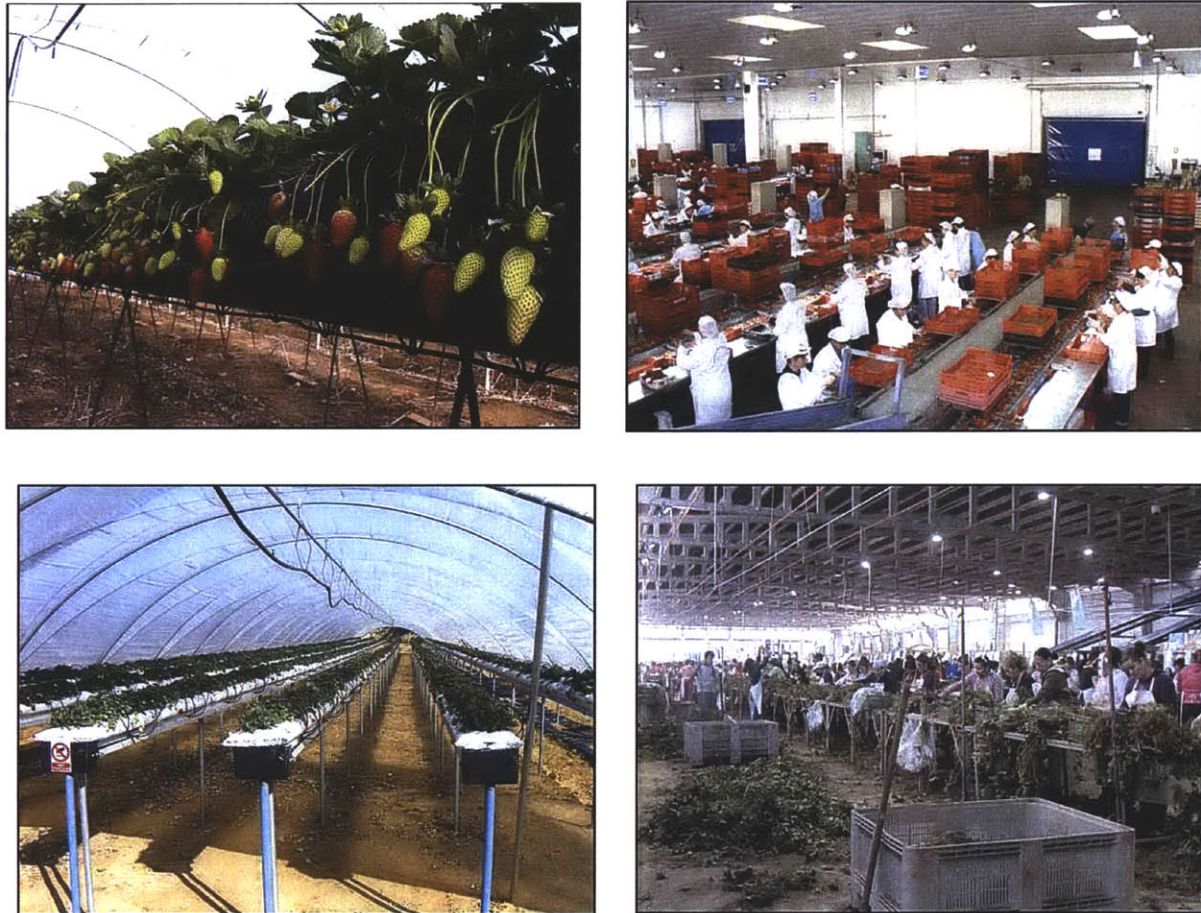


Figure 10: Strawberries must be picked 'just in time' which requires precise labor coordination. Photos: Mercedes Gordo

Strawberry farmers in Huelva have implemented the process of circular migration as a social innovation according to specific guidelines for the movement of people. The main objective is to assure certainty and planning, key in this time-sensitive business environment [Gordon, 1995; Mendoza, 2000]. The three phases illustrated in Figure 11 show how the experience of Huelva in labor migration management started with innovations from farmers followed by innovations

from local programs that increased the resources. This will be described further in the next sections:



Figure 11: Three phases of the management of the search for a labor force

### 2.2.1 Phase 1: Replacement of Spanish men by African men

The departure of Spanish workers from agriculture created an important gap to be filled by other capable laborers. However, as Spanish workers were abandoning the fields the number of Moroccan and Algerian migrants for the agricultural season began to grow. In the late 1990s, the local press became aware of what entrepreneurs needed to complete a successful agricultural season. The majority of migrant workers were men; migrant women were not yet available;

### 2.2.2 Phase 2: Replacement of Moroccan men by Eastern European women

Different socio-political and cultural circumstances (international politics, new politics of immigration, Moroccan immigrant sit-ins, complaints of employers that laborers abandoned the fields before completing the harvest, etc.) began to encourage the hiring of women, who from the beginning were thought to be more controllable workers because of family connections in their countries of origin [Gualda, 2009]. Women were also preferred because of their superior skills, such as being tidier than men, not fouling fields, quarrelling less among themselves and drinking less alcohol, thus making themselves available for hard work that begins very early in the morning. Also, most of these women have children at home, making them more likely to return.

The farmers must also provide housing to workers that come from abroad. The majority of them decided to take only women, because it would be inappropriate to house people of different genders but belonging to different families in the same quarters [Gualda, 2008, 2009].

These factors highlight the importance for employers, in the context of agriculture, to find employees with flexible schedules and controllable traits [Shih, 2002]. Temporary ‘*contracts in origin*’ became one answer to the necessities of circular migration. Such a temporary contract provided the opportunity to work for a period of a few months with the possibility of returning the following year if a person returned legally. Employers’ perceptions are that, in general terms, women are easier employees to manage. In a sense, Abdullah [2005] stressed the importance of the ideal worker to be ‘*docile, and disciplined*’.

The recruitment of women began in 2000 during the first major wave of women guest workers from Poland. The ‘*contracts in origin*’ provided a temporary screening mechanism and eventually permits for foreign workers. Local advocates of this policy [AENEAS, 2008; Millán, 2009] argued that this type of contract was the solution to the labor demands of local entrepreneurs, for several reasons as we see in Table 1:

Table 1: Benefits of a circular migration program

Benefit	Description
Legal Framework	It regulated workers by providing a signed contract following a selection process in the country of origin.
Return Guaranties	The contracts had a fixed term which matched the season and employer needs, requiring the worker to return home at its expiration.
Just one selection process	Workers who fulfilled the terms of the contract could be hired in subsequent seasons without going through the selection process.
Eligibility for resident and work permit	In accordance with the law, after the fourth return they could be eligible for resident and work permits in Spain.
Travel paid by employees	The employer is required to pay the workers’ travel to Spain (with the employees paying to return).
Housing provided by employer	The employer is required to provide a house with minimum living conditions. All of this is implemented by the "Huelva Agreement for Agriculture".

These benefits drove an increase in the number of Eastern European women working in the agriculture sector in Huelva. For example, during the 2007-08 season there was a need for approximately 60,000 workers; temporary contracts in origin provided 37,480 people (62%).

Polish women also replaced Moroccan men. Similar situations happened with women from other countries such as Romania, Bulgaria and the Ukraine who also substituted Moroccan men.

Table 2 illustrates the diverse countries from which workers participated in this labor migration program.

Table 2: Foreign workers in Spain by country of origin [Bago, 2007]

COUNTRY	2001	2002	2003	2004	2005	2006	2007
Bulgaria	0	0	0	508	604	941	2 577
Columbia	0	149	177	105	82	8	2
Ecuador	0	0	15	8	64	26	12
Morocco	198	336	95	635	1 094	2 330	1 946
Poland	540	4 954	7 535	8 811	7 361	9 796	-
Romania	0	970	4 178	10 933	13 186	19 153	26 278
Ukraine	0	0	0	0	0	0	724
<b>Total</b>	<b>738</b>	<b>6 409</b>	<b>12 000</b>	<b>21 000</b>	<b>22 391</b>	<b>32 254</b>	<b>31 539</b>

Polish and Romanian women were contracted because Poland and Romania's entry in the European Union eliminated the need for much of the bureaucratic requirements for international contracts. Poland and Romania, now European Union members, no longer needed to participate in guest worker programs. This facilitated a more constant influx of female workers into the Spanish agricultural industry.

### *2.2.3 Phase 3: Replacement of Eastern European women by African women*

The orientation towards Morocco in the contracts in origin is largely due to the difficulties of finding Polish and Romanian workers in 2005-2006, and the continuing cases of infidelity with local workers. Furthermore, Bulgaria's inability to provide sufficient workers also contributed to the viability of Moroccan labor once again. In this context, an international agreement was signed between Morocco and Spain in 2005 for the recruitment of workers for the strawberry harvest in Huelva. The new Aeneas Project-Cartaya-Kenitra promoted the new recruitment of guest women workers [Gordo, 2009; Moreno, 2009].

The first group of guest women worked in Huelva during the 2005-2006 season. The following year (2006-2007) some 5,000 guest women worked in agriculture in Huelva. In the 2007-2008 season there were around 16,000, and in 2008-2009 the number grew to 10,400. In November 2010, the recruitment level dropped to 5,500 guest women for the 2011 season [Millán, 2010b].

While in other agricultural industries in Spain the contracts have been made predominantly with males, Huelva employers seem to have gravitated towards women, regardless of their country of origin. Whether it is women's perceived greater docility [Abdullah, 2005; Moreno, 2009], their better skills and work attitudes, the desirability of keeping persons of the same gender in accommodations provided by employers on farms or other less humanitarian reasons suggested in public discourse (See Lewycka's famous book: *Two Caravans*, 2008), trends clearly point towards the feminization of agricultural work in the context of contracts made with foreign workers recruited in their own countries. However, in the presence of economic crises (post-2008), there was a shift away from such policies and a decline in this type of hiring in order to promote local employment as shown in Figure 6.

### 2.3 Social conflicts in an economic crisis context

At the end of the 2007-08 season we can see the first signs of economic crisis as Spanish people shift toward (re)incorporation into the agriculture industry (Abellán, 2008; Millán, 2009).

Unemployment continued to grow in the province of Huelva, local workers responded, saying, for example:

*"many families...want[ed] to return to work in strawberry and citrus fruit cultivation"* (Spanish woman, focus group in Lepe, 2009).

*"I already work where it is needed: in the field, looking after an elder, or whatever, my husband, he has almost finished the unemployment subsidy and found nothing ... with three small children that we have"* (Spanish women, focus group in Palos de la Frontera, 2009).

Such comments represent a significant change from previous seasons when the unemployment rate of the local population was not very high. Given the risk that strawberries could remain uncollected, worker substitution and changes in gender and ethnic segmentation are purely instrumental strategies to reduce costs, avoid conflicts at work, and provide employers the opportunity to gain stability in a moment when labor would be critical for the harvest. The crisis shows that, beyond socio-cultural discourse, the priority is the harvest, regardless of who is going to collect, provided that this continues to be profitable to employers. Figure 12 and Figure 13 show clearly the changing patterns of recruitment based on ethnic-gender stratification and replacement:



Figure 12: Harvesting by men from Morocco in 2001 (left) and by women from Poland in 2004 (right)  
Photo: Huelva Información (left) Mercedes Gordo (right)



Figure 13: Selection process in origin by women from Morocco (2006) and women from Senegal (2008).  
Photo: Mercedes Gordo (left) FUTEH (right)



During the economic crisis, it was observed that employers did not independently decide who to hire; intervening policies at the local and international level played a significant role. Spanish workers could return to the strawberry fields, if the economic crisis persisted. However, many entrepreneurs, having experience of the Spanish abandonment of the fields, thought it was inefficient to rehire Spanish workers. This has led to the innovation of creating contracts in origin and even of reserving a quota of contracts in Morocco in case the demand for labor increases [Huelva Información, 2010]. In fact, for many, the return of Spanish workers to the agricultural industry is regarded as temporary. They expected to reactivate contracts with seasonal workers as soon as the economy recovers.

## 2.4 Selection process, mobility and integration

The selection process for workers in circular migration programs differs from one country to another. In this case study we have focused in the recruiting process for workers in Morocco because it is one of the more sophisticated. Morocco's National Agency for the Promotion of Employment and Skills (ANAPEC) pre-selects candidate to be hired in origin by Huelva farmers. ANAPEC coordinates with the Foundation of Foreign Workers in Huelva (FUTEH) and the Spanish visa department in Morocco.

The quality of this program and its relevance for the European Union relies on the strong relationship between the two governmental agencies for labor. Huelva was the first destination for Moroccan guest workers under a circular migration program. The experience in this pilot project led the government of Morocco to think of those programs as tools for development as remittances play an important role in the Moroccan economy.

ANAPEC has been exploring for the last few years new circular migration partnerships with other countries such as France, Portugal and United States. In addition, new sectors are being considered by ANAPEC such as hotel catering, service and health (specifically the jobs in these sectors that have been less desirable to local workers during economic growth). Table 3 shows ANAPEC's vision for circular migrations programs. Conditions and resources are also reflected in the table:

Table 3: Selection process for circular migration workers in Morocco [ANAPEC Rabat, 2010]

<b>Selection Process in Morocco (ANAPEC view of the system)</b>
<b>Business Sector</b>
Agriculture
Hotel catering,
Services
Health
<b>Destination country</b>
Spain
France
United States
Portugal
<b>Job Offer Conditions</b>
Contract Duration: 3 Months (Spanish standard contract)
Trial period: 15 days
Salary : 37 euros/worked day
6.5 hours/day
Accommodation on the employer
Weekly leave: 1 day
Transportation costs from the place of residence in Morocco to the place of work on the employer
Medical coverage
<b>Profile Of Recruited Workers</b>
18 to 45 years
Feminine gender
From rural origin
Children in the origin
During the stay in Spain they will have to live in the farms
<b>Female Workers' Selection Process</b>
16 regions
61 provinces and police headquarters
264 inspection centers
38 agencies participating in the operation
5 selection sites: Mohammedia, Fès, Marrakech, Agadir and Dakhla
150 Employment counselors mobilized for the operation
<b>Accompanying And Follow-Up In Morocco</b>
Organization of awareness and integration sessions during the selection process
Support the penetration of banking services (opening dual bank accounts in Morocco and Spain)
Support in administrative procedures (passport, visa, medical certificate...) seeks to assist workers in Spain through an intercultural system of mediation and promote vocational and linguistic training as a key element for integration.
<b>Support And Follow-Up In Spain</b>
Employment regulatory framework in Spain (Unions and work inspection)
Visits and follow-up reunions in-situ (both official and by the Anapec)
Social follow-up by 25 social mediators (recruited by the Cartaya Municipality within the AENEAS program framework) and 75 NGO members; Follow-up and provision of medical care
Organization of courses and workshops: Spanish language, internet, intercultural exchange, family planning, violence prevention, hygiene, community life, security at work, etc.
Management and follow-up on claims
Support for return: group travel organization, luggage handling facilitation, etc.

Figure 14 shows part of the selection process in Marrakesh. Figure 15 shows the mobility part of the process in which guest workers are provided with ground and sea transportation to their final destinations on Huelva farms.



Figure 14: Selection in Marrakesh, Morocco. Photo: ANAPEC (left) Mercedes Gordo (right)

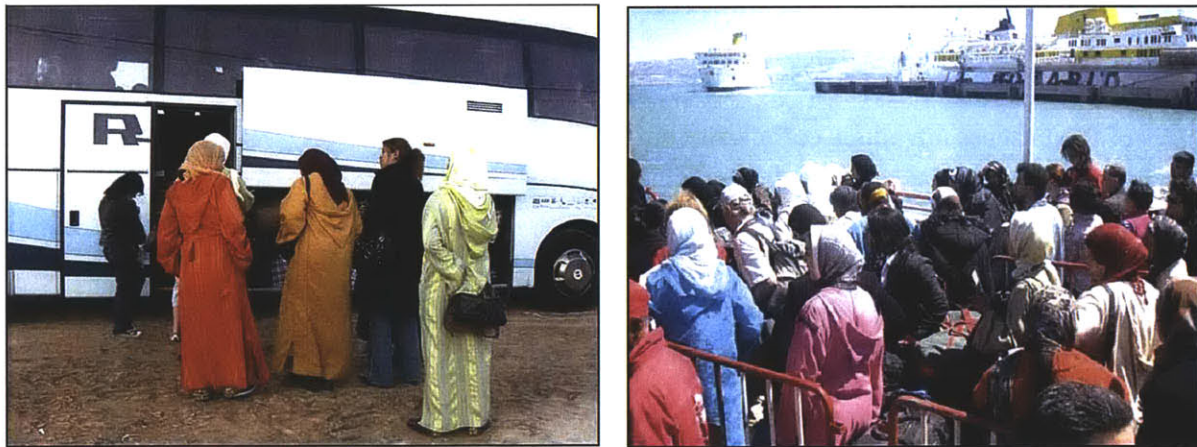


Figure 15: Trip Tangier-Tarifa-Almonte. Source ANAPEC. Photo: Mercedes Gordo (left) ANAPEC (right)

FUTEH coordinates action among all stakeholders from the circular migration management program office. Once guest workers arrive at their destinations, farmers provide them with housing. This process is supervised by FUTEH and ANAPEC. Social workers make sure that workers received proper accommodation and social and professional integration. Figure 16 shows ANAPEC managers during a visit to the Huelva settings.



Figure 16: (left to right) languages course, cooking courses and follow up on the farm. Photo: ANAPEC

As part of the case study, we also collected information about the process from the viewpoint of FUTEH (Table 4). One of the most important parts of this process is the legal immigration paperwork for which FUTEH collaborates closely with the Spanish consulate in Tangier. The processes for a large number of guest workers must be completed in a short period of time (because calls for workers depend on weather conditions, this mobilization is executed in days). Also the logistics for housing and travel must be synchronized with preceding processes. Other parts of the process introduce complexity into the systems.

For the purpose of our model we will include only the basic required functions to analyze the behavior of a high demand for workers in specific periods of time. We also look at the impact of these logistic and international relationships after the number of guest workers required is seriously reduced due to economic crisis.

Table 4: Value stream of the labor migration management in Huelva [FUTEH, 2010]

<b>Process in Spain (FUTEH view of the system)</b>
<b>Stages in the process</b>
Hiring process
Travel to Spain
Housing
Healthcare
Languages courses
Return
New season
<b>Employment offer</b>
Employment offer
Validation offer by immigration dept.
Sending the offer to Spanish Embassy in Morocco
Communication of the offer to employment office in Morocco
<b>First time workers management process</b>
Employment office in Morocco
Pre-selection of candidates
Convocation selection process
Final selection Signature of Contracts
Visa process and travel arrangement
<b>Repetitive workers management process</b>
Employment office origin
Reception of contracts
Convocation signature process
Signature
Visa process and travel arrangement
Travel
Reception of workers in Tarifa
Agreement with port authority to facilitate process
Buses organized to move workers to the farms
Intercultural mediators are present during all phases of the process to facilitate understanding

## 2.5 Chapter Summary

As stated before, this chapter illustrates a case study of circular migration in the province of Huelva in Southern Spain. Relevant material based on interviews, secondary sources and discussion within the MIT-Huelva research group was reviewed in this chapter. The development of the Spanish economy following the decline of the social status of agricultural work and other factors contributed to the growing need for foreign laborers in the strawberry fields. This led entrepreneurs to innovate socially and economically to create a process to identify and select laborers in other countries.

Initially, the progressive entry of Moroccan and Algerian migrants for the agricultural season replaced Spanish men with African men. The recruitment of women began in 2000 during the first major wave of Eastern European guest worker women; Moroccan men were replaced by Eastern European women. After Poland became a member of the European Union, African women began to replace Eastern European women. However, social conflicts began when economic crisis caused unemployment to increase in Huelva. At that time, intervention by the government forced yet another replacement: Spanish workers for African women. The crisis shows that the employers' priority is the harvest and its continued profitability regardless of who does the work.

Finally, this case study emphasizes the importance of the selection process, mobility and integration of guest workers. The quality of this program and its relevance for the European Union relies on a strong relationship between the two labor governmental agencies, ANAPEC and FUTEH, and their capability to manage complexity.

Table 5 summarizes chronologically some of the key factors involved in the process<sup>5</sup>:

Table 5: Chronology of Immigration in Huelva

Period	Labor type	Market Need/Policy	Conflicts
1986-1997	National immigration	Andalusian provinces have different agricultural seasonality: When the grape and olive harvests finish in Cordoba the strawberry season begins in Huelva. Workers need to move in order to avoid seasonal unemployment.	The large number of workers that move their families in order to participate in harvests across Andalusia overload local public services such as a school and clinics. The most important problem is housing; in addition to the cost of maintaining two houses, workers faced many conflicts in term of rentals.
1997-1999	First experience with Moroccan immigration	Because of problems in the previous period the government decided to provide special unemployment benefits for agricultural workers to avoid internal migration. That forced farmers to explore other labor markets, first in Morocco.	The farmers' search for foreign labor generates many problems among the local population. For first time, people in small Spanish towns need to learn how to live with other visiting foreign laborers. Many of the conflicts arise between tenants and owners. Several incidents create security concerns among local populations that perceive the immigrants as a threat.

<sup>5</sup> This table does not contain every country participating in the circular migration program with Huelva at every stage. (In Table 2 we can see the dominant migration flows by country.) It does illustrate the more relevant stages and sending countries over the last few decades of migration in the province of Huelva.

			As production increases and local workers become even less available, African workers arrive in greater numbers. An alarmed public feared an avalanche of immigrants trying to cross the border illegally.
1999-2001	Moroccan illegal immigration increase	As African workers illegally came to Spain in higher numbers, the Spanish government acted to regularize the immigration.	The social situation become more complicated; the number of illegal workers grew out of control and the government introduced a large-scale regularization of immigration. Social conflicts created a strong need to initiate contract in origin programs.
2001-2004	Eastern Europe immigration	With the creation of circular migration programs, foreign workers were hired in their countries of origin. This stopped the "call effect" This circular migration program stimulated the hiring of women from Eastern Europe.	During this period of time, significant conflicts were reduced. Illegal immigration decreased. Farmers were able to increase production year after year due to a guaranteed labor force.
2004-2008	Women from Morocco	Because Poland (and later Romania) becomes part of the European Union, their citizens can work throughout Europe. However, they stop coming to the harvest. Farmers decided to implement the circular migration program with Morocco again. This time they only hire women due to the success of the Eastern Europe experience.	During this period of time the circular migration program provides an excellent framework for farmers, society, foreign migrants and governments. However, at the end of this period the impact of the financial crisis on Spain destabilizes the circular migration program.
2008-2011	Local workers	Responding to complaints that the circular migration program is hurting Spanish workers, the government decides to pursue two policies: one encourages farmers to hire local workers; the other is to reduce the number of work permits for foreigners.	A new social problem is generated as local workers want to come back to the farms, but foreign workers are preferred by farmers who experienced the Spanish abandonment of farm work in favor of construction in more prosperous times. Farmers have also become used to the foreign labor force and do not want to jeopardize it. New conflicts arise between locals and foreigners competing for agricultural jobs.

### 3 METHODOLOGY

In growing economies, labor migration plays an important role. However, an increase in the number of foreign workers can have severe social consequences if a recession occurs. For that reason, some countries have implemented circular migration programs as a temporary solution to control migration flows depending on the labor shortfall.

However, a well-designed circular migration program requires more than a logistical supply-and-demand approach. A more holistic approach that considers the social, political and economic implications of such programs could be more successful. In this thesis, we discuss the multi-dimensional dynamics of a particular implementation of circular migration in Southern Europe. The case of Huelva in Spain represents a success story in social innovation from the point of view of foreign labor supply management but it did not come about by accident. We explain how a well-designed strategy over time can make the system respond favorably in a period of economic crisis.

In order to characterize the complexity of labor migration flow in southern Europe we used system dynamics<sup>6</sup> [System Dynamics Society, 2010] to understand the structural foundations and related variables. Created by Forrester (1957), system dynamics has its roots in control system theory but has been applied to complex problems in social science, economics, politics and business management. The objective of system dynamics is to provide a mechanism for modeling and simulation to explain the dynamics of specific phenomena and then use that explanation to develop interventions that can improve outcomes<sup>7</sup>.

System dynamics plays an important role in helping decision makers avoid suboptimal decisions, often referred to as policy resistance<sup>8</sup> [Sterman, 2000]. The concept is simple: When you

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<sup>6</sup> "System dynamics is a computer-aided approach to policy analysis and design. It applies to dynamic problems arising in complex social, managerial, economic or ecological systems -- literally any dynamic systems characterized by interdependence, mutual interaction, information feedback and circular causality" [System Dynamics Society, 2010].

<sup>7</sup> In this thesis, we do not develop interventions since the case study in Huelva itself contains correction policies.

<sup>8</sup> The tendency for interventions to be defeated by the system's response to the intervention itself [Sterman, 2000].



introduce a disturbance into a natural system, it may initially be able to cope with stresses and shocks. However, over time the system may react to the disturbance – or exhibit policy resistance – which may seem counterintuitive because of the time delays associated with the reaction.

Much of the art of system dynamics modeling is discovering and representing the feedback processes, which, along with stock-and-flow structures, causal-loop diagrams, time delays, and nonlinearities determine the dynamics of a system [Forrester, 1968; Saeed, 1982; Sterman, 2000]. The use of system dynamics helps overcome the limitations in people’s intuition about complex problems and their *often logically incomplete mental models* according to Forrester. The resulting insights are intended to help scientists, policymakers, the media and the public at large better understand complex multi-cause and multi-effect relationships. This is accomplished through the use of building blocks that are mapped creating the model structure [Forrester, 1969; Meadows, 2004]

The process of building models in system dynamics allow decision makers to better understand the problem and identify possible side effects that could result from their decisions. One of the reasons side effects are underestimated is the relativity effect<sup>9</sup> [Ariely, 2008] in which we look at the things immediately around us in relation to others to make decisions, instead of extrapolating the long-run consequences of circumstances on things over time. Another reason is how previous assumptions can fill logical gaps in an otherwise rational choice, as in the behavioral model of the “business man”<sup>10</sup> [Simon, 1957].

To this end, we followed the following model-building process illustrated in Figure 17 and detailed below [Sterman, 2000]:

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<sup>9</sup> “We not only tend to compare things with one another but also tend to focus on comparing things that are easily comparable – and avoid things that cannot be compared easily.” [Ariely, 2008]

<sup>10</sup> “The “flavor” of various models of rational choice arise primarily from the specific kind of assumptions that are introduced as the “give” or constraints within which rational adaptation can take place. Some of the constraints are set alternative to choice, relationships that determine pay-off and preference-ordering among pay-offs.” [Simon, 1957]

1. **Problem Statement:** Formulated the problem statement and dynamic hypothesis and included drawings from reference modes of each variable identified as critical in order to describe the behavior of the system. A time horizon should also be defined.
2. **Mapping:** Stocks, flows and variables are mapped establishing causality among them.
3. **Analysis:** Once causal loop diagrams are mapped and analyzed, the nature of the loops generating reinforcing or balancing behavior can be identified. Beside a qualitative analysis, some equations are written to facilitate the simulation.
4. **Testing:** In this part of the process, the data is introduced in the exogenous variables and stocks are initialized.
5. **Policies:** Following the simulation, the model was validated and compared with the results of the reference modes in the first step. In this step we have the opportunity to implement some recommendations from stakeholders that could make the system work more effectively.

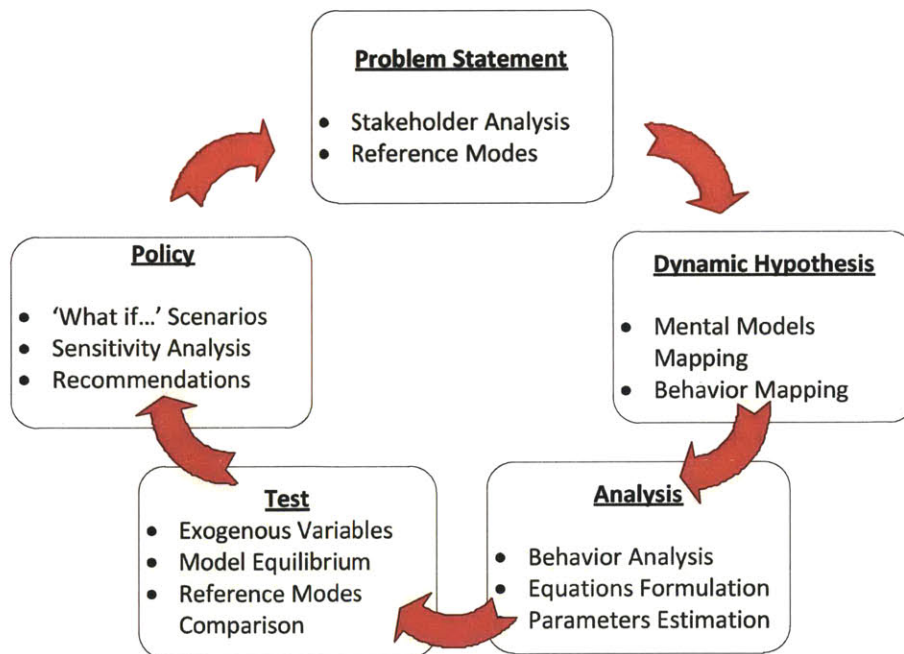


Figure 17: Model-building process

We used primary and secondary sources to identify the key variables in the model. The primary sources were interviews with several stakeholders in Southern Spain such as a representative of the Foundation of Foreign Workers in Huelva (FUTEH) and the Chairman of the Committee of Municipalities responsible for circular migration in the province of Huelva. We also ran several focus groups in the area, allowing local inhabitants to relate their experiences. Secondary sources included a wide range of documents about the experience of circular migration in Huelva (reports, articles, statistical data, local press and local surveys). All of this helped to produce the first qualitative model and the identification of variables.

To start building the model, we used a number of research methodologies such as stakeholder interviews and secondary sources, data collected from the University of Huelva<sup>11</sup> and observation/discussion with related research groups. Those sources of data were very valuable not only in informing the model but also in understanding the dynamics involved in the processes throughout the last 20 years of social innovation in the province of Huelva. Once the basic structure of the model was built we incorporated additional exogenous variables and causal loop diagrams. Subsequently, we validated the model with new interviews of stakeholders from the association for mobility (FUTEH), a leader of the circular migration program in Huelva and experts on circular migration programs in general. The model was presented so that stakeholders could provide additional feedback, which was incorporated into the final version of the model. This iterative process involved revisiting the model based on feedback and discussion.

The procedure to work with a reliable model was the following. First, interviews with government officials who described the nature of circular migration and how policies are implemented led to the development of causal loop diagrams. Other variables were listed based on interviews with farmers. Second, we showed those diagrams to stakeholders such as the circular migration program management team, and provided them with the opportunity to add more factors or to correct the model.

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<sup>11</sup> *Social Studies and Social Intervention* Research Center, [www.eseis.es](http://www.eseis.es).

The effect of strengthening one factor of the model can be seen on the wide range of socio-economic variables. This is one of the important advantages of this methodology compared to others, because multiple assumptions can be examined for their long-term policy implications. Others have used system dynamics to build social models and determine, for example, the optimal employment and production policies in the Iranian agricultural sector [Moosavi, 2009] and labor migration [Kribans, 2009].

System dynamics brings perspectives from sociology, macroeconomics, migration, industry and public policy into play. In formulating the hypothesis for this project, inter-administrative cooperation, temporary housing and guaranties for the return of guest workers will be considered as key elements in explaining the benefits of implementing responsible labor supply management practices while providing a just-in-time workforce. However, only the more critical ones will be included in the model to simplify the complexity of the problem, reduce ambiguity and focus creatively on the underlying meaning of the policies affecting the behavior of circular migration.

Figure 18 shows how decisions are made in the traditional management of social systems. The feedback theory provided by the system dynamics approach allow the addition of complexity principles for selecting information and basic structure as we will see in the results of this thesis. A broader mental model<sup>12</sup> that considers non-linearity, time delay and feedback loops will help to explain the dynamic behavior and potential improvements of policies in the case of Huelva and foster further implementation in new settings [Forrester et al., 1976]:

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<sup>12</sup> “Although assumptions may be explicitly stated, the human mind is not well adapted to determining the future time-varying consequences of those assumptions. Different people may accept the same assumptions and structure, and then draw contrary conclusions. A consensus is hard to reach, and even a majority opinion may be incorrect... The system dynamics model is more explicit than a mental model, so it can be communicated with less ambiguity” [Forrester et al., 1976].

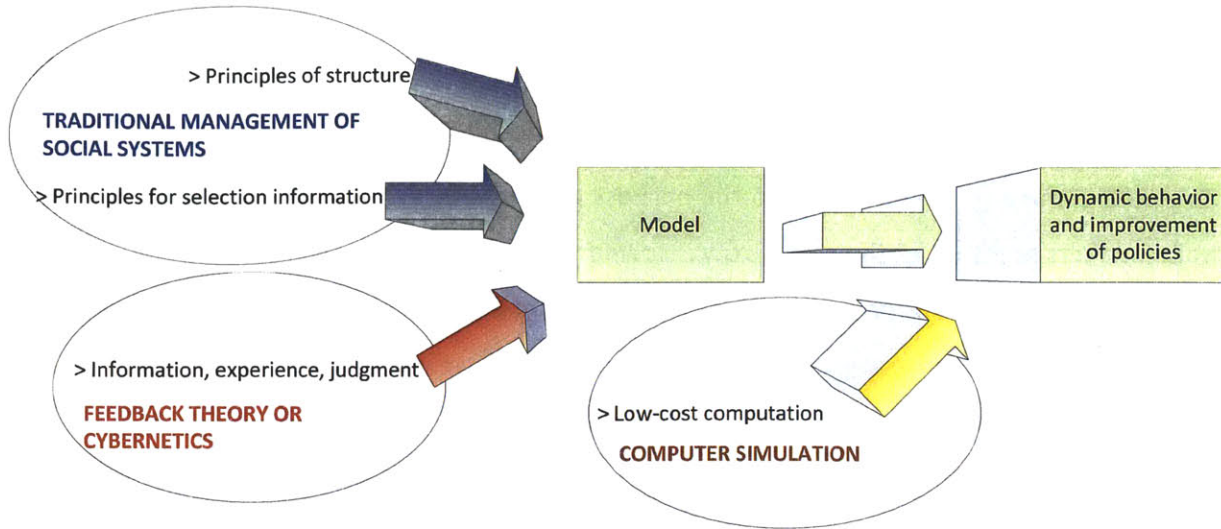


Figure 18: System dynamics model help to understand the dynamic behavior and potential improvement of policies

This chapter explained the decision to choose system dynamics as a methodology to analyze the management of labor migration. To help decision makers better understand the problem and identify possible side effects that could result from their decisions was the main reason for selecting system dynamics as the principal methodology in this thesis. This chapter also described the process of building models in system dynamics. We also reviewed the extensive literature on system dynamics in order to apply the discipline to the iterative process involved in this multidisciplinary subject in which sociology, macroeconomics, migration, industry and public policy come into play.

## 4 RESULTS AND ANALYSIS

As stated in the introductory chapter, the purpose of the model built in this research will assist policy makers to interpret the complexity involved while implementing circular migration programs in their regions or countries. The simulation of the model will also illustrate how economic forces and over-aggressive policies can cause a potentially detrimental disruption of the normal state of affairs. Finally, the analysis of the simulations will provide insights to governments that want to start circular migration programs about how stakeholders' mental models can be augmented with a broader system-thinking perspective and help those governments avoid unintended consequences.

In order to model the circular migration program supplying workers for the strawberry harvest in the province of Huelva in Spain, we studied the period 2002-2011. Our model will approach mainly labor supply management and will contain the key factors that make the program robust under economic crisis conditions. Following an explanation of our framework, we detail a list of stakeholders and variables involved in the circular migration process. Also, we include a basic structure of the model followed by another one including the feedback processes. Finally, the model will be simulated under certain scenarios and policies: The results will demonstrate how adaptive policies enable macroeconomic equilibrium.

The main objective in the agriculture industry is the quest for certainty and planning of the strawberry harvest. The continuous need for workers to process an extremely perishable product drives the recruitment and harvesting loops of our model. Figure 19 shows a very basic conceptual model that elucidates the overall problem faced by farmers in every agricultural season: recruiting enough workers to complete the harvest. The farmers' goal is to obtain a good return on their investment by keeping those loops balanced.

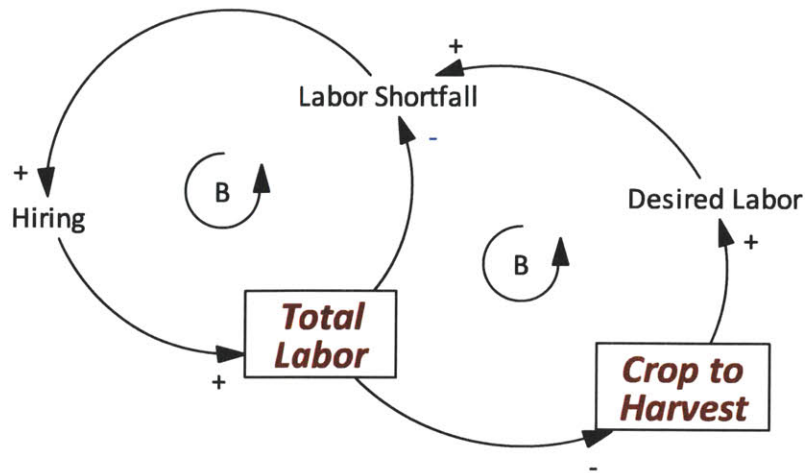


Figure 19: Harvesting and labor supply constitute the basic structure for the model on circular migration.

In Figure 19, solid arrows represent links of casual relationship. The polarity determines whether an independent variable causes an increase (+) or decrease (-) in the dependent variable. The relationship between building blocks is governed by real-world phenomena. When linking several variables and closing the loop we can create either a reinforcing effect (R), as we iterate larger or smaller values of the variables in the loop, or a balancing effect (B) where some variables offset a change in others in every cycle. [Forrester, 1973; Richardson, 1986; Sterman, 2000; Repenning, 2001; Lin et al., 2007; Desheng et al., 2010]

Figure 19 includes two stocks or levels (variable indicated by rectangles) that represent the basis for agriculture production: the total number of workers in the agriculture sector and the number of harvesting task to complete<sup>13</sup>. The planting of the strawberry crops is finalized in October; harvesting starts approximately in January and concludes at the latest in June<sup>14</sup>. The decision to plant will depend on the results from the previous season and on the availability of committed workers for the following year. Once the fruit is ready to be picked, labor should be provided without delay. In the Figure 19 model, labor supply is simplified. However, there are two main types of workers: local and immigrants with temporary work permits. The main concern for farmers is the need for a sufficient harvesting rate that is influenced by weather conditions that

<sup>13</sup> This conceptual model is based on James Lyneis's dynamics of project performance model [Lyneis, 2001].

<sup>14</sup> There are variations depending on climate factors.

make the fruit mature at unpredictable time. Farmers do not have a preference about who picks the fruit; they just need committed workers able to finish the harvesting either early in May or late in June based on weather conditions.

During the financial crisis in 2010, when the agriculture industry played a crucial role in the Spanish economy, an unexpected decrease in the number of hectares planted became an additional problem. For this reason the system dynamics model shows a gap between the surplus of local unemployed workers that do not wish to come back to harvesting jobs, and a reduction in the number of visas to guest workers. Figure 20 provides the Casual Loop Diagram (CLD) that describes this behavior over time creating a reinforcing loop. The CLD that relates the variable identified above (guest workers, local unemployed workers and hectares planted) explains the hypothesis stated in this thesis, that is, that as the number of contracts available to foreign workers for agricultural harvesting is drastically reduced, the total number of unemployed tends to increase over time. The CLD communicates the essence of the structure and highlights the most important feedback responsible for the dynamics of this particular system. The model is relatively simple, but captures the key drivers of project dynamics. If the foreign labor is supplied and harvesting is finished successfully, then farmers decide to increase the number of hectares planted in the subsequent year. However, if available local workers do not finish the harvesting season, farmers experience decrease in sales and react by reducing their forecast for next year. Another factor important in the model is the reaction of farmers to reduce planting, even when the sales are going well, when the guest workers number is reduced. That drives down the number of hectares planted and thus reduces the need for workers and the reinforcing loop creates a dynamic where the harvesting and need for workers jointly decrease. Finally, local unemployed workers are affected by the over protection of local employment by the effect of reducing the number of hectares, and a decrease in business in sectors such as tourism, transportation, construction and services. These elements will be explained in more detail in the following sections using a structure where levels and flows are included.



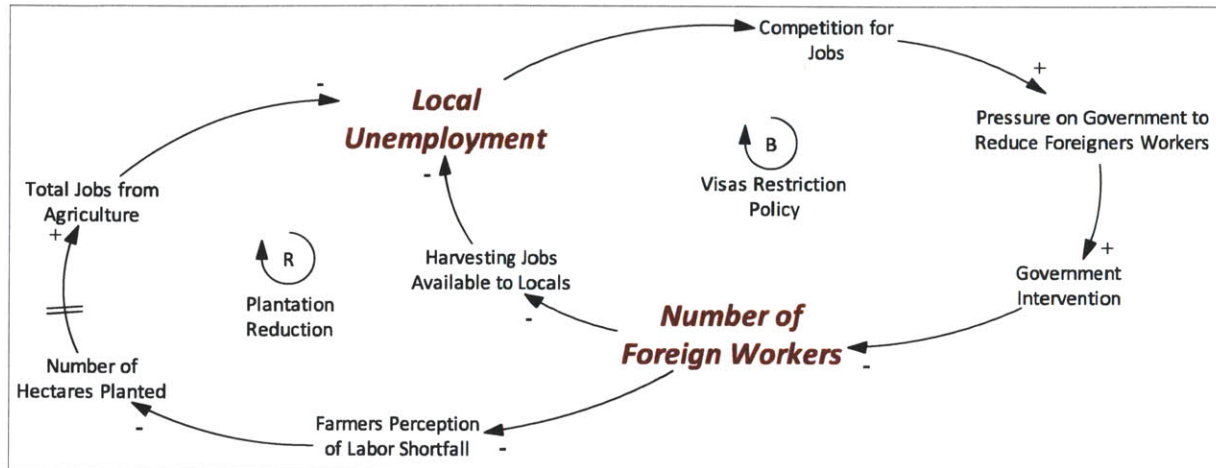


Figure 20: Unintended consequences of reducing the number of foreign work permit

Prior to developing the structure, we will describe the stakeholders and variables used to model the circular migration process. We will use them to map structure and feedback processes of the management of agricultural labor supply in the province of Huelva, Spain.

#### 4.1 Stakeholders

Before mapping the different variables involved in the circular migration process, a brief description of the stakeholders is provided in Table 6. It is evident that such an initiative requires an important collaboration among multiple parties at different levels of government and non-government organizations.

Table 6: Stakeholder descriptions

STAKEHOLDERS	DESCRIPTION
ANAPEC	Morocco's National Agency for the Promotion of Employment and Skills: they pre-select candidate to be hired in origin by Huelva farmers. ANAPEC coordinate with FUTEH and Spanish visa department in Morocco
Beturia	Group of agricultural municipalities in Huelva which every year need a larger quantity of foreign labor force for strawberry cultivation
FUTEH	Foundation of foreign workers in Huelva: circular migration Management Program Office. FUTEH coordinates action among all stakeholders
NGOs	Labor Integration Program Foundations. These non-government organizations aim to improve the employability and access to the labor market and facilitate the maintenance and quality of employment of the immigrant population. They also support immigrants in health and other social issues
SAE	Andalusia Employment Service
European Union	EU Funding: The Social European Fund provides fund under the European Pact on Immigration and Asylum
Unions	Trade Unions, supervising labor conditions at work (i.e., CCOO, UGT, etc.)
COMI	Huelva's Commission of Municipalities with Immigration
Representatives of City Councils with Immigration	There are at least 15 municipalities involved in this region of Spain
Spanish Immigration Office	Representative of this office specialized in dealing with visas
AENEAS Agents	Experts in Aeneas dealing with circular migration. Following the AENEAS project in 2010 the M@RES project (EU Funded) was started to manage migration flows and the circular migration program in the province of Huelva. This program provides a robust information system platform to monitor migration flows
Farmers Organizations	Farmers' organizations that promote circular migration and select personnel in other countries. They represent small farmers

Benefits and priorities from key stakeholders such as workers, farmers and governments benefits are detailed in Table 7. The most significant aspect to highlight is the win-win situations and the benefits from these programs.

Table 7: Key Stake holders Benefits of circular migration Programs

Stakeholder	Benefits and priorities
Immigrant Workers	<ul style="list-style-type: none"> <li>• The security workers are being hired for the following campaigns without going through a new selection process</li> <li>• Workers can be hired by any employer, avoid relying on one particular activity</li> <li>• Workers stay in touch with their families and their social environment.</li> </ul>
Farmers	<ul style="list-style-type: none"> <li>• The necessary manpower is available during the critical moments of the campaign</li> <li>• The workforce will be available quickly through efficient human resource management</li> <li>• Workers comply with all their contracts</li> <li>• The harvest will be collected on time, ensuring respect for the dignity and rights of workers</li> </ul>
Country of Origin	<ul style="list-style-type: none"> <li>• Increase in remittances</li> <li>• Efficient management of job applicants</li> <li>• The skills learned by immigrants are exploited by the local economy.</li> </ul>
Host Country	<ul style="list-style-type: none"> <li>• Control and management of migratory flows that meet the needs of labor market</li> <li>• Efficient management of supply and demand for labor</li> <li>• This avoids problems of integration</li> </ul>

## 4.2 Variables in the system dynamics model

In the modeling process we begin by identifying variables, stocks and flows based on stakeholder interviews and secondary sources. In Table 8 we describe three variable types in stock-and-flow diagrams: stock variables, flows variables and auxiliary variables [Richmond, 1992; Sterman, 2000].

Table 8: Variables used in circular migration system dynamics model

Stock (Level) variables	Description
Guest Agricultural Workers	Number of guest workers available and ready to travel from their country of origin to Spain
Local Unemployed Workers	Number of local workers registered as unemployed
Agricultural Workers	Number total of workers (local and guest) hired by farmers
Other Sectors Local Workers	Number of local workers hired in service/construction sectors
Crop	Number of hectares planted
Flow variables	Description
Authorization Rate	Spanish governmental instrument designed to recruit non-EU originating agricultural workers
Voluntary Return Rate	Workers contracted in origin must return to their home country once the harvesting is done
Plantation Rate	Number of hectares planted every month based on a reference plantation rate plus an additional rate determined by the willing for farmers to increase or reduce it
Harvesting Rate	Rate of harvesting based on the availability of total agriculture labor
Agricultural Hiring Rate	Rate of hiring local unemployed workers in the agriculture industry
Employment Shift	Rate of attrition in the agriculture industry by local workers that found another job in other sectors such as tourism or construction
Other Sectors Recovery Rate	Rate of hiring of local employed workers in service/construction sectors
Other Sectors Unemployment Rate	Rate of unemployment in the service and construction sectors
Auxiliary variables	Description
GDP	Gross Domestic Product as a measure of the financial crisis
Desired Labor Harvesting Jobs	Number of workers needed for the harvest based on productivity and number of hectares planted
Guest Workers Desired by Farmers	Number of foreign workers demanded by farmers based on the labor shortfall
Labor Shortfall	Agricultural labor shortfall based on the total number of workers (includes local agricultural workers and guest workers)
Government Return Incentives	The government incentivizes the voluntary return of foreign workers in order to give priority for agriculture jobs to local workers and reduce the toll on social services designed for Spanish citizens
Pressure to Farmers to Hire Local Workers	Effort spent in convincing farmers to hire local workers instead of guest workers. Part of this effort relies on increasing wages and incentives
Farmers' Fear of Running Out of Workers	Number of farmers willing to decrease planting next year as a consequence of the perception that without enough guest workers the harvesting will not be done
Relative Attractiveness of Agricultural Jobs	Attractiveness of agriculture jobs among local population relative to jobs in the service and construction sector. Other variables such as wages and difficulty are aggregated here
Complains about Immigration	Number of unemployed workers complaining about immigration based on the difference between reference points before the economic growth
Additional Authorizations based on Complaints	Number of visas authorized by the central government based on the number of complaints filed by the unemployed population
Min Time per Return	Minimum length of duration of stay in the host country by guest workers
Minimum Foreign Work Permits	Minimum number of visas guaranteed for foreign workers independent of the number of complaints filed by unemployed

### 4.3 Model structure

The guest worker program in Huelva is designed to meet agricultural labor demand when the local labor supply is insufficient. Therefore, immigrants with temporary work permits can be hired into the agriculture sector to handle the increased demand. However, local workers<sup>15</sup> can either work in the agriculture or in the service/construction sectors. Figure 21 shows how farmers control the number of local agricultural employees by increasing or decreasing the inflow rate (variable attached to a valve and pipe symbols representing activity between two different stocks or levels) coming from the local unemployed worker stock (level). They also ask the government to increase the number of visa authorizations for guest workers thus increasing the inflow of laborers. Occasionally, when labor shortfalls occur, farmers take the risk of hiring illegal workers to address the immediate need. This is only a temporary solution because immigration violations<sup>16</sup> can jeopardize a farmers' eligibility to participate in the guest worker program.

The basic structure of the circular migration system dynamics model is presented in Figure 21. It illustrates the people that flow from one stage to another at a rate determined by the economy, migration policies and by the structure of the system itself. In this part of the model we have identified three types of available workers including local people working in the harvest (on the right), workers from other sectors (on the left) and unemployed (on the bottom). The people contained in these three stocks can move from one stage to another. Those who have been working during the few months of the harvest, and then stop doing agricultural work can either get a job in the tourism sector or can remain unemployed and receive unemployment benefits from the government. Also, somebody who has lost a job in another industry might join the unemployed group, or choose to work in agriculture. Unemployed workers can move to another group by getting a job in either agriculture or another sector.

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<sup>15</sup> Remember that local workers here mean mainly two types of workers: nationals and immigrants with permanent work permits or without the need for work permits thanks to the most recent additions of Poland, Romania and Bulgaria to the European Union in 2004 and 2007.

<sup>16</sup> This part is not represented in the model but was considered in the original analysis of this research as an important factor to include in the model in future work.

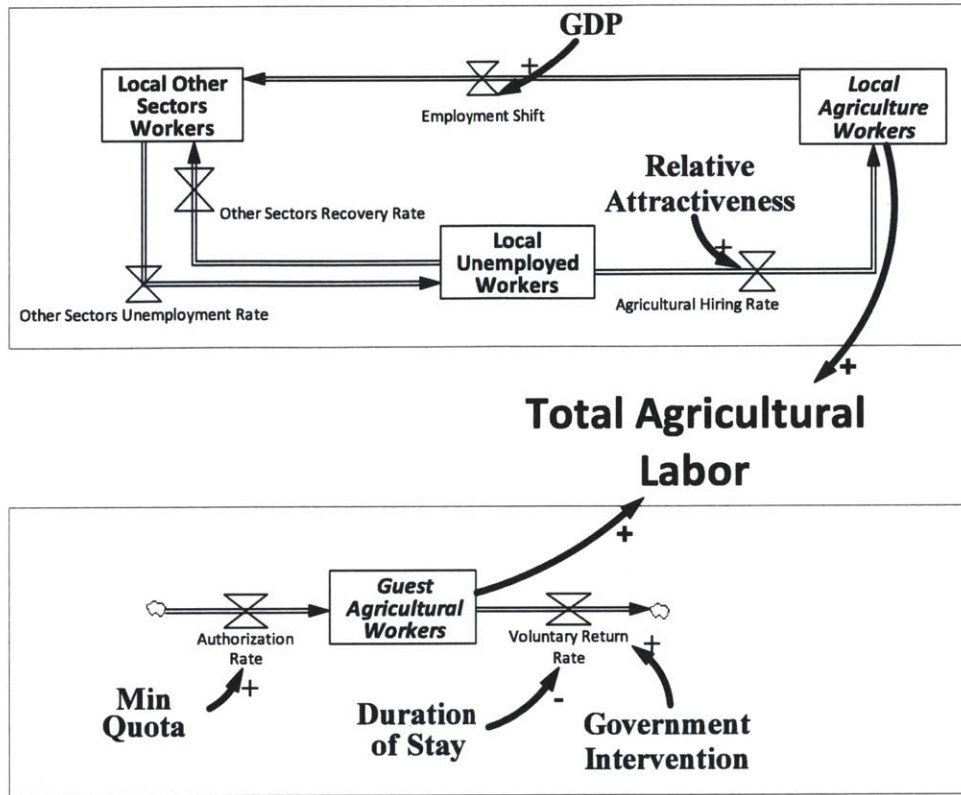


Figure 21: Model structure

Stocks or levels (variables marked by rectangles) represent the number of people working in a specific sector. Solid arrows represent links of causal relationship; other arrows represent the inflows/outflows to/from the stocks. The symbols used for flows function like a tap that can be adjusted to regulate the rate of the flows according to the variables that influence them.

According to the data collected during several interviews with people at the foreign workers agency, FUTEH, in the case of Huelva during the last decade most of the local agricultural workers move to other sectors as soon as the economy improves. Our indicator in this case is the GDP for the province of Huelva. For the purpose of this model we assume that local agricultural workers can only flow to other sectors' stock or remain agricultural workers.

Our interviews showed that farmers try to retain local workers who have been loyal. That is the reason the flow in our model between agricultural workers and unemployed Spanish workers

goes only in one direction. However, farmers reject hiring workers who had previously moved to other sectors, and later become unemployed. In other words, while farmers prefer to retain local workers, they prefer foreigners to Spanish workers returning to agriculture out of economic desperation. Foreign workers recruited through a circular migration system have demonstrated greater loyalty to the farmers.

Normally, workers who lose their jobs in the construction or tourism sectors prefer to be unemployed rather than to work in the agriculture sector. This is due to the social stigma attached to manual labor in the agriculture industry. Not until they have exhausted all unemployment benefits or employment possibilities in other sectors do workers begin to search for work in the agriculture industry.

If farmers do not hire them because of they prefer loyal foreign workers, the local unemployed complain to the government forcing them to reduce work permit authorizations to foreigners. In this model we have not considered illegal immigrants because of the lack of reliable data, and because the implications of those flows goes beyond the boundary of our model.

Before the service sector developed in Huelva, local workers used to supply most of the labor needed in agriculture. Later, after Spain became part of the EU, the province of Huelva began experiencing rapid development in the tourism and construction sectors. As the service sector accelerated and more employees were needed, fewer locals wanted to work on farms that offered hard work and low wages. To solve the problem of labor shortfall in the agricultural sector, and to avoid illegal immigration, implementation of contracts in origin strategies allowed the hiring of a large number of guest workers for the agriculture sector in Huelva. In addition to the difficulty of agriculture jobs, one of the more important problems was the overlap in timing of the strawberry harvest and seasonal tourism activity, especially in coastal municipalities. Since strawberry harvesting takes place mainly between January and June (see Table 9), and tourism season peaks between April and September, the overlap from April to June is large. This overlap varies significantly depending on climate conditions<sup>17</sup>.

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<sup>17</sup> This parameter will not be considered in the model since the simulation will focus on the dynamics across different years.

Table 9: Main agriculture season in the province of Huelva [GEA, 2008]

Season	Start-End
Strawberry Planting	Oct-Nov
Strawberry Harvest	Jan-Jun

During the financial crisis of 2008 the number of construction and service sector jobs decreased. This created a spike in unemployment that alarmed the local population and caused them to think that the circular migration program was an impediment to economic recovery.

However, a sudden halt to the hiring of guest workers was not enough to decrease local unemployment. Local workers who had been well educated and become accustomed to service sector jobs did not find agricultural jobs attractive anymore. Furthermore, farmers continued to demand guest workers, arguing that local workers would not commit to the entire harvest season, lasting until June because previous commitments to restaurants and hotel services jobs would take precedence with any improvement in weather. Other workers found it physically difficult to finish the harvest season because of the hardness of the work.

Together these factors actually exacerbated the labor shortfall, and farmers were afraid they would face the difficulty of finding sufficient labor they had experienced in previous years, before circular migration programs existed. Some farmers proposed to plant much less than in previous years if the local government did not guarantee a minimum number of guest workers [Millán, 2010b].

As we will show, reduced planting (and thus production) is a negative effect that proponents of circular migration programs aim to avoid. It is not clear whether, in the long run, implementing national policies that eliminate circular migration programs will make more jobs available to local workers. If we consider the side effect of reduced planting because farmers fear not having enough workers, we can argue that these policies function counterintuitively because, as will be shown in the simulation, they could actually reduce the number of jobs available to local workers.

Also, it is very important to emphasize that foreign workers are hired mainly for the harvest. Agricultural jobs also include other functions, such as fruit processing, transportation, sales,



marketing and management. In addition, a high level of agricultural activity generates indirect jobs in other sectors that supply not only the agricultural labor force, but also the guest worker population<sup>18</sup>.

For this reason, instead of completely eliminating circular migration programs, proponents of its implementation in Huelva decided to apply three policies simultaneously:

- a. Encourage farmers to hire local workers instead of relying on guest workers for the next harvest. This keeps the program alive while encouraging the responsible social practice of having farmers hire locals. Such a policy also reduces some uncertainty for farmers by providing a steady supply of available labor. The policy that incentivized this behavior was based mainly in social sensitivity campaigns, incentives and negotiations through which farmers could be granted a minimum quota of guest workers if they increased local hiring.
- b. Intensify inter-administrative cooperation in order to increase mediation and labor orientation to local workers. This could increase the attractiveness of agricultural jobs among the population, and foster commitment of local workers to finish the harvest season. This should decrease the number of workers abandoning the fields in the middle of the harvest.
- c. Maintain a minimum number of guest worker permits (*Min Quota* in the model)<sup>19</sup>. This policy stabilized the number of guest workers under the government policy of early voluntary return. This minimum of authorizations was independent of complaints filed by Spanish workers concerned about their own employment status. Also, by increasing the duration of stay in the host country, the system guaranteed a minimum number of guest workers independent from government policy.

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<sup>18</sup> Even though the model is prepared to consider the effect of indirect agricultural jobs on employment in other sectors, it was not simulated under this secondary stress condition in order to simplify the response of the system and focus on the research question: What elements were driving the creation of circular migration of policies in the province of Huelva before and during economic crisis?

<sup>19</sup> This minimum quota is critical in order to guarantee the harvesting in the last few weeks of the season when local workers shift to the tourism sector.

The agriculture industry also looked for integration and future planning of human resources. After the two first policies came into effect, farmers played a more active role in communicating with social agents and governments to identify labor demand and forecast future demand in certain time periods and sectors. The agricultural industry became truly committed to its new role and commitment from social, political and economic perspectives [Moya, 2009].

As the Chairman of Huelva's Commission of Municipalities, responsible for circular migration, declared when we show him the value of their policies [Millán, 2010b]:

*'it is necessary to maintain circular migration working even with a little activity because it builds trust with immigrants, keeps international relationships active, creates a backup in case the tourism season starts early and prevents the labor shortfall in times of high economy activity'*

Chairman of the Huelva's Commission of Municipalities with Circular Migration  
Interview Nov 7, 2010

At the beginning of the planting period for strawberry cultivation in October (see Table 9) farmers have to forecast how many hectares are going to be planted that year. This decision is mainly based on the forecast of worker availability [Millán, 2010; Cembrero, 2010; ISELMU, 2010]. At this point the number of visas the government commits to offer to guest workers is critical. Even though the employment office announced to farmers the availability of a large number of local workers listed as unemployed, experienced farmers perceive this labor supply to be uncommitted to finishing the harvest and thus decided to decrease the number of hectares planted unless the government also promised a minimum supply of guest workers.

This behavior is represented in our model by the reinforcing loop *Effect of Crisis in the Planting*: the extent of the labor force needed for the harvest is based on the number of hectares planted as shown in Figure 22. As farmers see the number of foreign worker authorizations decrease, they anticipate a labor shortfall and their willingness to increase the amount of planting falls

dramatically. Because the labor demand is less than the existing supply, the local agricultural labor hiring rate decreases and creates an increase in the unemployed stock<sup>20</sup>.

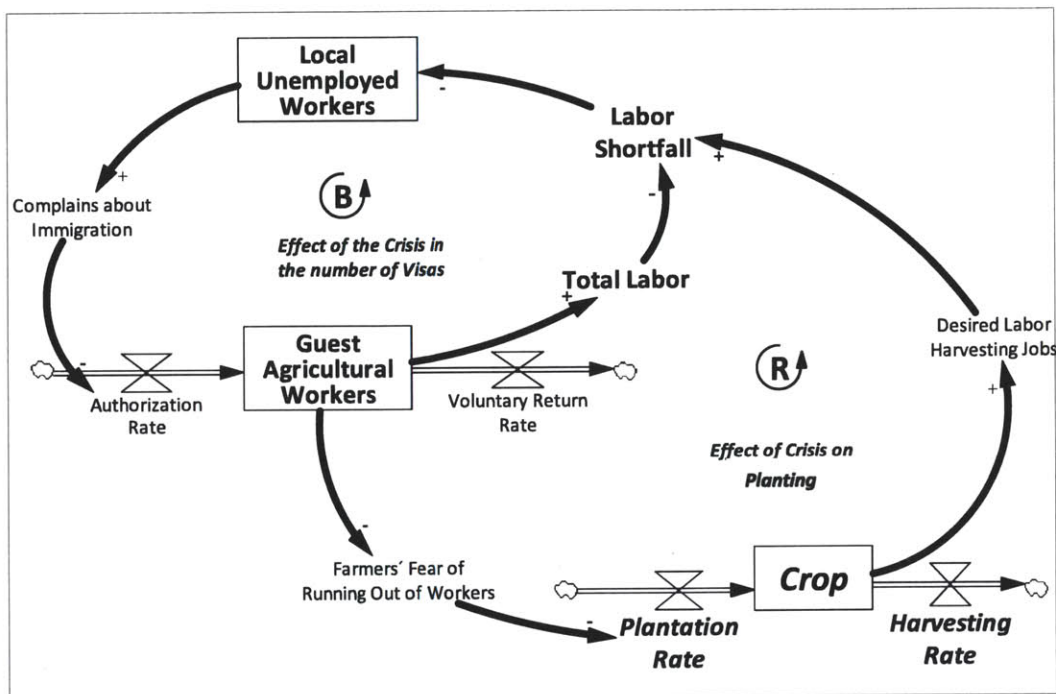


Figure 22: Effect of the crisis on planting

Figure 23 shows the basic structure and the feedback process of the policies of circular migration (the next section of this chapter will also show the results from the simulation model). The model illustrates how the policies applied in the case of Huelva's implementation of social dialogue between all stakeholders were designed to prevent this situation. The decrease in the number of guest worker was very slow. In times of crisis a region like Huelva relies on agriculture. Huelva provides an excellent case study in which a well-designed and managed circular migration program provides a tool to properly control the migration labor flow. The system dynamics model, either the basic stock and flow structures or the causal loop diagrams, help explain how different policies interact over time.

<sup>20</sup> In this case we would consider the secondary effect of planting on the number of indirect jobs generated by agricultural activity; this would have decreased as well. And finally this would increase the flow of the *Other Sectors Unemployment Rate*, and the *Total Number of Unemployed*. However, as stated before, this model focuses on the effect of planting on harvesting jobs.

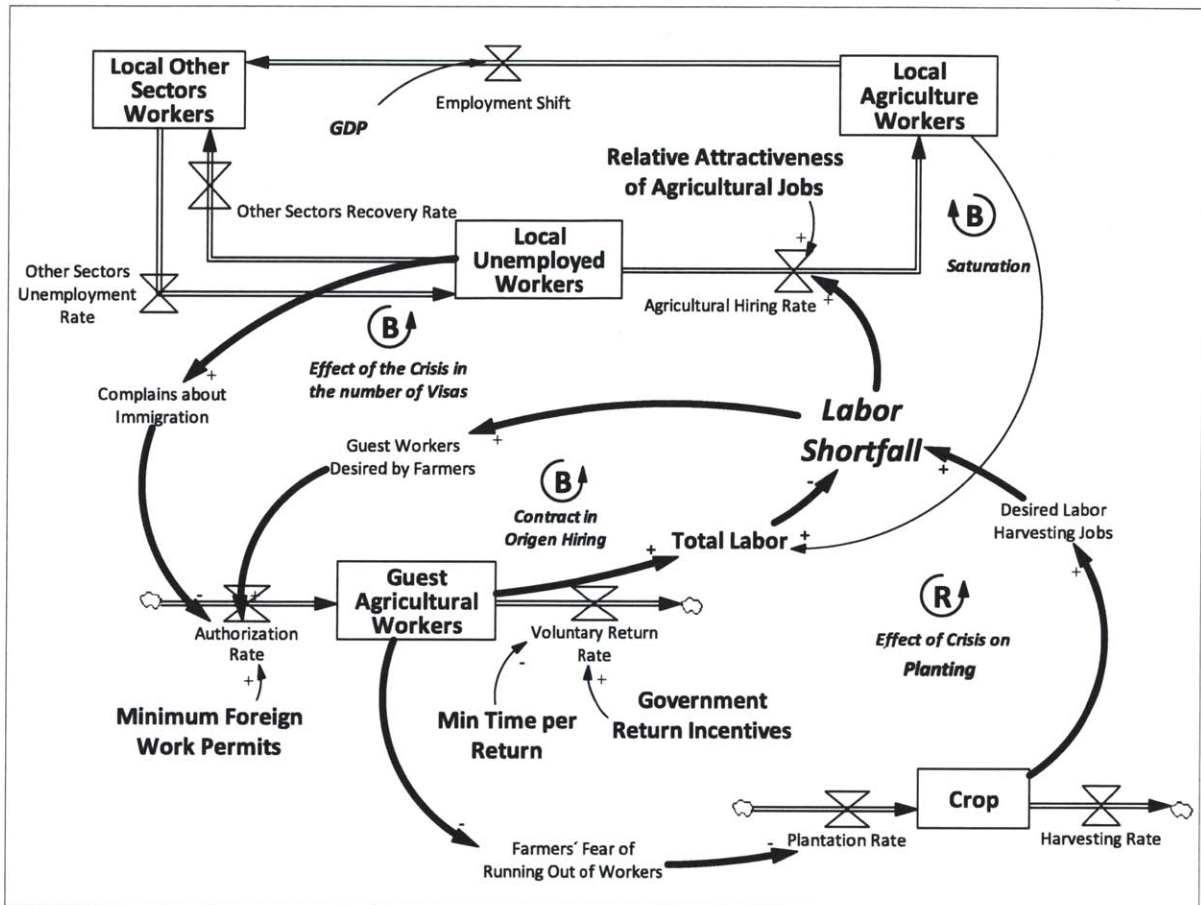


Figure 23: Model structure and feedback processes

One of the principal concerns that face circular migration leaders when implementing a program like this is how to make the immigrant population respond instantaneously to the economy: This question has two answers depending on whether the objective is to increase or decrease the number of guest workers. In the first case an increase depends on the authorization rate of visas which is controlled by the government. Officials decide every year depending on the farmers' desire, number of hectares planted, and the number of complaints from unemployed workers or society in general (in the model, GDP is considered an indicator of economic constraints). Other factors such as visa processing at the consulate, housing, transportation, healthcare and training of guest workers are very important in term of logistics according to the interviews conducted

[FUTEH, 2010]. However, factors such as these are not considered within the scope of the model<sup>21</sup>.

In the second case, to respond instantaneously to fluctuations in the number of guest workers, the solution is easier since these labor management programs are designed to have great flexibility. The nature of circular migration makes it possible to reduce the inflow rate by reducing the number of work permits authorized. In the model this is represented by a stock representing an accumulation.

Accumulation takes time because the inflow is reduced until the stock level begins to decrease. One analogy is the effect of closing the tap when the bathtub is already full. Closing the tap does not mean that all the water is going to disappear. Reduction will depend of the outflow rate. In the case of guest workers stocks, even if due to economic crisis the government wants the guest workers to return to their home countries and cancels the authorization of work permits it will still take some time for the workers to leave.

In the case of Huelva, the government not only suddenly stopped providing visas to guest workers, but also decided to increase the outflow by helping foreigners return to their home countries early. As will be shown in the simulation, this is one of the reasons, together with the cancelation of the foreign work permits, for a collapse in the number of guest workers and the activation of the reinforcing loop *Effect of Crisis on Planting*.

The feedback reinforcing loops mentioned above (see Figure 23) drives an exponential growth in the number of immigrants. As farmers get used to this type of labor force they tend to continue using it. As the number of guest workers increases, farmers are more willing to increase planting. If planting goes up, the amount of desired labor goes up and any labor shortfall goes up as well.

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<sup>21</sup> Even though the following factors have not been considered in the simulation model in order to keep it simple and focus on the research question, in an economic growth period the problem consists mainly in how to organize the logistics in order to be able to host almost 40,000 guest workers in the province. Housing is one the most significant challenges to be worked out. Providing health care—and other social services—in small towns where the population doubles during harvest adds even more complexity. It has been improved through specific and coordinated policies for the integration of immigrants [Plan Integral Inmigración I, II, 2001, 2006]. However, in the case of Huelva there was an additional problem in socially integrating the foreign population. Major efforts were made to avoid conflicts among locals and guest workers but these types of frictions are difficult to anticipate and manage since they are highly unpredictable.

Such a policy move opens the tap controlling the flow between unemployed workers and local agricultural workers, with the effect of increasing employment. As fewer unemployed complain about competition from immigrants, government officials feel comfortable in authorizing more visas. Again, farmers are willing to plant more as the guest worker stock increases.

However, if for some external reason like an economic constraint plus additional government intervention as unemployment increases, the number of complaints increases too, the number of guest workers decreases, planting also decreases, labor shortfall is decreased and—counterintuitively—the number of unemployed workers increases. Here is the most interesting part of the story: Government and society only see the balancing loop Effect of Crisis on Number of Visas. If unemployment increases the number of foreign workers should decrease as well: This is their mental model. However, as the model illustrates, if the number of guest workers decreases, planting decreases which leads to more unemployment. Stakeholders will think that more reduction in the number of guest workers is needed.

The end of the story would be that the government finally decides to cancel the circular migration program immediately and force foreign workers currently in Spain to go back home early.

This intervention would create a collapse not only of the circular migration program, but also of the system, causing unemployment to increase exponentially. For that reason, the model built for this thesis contains other factors that were implemented by the local administrator and circular migration manager in the province of Huelva in order to avoid such an extreme situation. It will be demonstrated in the following sections.

#### 4.4 Simulation results from the circular migration system dynamics model

The circular migration system dynamics model is calibrated based on the interviews with stakeholders that provided clarification and corrections to some of the loops. Via exogenous variables and systematic comparison of model outputs we executed changes in structure,

parameters, correcting the data and choosing which decisions to ignore (sometimes using exogenous effects).

In order to run simulations we have defined several scenarios as described in Table 10:

Table 10: Description of simulation scenarios

Scenario	Description
A: Base Case	Behavior that the system produces without the introduction of shocks or other interventions
B: Economics Constraints	System responds to economic shock but without external policy by government
C: Government Policies	System responds to economic shock and also government policies such as a forced visa reduction
D: Circular Migration Management Policies	System responds to economic shock, but in this case local circular migration management policies reduce counterintuitive consequences of government visa reduction

In order to analyze these dynamics over 100 months (the simulation time horizon), we will need to make an important assumption during the calibration:

We will use annual data to feed the model. That basically means that during the simulations the different stocks (levels) will contain the number of workers during the harvest seasons over the last decade.

The purpose of this model is not to simulate the flow of workers during a single year. The purpose is to explain how the structure of the system generates different behaviors across different harvest seasons. This will provide better insight to policy makers in circular migration programs on how a decision made in one season can create accumulative forces during the following few years capable of destabilizing the system.

In a previous version of this model we considered the option of simulating a very realistic scenario in which we could see how local workers flow from one state to another during a single year. That case was very useful for one of the stakeholders responsible for the management of foreign labor. This original model showed how local workers may move from agriculture to the tourism sector (depending on weather conditions) in the middle of the harvest and how these

events affected farmers' willingness to hire local workers. This overlap between the two industrial seasons was simulated and helped managers better understand the decisions made by farmers during a single year.

Even though this case was very interesting for those managers, we thought that a model enabling policy makers to envision the dynamics over the last decade would be more useful.

#### 4.4.1 Scenario A: Base Case

With the assumed system, we start with a base case to focus on its dynamics. Without introducing any shocks or other interventions, the base case represents the behavior that the system produces. We have calibrated the model to keep the stock (levels) stable, which means that during the time horizon of the simulations they do not change. The value of these parameters is shown in Table 11. Behaviors of these variables are illustrated later in this section.

Table 11: Base case parameters

Parameter	Definition	Value
T	Length of the model year	100 Months
U	Initial Unemployed Workers	50,000 people
A	Initial Local Agricultural Workers	60,000 people
O	Initial Other Sectors Workers	70,000 people
G	Initial Guest Agriculture Workers	1,000 people

The values of the parameters are chosen according to the data collected for the case under study. However, in order to facilitate the analysis of the simulation those values have been rounded.

Our simulation will run for 100 months that contain the more relevant dynamics during the last decade of the circular migration program in the province of Huelva.

At this point we have to clarify that in this research we have not developed a regression analysis in order to parameterize the model. The main reason for this decision is that the data available in terms of economic growth rate, unemployment rate and the guest worker program do not reflect just the behavior of the factors under analysis. For example, in the province of Huelva diverse investment in the tourism sector made an impact in the variation of Gross Domestic Product (GDP) and the number of workers involved. Also, the number of guest workers after 2008 does



not reflect those foreign workers from countries that have become part of the European Union, and thus are now considered to be local (in the case of those workers registered in Huelva).

The goal of this thesis is to determine the dynamics and tendencies of certain policies and the behaviors created by the system structure. We will start with the base case without introducing stress rendering the stocks (levels) constant. In sections below, we will stress the system by introducing economic constraint in term of GDP. That will change the behaviors of the system to show an approximation of what happened in the province of Huelva during the last decade. The model has been calibrated to reflect this behavior, and will also show how certain external policy affects this behavior.

In Table 12 we can see the inflow and outflow of the main stocks (levels) in the model:

Table 12: Inflow and outflow relationships in the stocks (levels)

$\text{Unemployed (level)} = \text{INT} [\text{Other Sectors Unemployment Rate} - \text{Agriculture Hiring Rate} - \text{Recovery Rate}] + U$
$\text{Local Agriculture Workers (level)} = \text{INT} [\text{Agriculture Hiring Rate} - \text{Employment Shift}] + A$
$\text{Local Other Sectors Workers (level)} = \text{INT} [\text{Employment Shift} + \text{Recovery Rate} - \text{Other Sectors Unemployment Rate}] + O$

As we see in left graph in Figure 24, in the base case all stocks (level) are constant year after year. This would be the case in which farmers hire the same number of local workers every season (around 70,000), the same number of immigrants (1,000 guest workers at the beginning of the circular migration process in 2002) and the economy absorbed the same number of workers in other sectors. In the graph on the right we can see the inflow of the unemployed stock (2,000 workers a month after being fired from other sectors, 1,000 local unemployed being hired by other sectors, and 1,000 local unemployed being hired in agriculture).

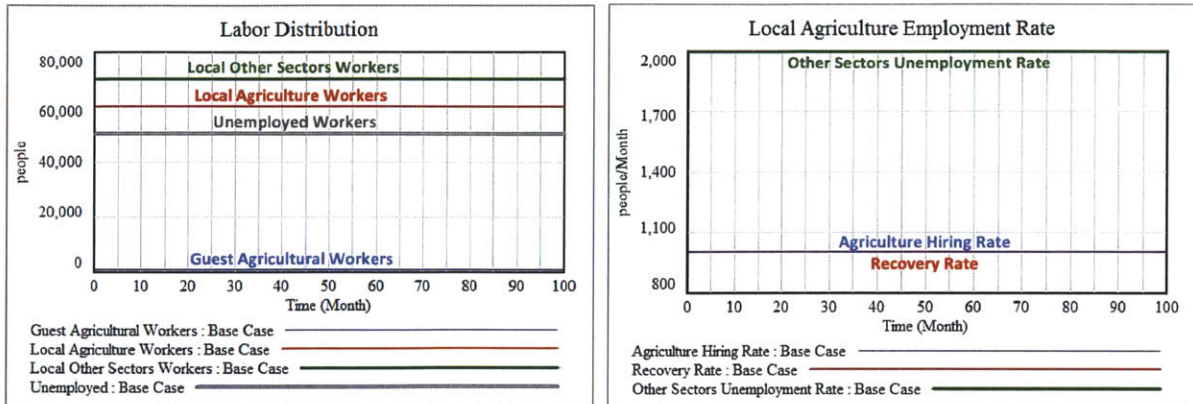


Figure 24: Behavior for the base case (Scenario A)

In the real case there are flows across the system, as, for example, workers leave the system through retirement. However, for the purpose of this model, we only considered internal flow. In this way the number of total local workers either in other sectors, agriculture or unemployed remains constant over time. We will see in subsequent sections that the only way to respond to an increase in local jobs in the local system is by hiring people from abroad. We have assumed that when new jobs are created through economic growth, they are in other sectors. When new jobs are created, for example, in the tourism or construction industry with wages higher than in the agriculture sector, people will change jobs. The consequent labor shortfall in the agriculture sector will stimulate stakeholders to invite foreign workers to conduct the harvest as we can see in the model.

#### 4.4.2 Scenario B: Government Policies

In this section we will simulate the behavior of the model under economic constraint. As we have described in the background chapter, during the last decade the province of Huelva has experienced an exponential growth in the economy, a shift in local labor force and in number of guest workers. During the economic crisis Huelva also experienced the collapse of those factors.

Table 13: Variable that shocks the system in scenario B

Scenario	Variable	Value
B: Economics Constraints	GDP	<ul style="list-style-type: none"> <li>• 1 from month 0 to month 10</li> <li>• 35% growth from month 10 to month 55</li> <li>• 30% recession from month 55 to month 100</li> </ul>

Our model illustrates how introducing a step in the GDP (35% growth) during the first year of this simulations (months=10) changes the stable behavior we found in the base case. In the fourth year we introduce a new step that creates a recession in the economy as shown in Table 13. We have assumed in this simulation that the growth or recession is constant during a period. That will facilitate the analysis of the results and it will not be much different than if we introduce the real scenario. Again, the purpose of this model is to illustrate the behavior when some shocks are introduced and how key factors (or policies) can help to stabilize the system. The quantitative results of those simulations, even though they are important to assist the analysis, are not crucial for the purpose of the model.

In Table 13 and Figure 25 we can see the intervention that we introduce into the system. This will provoke a response to the system that will show us how this particular circular migration structure creates behavior over the time:

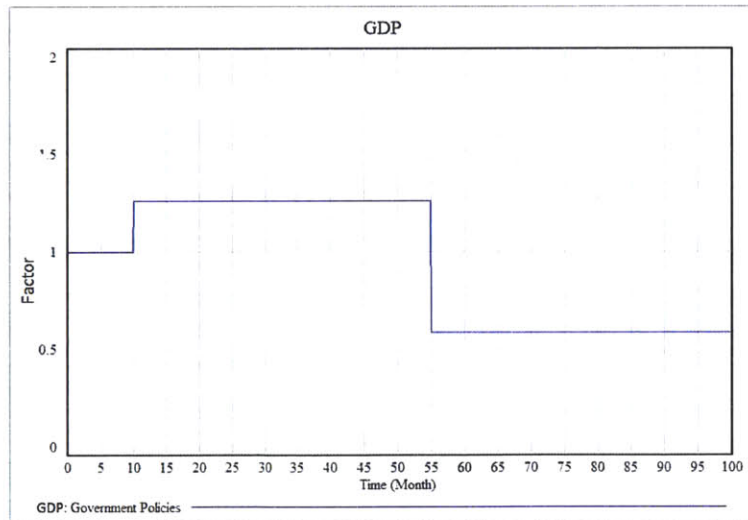


Figure 25: GDP factor in the province of Huelva

Before illustrating the result of scenario B, we show in Table 14 the number of unemployed at three points in the last decade. Table 15 shows the number of guest workers throughout the

decade. These numbers will help us understand the result of the simulation and examine how the model responds according to data.

Table 14: Unemployed in the Province of Huelva [INE, 2010]

Year	Unemployment Rate	Number of unemployed
2002	22%	53,363
2006	14%	33,495
2010	31%	75,809

Table 15: Number of guest workers [FUTEH, 2010]

Year	Number of Guest Workers
2001	600
2002	7,000
2003	12,000
2004	21,000
2005	23,000
2006	30,000
2007	33,000
2008	17,000
2009	4,800
2010	3,000

As we can see there are basically three relevant points in the data that we will consider references to analyze and evaluate our results. At the beginning of our time horizon the economy in the province of Huelva was growing, with a 22% unemployment rate. Many readers would consider this rate very high. However, in Spain and Andalusia there is structural unemployment. For example, 2006 was one the best years in history for the economy in Spain and the unemployment rate was 14%. (This is the second reference point we consider.) This is a very interesting phenomenon and some of its causes have been investigated during this research in order to avoid bias. However, the results of that particular investigation and the macroeconomic implications for the model are not presented in this thesis in order to focus on the dynamics of circular migrations programs during times of crisis.

Finally, the last important point in the last decade is 2010 when the unemployment rate increased to 30.8%, a historical record in the province of Huelva [INE, 2011].

The number of guest workers parallels the unemployment rate at those 3 points in time as we see in Table 15. However, the collapse in the number of guest workers in just two years does not match the economic crisis and the curve of the unemployment rate.

That means that in addition to the economic constraints, some policy constraints also accelerated the collapse in the number of guest workers in the province of Huelva.

In Figure 26 we observe the behavior of the system for the case in which only economic constraints are stressing the systems. In month 10 we introduce a 35% of increase in the GDP in the province of Huelva. The system reacts by increasing the number of local workers in other sectors (green line) from 70,000 to 125,000 by month 55. We have to remember at this point the two assumptions made previously based on the context of this case study and data collected:

1. An increase in the GDP produced an increase of jobs available in other sectors, and a decrease on the attractiveness of agriculture jobs to locals.
2. There are no inflows from outside of the system in term of local workers, so when the flows change there is a redistribution of local workers.

Thus, to satisfy this high demand for local workers in other sectors, local agriculture workers (red line) and unemployed (grey line) fill this labor shortfall in other sectors such as construction and tourism.

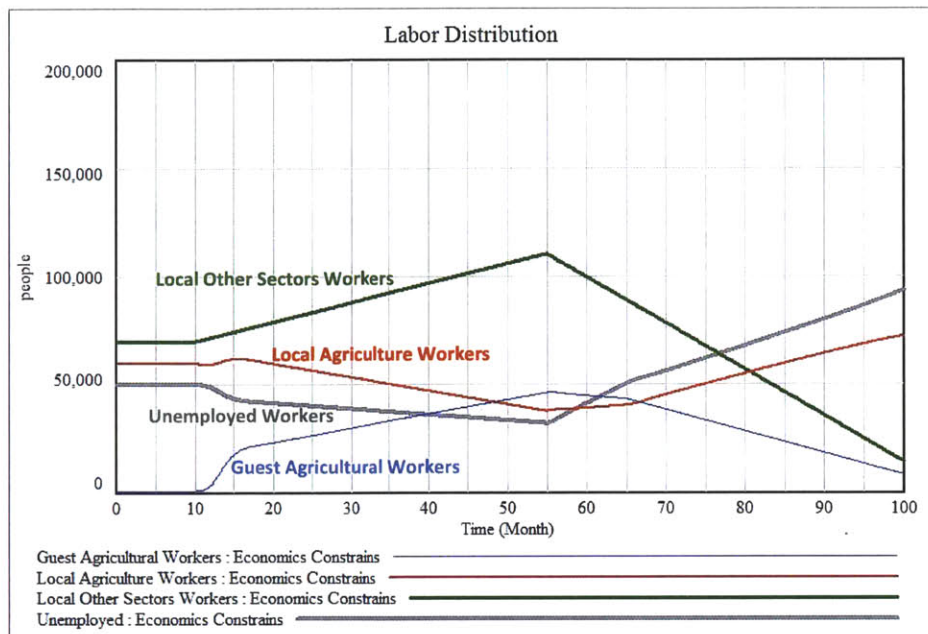


Figure 26: System response under economics constraints (2002-2011)

We can see in Figure 27 (right) several inflows/outflow to/from other sectors' stocks (level) of workers:

- *Employment Shift* as the flow coming from the agriculture sector (green line in Figure 27).
- *Recovery Rate* as the flow coming from the unemployed (red line in Figure 27).
- *Other Sectors Unemployment Rate* as the flow going toward the unemployed (blue line in Figure 27).

At the same time, as local agricultural workers change jobs, the labor shortfall in the agriculture sector increases from 0 to approximately 700 over months 10-55 (as we can see in Figure 27 left). The growing shortfall activates the *Contract in Origin Hiring* balancing loop, thus increasing the number of guest workers invited to satisfy the need for agricultural labor (blue line in Figure 26).

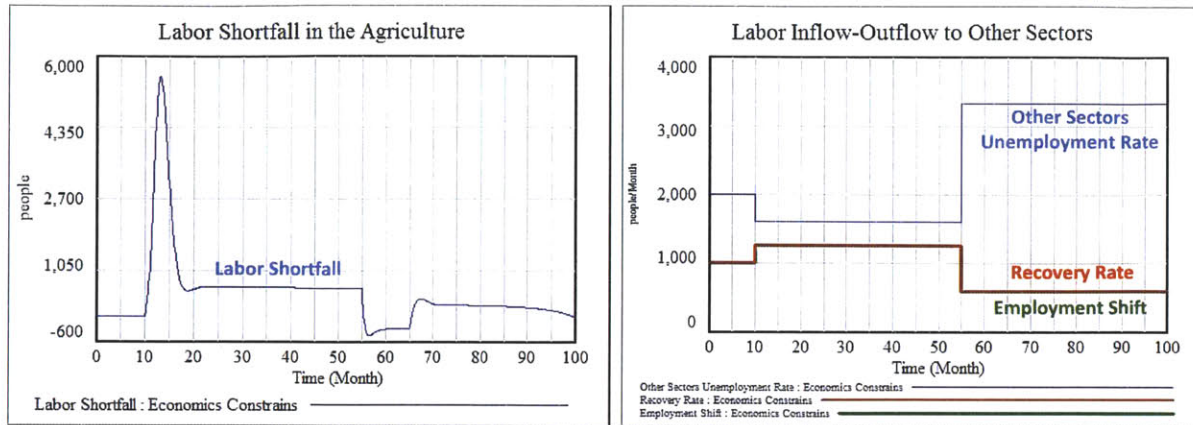


Figure 27: Effects of change in GDP on labor shortfall and other sectors flows (Scenario B)

#### 4.4.3 Scenario C: Government Policies

Scenario C illustrates the case when an economic shock is followed by government overreaction, and guest workers are taken out of the systems more rapidly. This artificial reduction in the number of guest workers creates a secondary effect as the farmers decrease the amount of crops planted in subsequent years, thus activating a reinforcing loop that will precipitate an increase in unemployment.

Based on the change in the economy (GDP factor decrease from 1.35 to 0.65 at month 55 in the model) the government decides in month 55 to assist guest workers to return home in an effort to reduce the number of unemployed by providing work for locals on farms.

Table 16: Variable that shocks the system in scenario C

Scenario	Variable	Value
C: Government Policies	Government Return Incentives	<ul style="list-style-type: none"> <li>Return rate increases 350% in month 55 due to the crisis and government incentives for returning</li> </ul>

In normal conditions, as illustrated in scenario B, the authorization of visas to guest workers decrease as a result of an increase in the number of unemployed workers. This is a very natural response of the system to regulate the number of local workers that come back to farms because of the lack of jobs in other sectors.

However, sometimes the national government overreacts during crisis situations. An increase in the number of unemployed during a crisis is normal and the circular migration program is designed to respond to this shift by decreasing the hiring of immigrants and allocating local workers. This is possible because circular migration programs are seasonal and guest workers are allowed to come to work for a maximum of 6 months. This facilitates the dynamic flow: when workers are needed more visas are provided; when they are not needed the number of visas is reduced. There is no risk of stagnation because of the highly flexible nature of the program. Because 6 months is the maximum period of stay, the system needs that much time to decrease the number of guest workers in response to the dynamics of the number of unemployed. However, from the beginning of the crisis, the government is under pressure from those citizens who find immigrant workers unnecessary.

The government decides not to wait for the natural reduction of guest workers (by the balancing loop *Effect of the Crisis in the number of Visas* in the model) and introduce a new policy that encourages foreigners (guest workers and other foreign workers) to return to their countries in exchange for some economic benefits.

This policy creates a collapse in the number of guest workers. This collapse has some benefits for 2 years as we can see in Figure 28 as the number of local workers employed (red line) increases from 40,000 to 75,000 and growth in the number of unemployed workers (grey line) slows down compared to scenario B.

Nevertheless, as we can see after month 80, when the number of guest workers reaches a minimum threshold the reinforcing loop *Effect of Crisis on Planting* is activated.



This reinforcing loop decreases the number of hectares planted; as fewer workers are needed to harvest the crop, unemployment will not only increase as jobs are lost in other sectors, but also as agricultural jobs are reduced due to smaller planned harvests. As mentioned above, farmers decided to decrease planting when the number of guest workers fell very low because they were afraid they would not have enough labor available at harvest time.

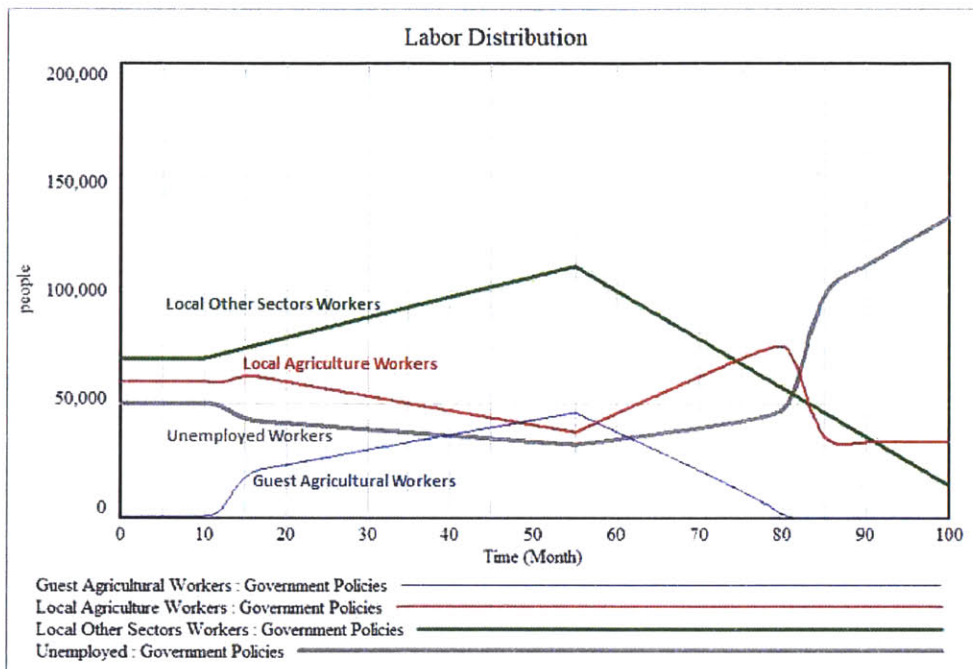


Figure 28: System response under government policies constraints

Below, in Figure 29 (left), we can see a comparative graph of the number of unemployed workers for scenarios B and C. We observe how the natural case in scenario B: Economic Constraint (red line) shows a higher number of unemployed during months 55 and 80. However, after month 80 the number is lower than in case C: Government Policies. Scenario C represents the overreaction of government to reduce foreign workers to benefit the local population as soon as possible. In addition, as we can see the unintended consequences as unemployment begins to grow uncontrollably as the policy led farmers afraid of a labor shortfall to reduce the amount of crops

planted. In Figure 29 (right) we can observe the number of local workers and how the system reacts to confound the policy after 25 months.

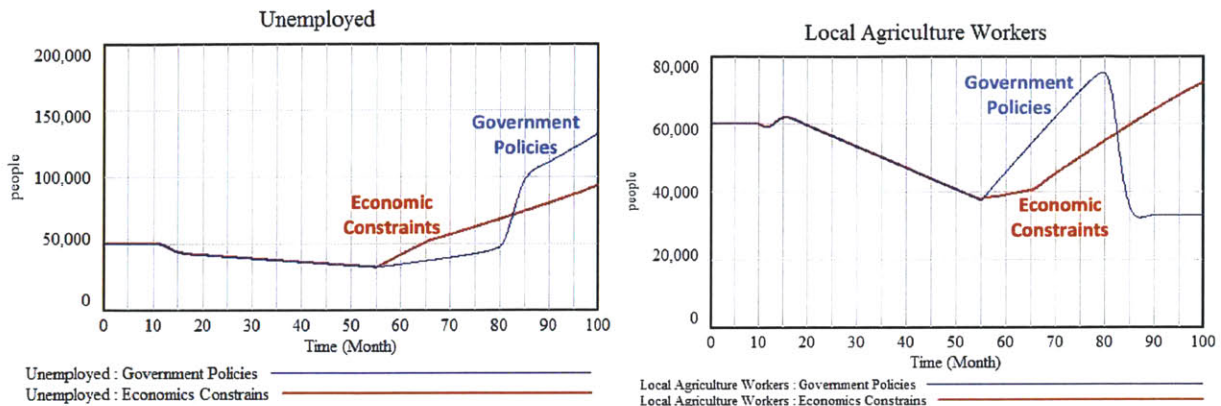


Figure 29: Unemployed workers under government policy constraint

In Figure 30 (left) we notice a decrease in the number of hectares planted as a consequence of collapse in the number of guest of guest workers. Figure 30 (right) illustrate the number of complaints from unemployed workers about guest workers. These complaints are the measured units used in this model to drive changes in the number of visas authorizations. The graph shows that the government policy delayed, but did not resolve, the problem of high unemployment, ultimately driving the number of complaints much higher and the number of guest workers lower. However, the red line shows how a moderated and more natural increase does not activate the reinforcing loop of planting.

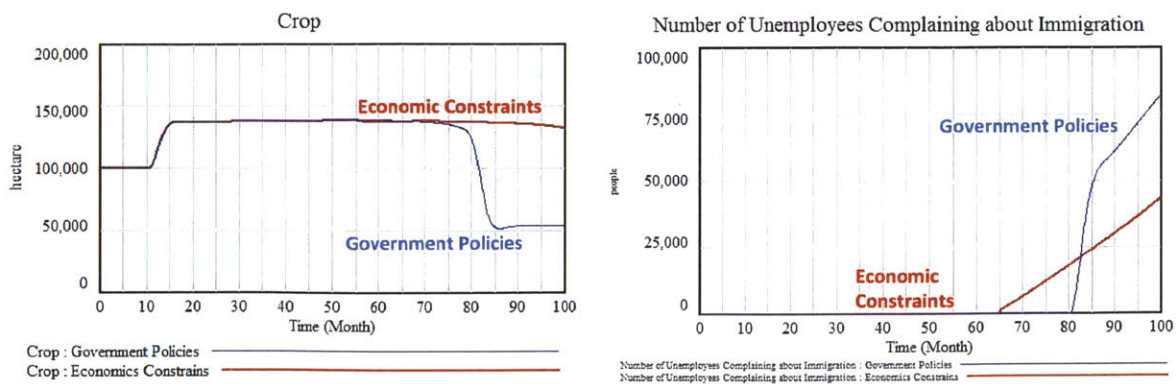


Figure 30: Crop (left) and complaints (right) under government policies constraints

Figure 31 (left) shows the Labor shortfall for scenario C, and we can appreciate that in month 80 more workers are needed but there is an exponential growth in the number of unemployed workers. In Figure 31 (right) we observe how the GDP affects the inflow and outflow in other sectors. These values are the same as in scenario B and illustrate how the system structures itself and that the policy introduced by the government is responsible for this change in the system's behavior.

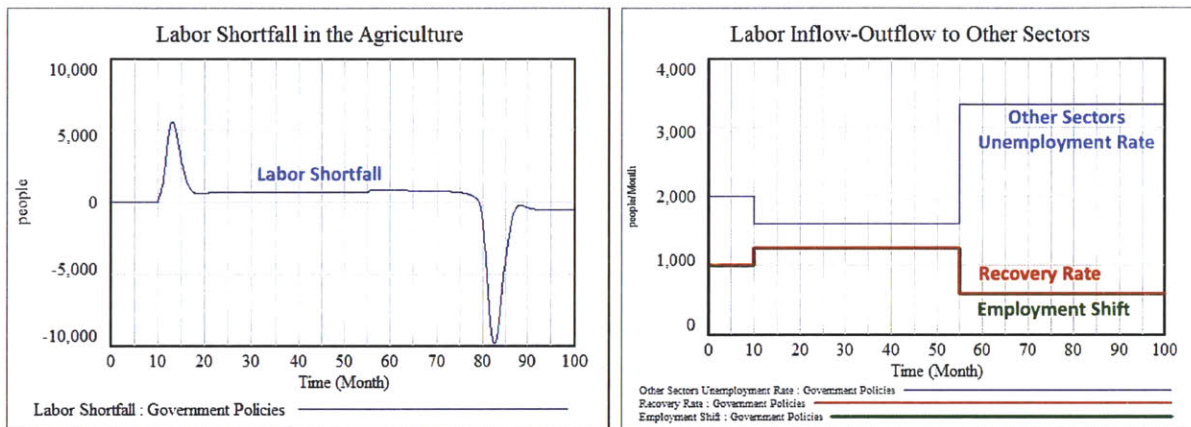


Figure 31: Effects of change in GDP on labor shortfall and other sectors flows (Scenario C)

#### 4.4.4 Scenario D: Circular migration management policies

Based on the previous scenarios, additional policies were implemented locally by the circular migration program managers in the province of Huelva. These policies increased the attractiveness of agricultural jobs among locals and reinforced the willingness of farmers to hire local workers.

Table 17: Variable that shocks the system in scenario D

Scenario	Variable	Value
D: Circular Migration Management Policies	Harvesting Jobs' Attractiveness	<ul style="list-style-type: none"> <li>Local government launches policies to increase the attractiveness of harvesting jobs among local workers from 0.5 to 3.5</li> </ul>
	Min Time per Return	<ul style="list-style-type: none"> <li>Return flow is slowed down by increasing the time that foreign workers stay in the host country</li> </ul>
	Minimum Foreign Work Permit	<ul style="list-style-type: none"> <li>Circular migration managers negotiate with central government and other stakeholders a minimum of 500 visa authorizations a month in order to keep the program working during the time of crisis</li> </ul>

By dynamically adapting these key factors during economic and government decision-making shocks, the system responds in a way described in the desired scenario D. Also by prolonging the stay of guest workers and forcing a minimum of guest worker visa authorizations a month we not only smooth out the increase in the number of unemployed, but also maintain the level of planting and thus we prevent a collapse in the number of local workers in agriculture.

In Figure 32 we can observe what happened when the circular migration program is not cancelled. The number of guest workers decreases exponentially and a minimum number of 7,000 workers (blue line) is maintained. These 7,000 foreign workers are what keeps the circular migration active (at a minimum) with two goals:

1. Responding to the desire of farmers to have guest workers, and thus give them the confidence to maintain a high level of planting, and
2. Keeping the program working and maintaining international relationships with sending countries, in order to be able to increase quotas as the economy recovers.

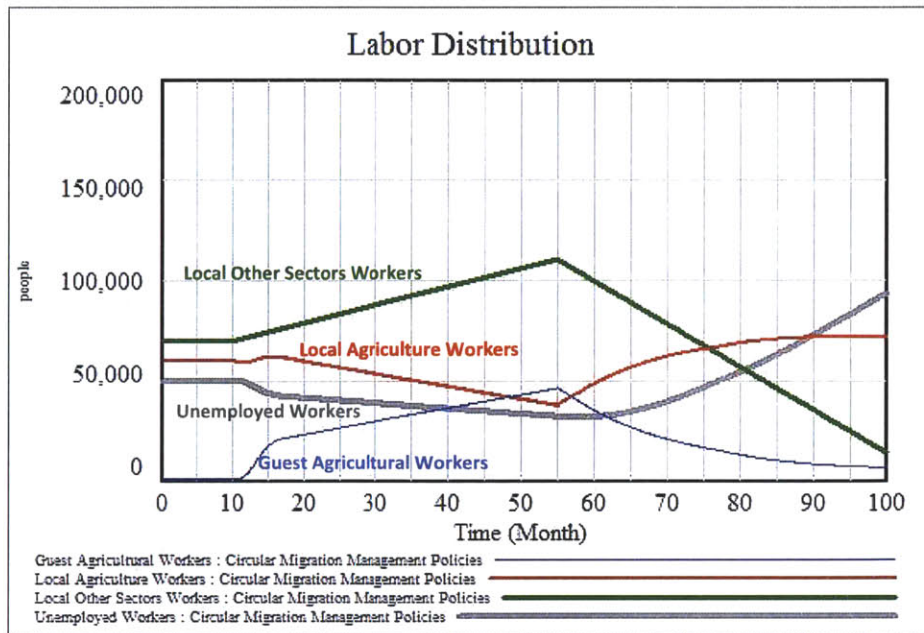


Figure 32: System behavior under Circular migration management correction policies

Also we observe in Figure 32 (red line) how the number of local workers in agriculture reached a final level of 75,000 workers. This is because the adjustments implemented by the managers of the circular migration programs create the confidence among farmers to maintain the usual level of planting as noted in Figure 33.

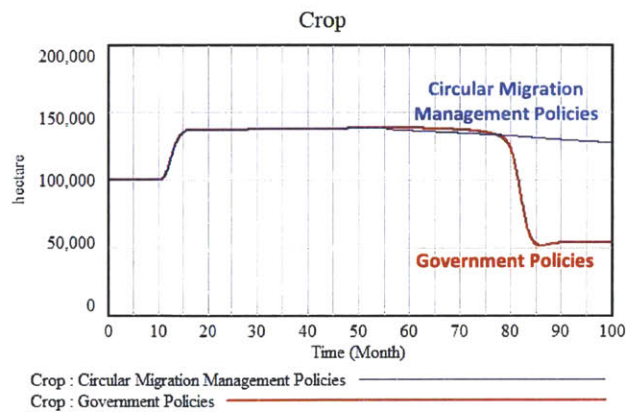


Figure 33: Farmers decided not reduce planting when a minimum number of guest workers are guaranteed

In Figure 34 (left) the blue line shows how new policy corrections prevent an abrupt increase in the number of unemployed workers. In Figure 34 (left) we see how this correction directly affects the number of local workers in the agriculture. The graphs below illustrate the comparative behavior of the same system responding to central government policies (red line), and the correction for maintenance of the management migration program (blue line).

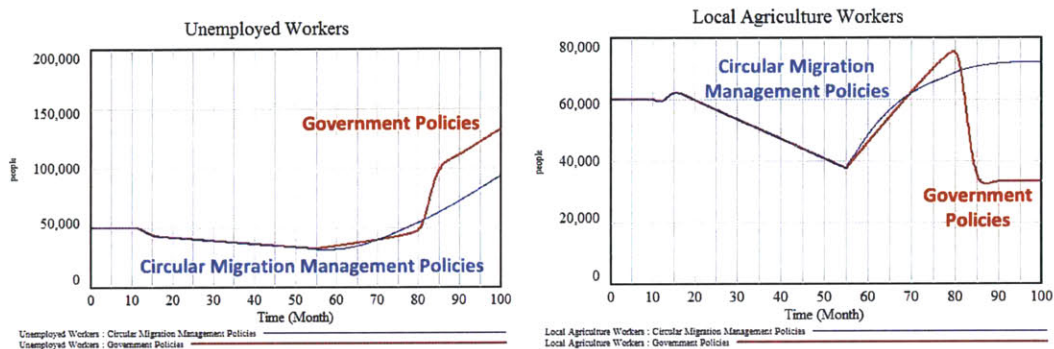


Figure 34: Number of unemployed and employed local workers after policies corrections

A summary of the four simulated scenarios, including other comparative graphs, is provided in the next chapter.

#### 4.5 Summary of the four simulated scenarios

The previous four simulated scenarios illustrate how one external factor, the economy, creates changes in a stable system. While the economy is growing, farmers look for solutions to their problems by innovating and initiating circular migration management programs. These innovations will provide them with a system able to supply labor for the harvest year after year. The system functions very well until the economy shocks the system again. In response, the system is able to return to its original status in a very natural way since two balancing loops (*Contract in Origin Hiring* and *Effect of the Crisis in the number of Visas*) are activated. An additional loop in the system (*Effect of Crisis on Planting*) is inactive even with economic constraints.

As we observed in scenario B, economic constraints activate only the *Contract in Origin Hiring* loop. As long as the number of unemployed workers increases, the number of their complaints also increases, and government starts reducing the number of visas. So far, this behavior is normal. However, the central government feels other pressures from society at large, and overreacts by reducing the guest workers more rapidly. Officials assume that this will accelerate the number of local workers able to find employment in the agriculture sector.

The model shows that such an aggressive policy can detrimentally disrupt the normal state of affairs. At that time, there were not enough unemployed workers to require a quick reduction in the guest worker stock (level) according to the condition of the balancing loop *Effect of the Crisis on the number of Visas*. Nonetheless, a national level policy was enacted to encourage guest workers to return to their countries before their planned stay periods were completed by funding their homeward trips and providing other economic benefits.

This external factor is what very quickly decreased the number of the guest workers and activated the reinforcing loop *Effect of Crisis on Planting*. Fewer crops planted reduced the total number of jobs for guest and local workers. In scenario C, when all guest workers return home, the number of jobs available to local workers in agriculture start decreasing as the number of hectares planted was reduced.

This is how a poorly thought out reaction by the government can stress the system. The system can overcome an economic change because the circular migration program was designed with that purpose in mind. However, the system cannot overcome other policies created in response to purely political stress. The result is that in trying to solve an immediate problem, the government in this peculiar case created another, bigger, one.

The focus of this research is not to provide recommendations to avoid this kind of mismanagement in other circular migration programs. Our objective is to describe what happened in the case of Huelva. At the beginning of this thesis, we mentioned that this particular implementation of a circular migration program was successful in providing a labor supply in the agriculture sector. This success is due in part to the innovation farmers made in looking for workers after experiencing a shortfall in agricultural labor. Innovative actions of managers and

local administrators of this program also contributed by implementing policies to counteract the consequences of government overreaction. This is illustrated in Scenario D in the simulations.

In Table 18 the characteristics of these four scenarios are summarized:

Table 18: Summary of the four scenarios simulated

Scenario	Key	Observations
A: Base Case	Nothing happens	<ul style="list-style-type: none"> <li>Without the introduction of shocks or other interventions the system remains stable in terms of number of workers in every stage.</li> <li>The flows between stocks (levels) also are stable allowing workers to circulate from one job to another without affecting the general behaviors of the system.</li> </ul>
B: Economic Constraints	The system is able to cope with external and natural market shock	<ul style="list-style-type: none"> <li>When the system is under economic shock by introducing steps in the GDP variable, we can see the behavior that is generated internally.</li> <li>The most significant observation is that two balancing loops keep the system under control and guest workers are introduced or taken out according to natural labor requirements.</li> <li>This is the desired scenario because it responds to labor market needs understood by all stakeholders.</li> </ul>
C: Government Policies	Government overreacts and introduces an artificial shock	<ul style="list-style-type: none"> <li>When the economic shock is followed by government overreaction, we observe that guest workers are taken out of the system faster.</li> <li>This artificial collapse of the number of guest workers creates a secondary effect in the farmers who decrease the crops planted in subsequent years activating a reinforcing loop that will precipitate the increase of unemployment.</li> </ul>
D: Circular migration Management Policies	Circular migration program managers and local administrators dynamically correct government overreaction	<ul style="list-style-type: none"> <li>Based on the previous scenarios, additional policies are implemented locally by the circular migration program managers in the province of Huelva.</li> <li>These policies increased the attractiveness of agricultural jobs to locals and reinforced the willingness of farmers to hire local workers.</li> <li>By dynamically adapting these key factors during economic and government decision shocks, the system responds in a way described in the desired scenario B.</li> </ul>

In order to better compare the four scenarios simulations results, and to understand why government reacted in this instance in a certain way, we have simulated the model one more time. In this new simulation we have increased the time horizon to 150 months<sup>22</sup>.

<sup>22</sup> The purpose of choosing 100 months for our original simulations was that we considered the data between 2002 and 2011 and we could validate the results. However, using 150 months we try to illustrate the tendency of the system in the long term until it is stabilized. This model does not try to predict the future of circular migration programs for the next 4 years since other factors come to play. Actually, the economy in 2011 is recovering and this factor is not considered.



In Figure 35 we can examine the four scenarios' results for local unemployed workers over a time period of 150 months. The most interesting observation in this graphic is how case B (Economic Constraints) and C (Government Policies) in month 112 end at the same point. The difference is that in Scenario C unemployment is much lower during the first few years of the crisis. These government policies would have been justified if economic recovery had begun before month 83. This is probably what government officials anticipated. However, because the economic crisis lasted longer, the system showed the secondary effect of such an overreaction: We see how, between month 83 and 112, unemployment rises higher than it would have if the government had not intervened.

Also, we observe in the graph how Scenario D (Circular Migration Management Policies), in which local administration and circular migration managers implement other local policies, concludes with much better results. As these officials managed to maintain a minimum quota of guest workers, increase the attractiveness of farm jobs among local workers and give farmers incentives to hire them, the number of unemployed workers in the province of Huelva increased less precipitously and by month 110, actually fell by 35,000.

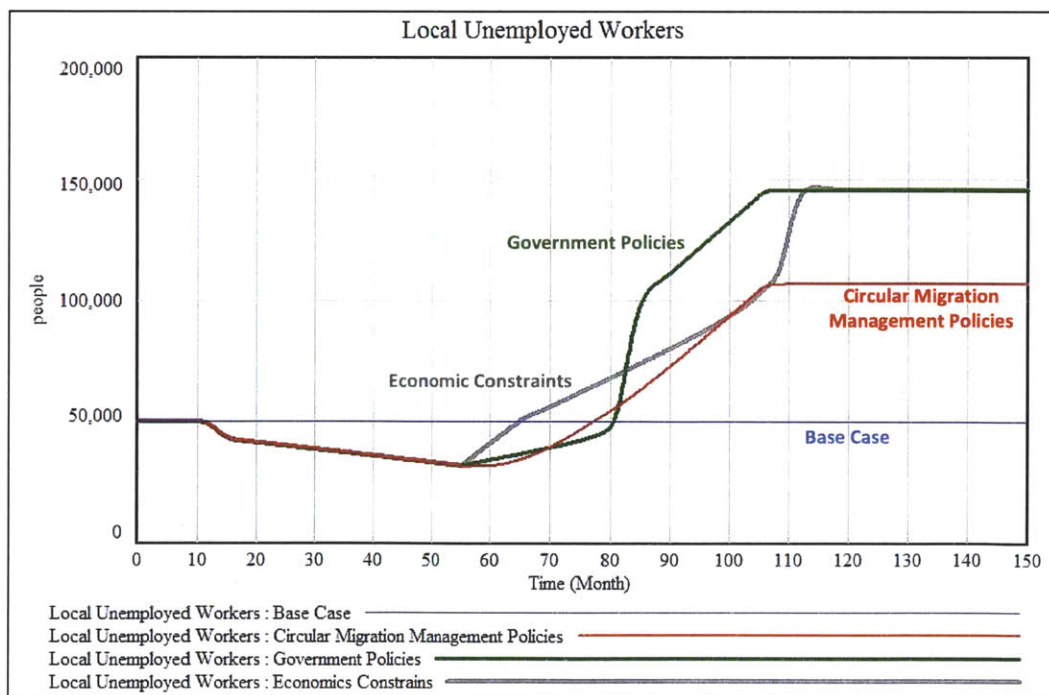


Figure 35: Local Unemployed Workers for scenarios A, B, C and D (simulation for 150 Months)

In Figure 36 (left) we observe how Scenario D (Circular Migration Management Policies) maintained a minimum level of guest workers (red line). In Figure 36 (right) we observe the effect on the level of hectares cultivated: In Scenario D (red line) the level does not decrease; in Scenario B (grey line) the crop decreases in month 110 when the number of guest workers reaches 0; and finally, in Scenario C (green line) the size of the crop planted initially decreases following the elimination of the circular migration program. (The number of guest workers reaches zero in month 83 as we can see in a summary of all scenarios and levels in Figure 37).

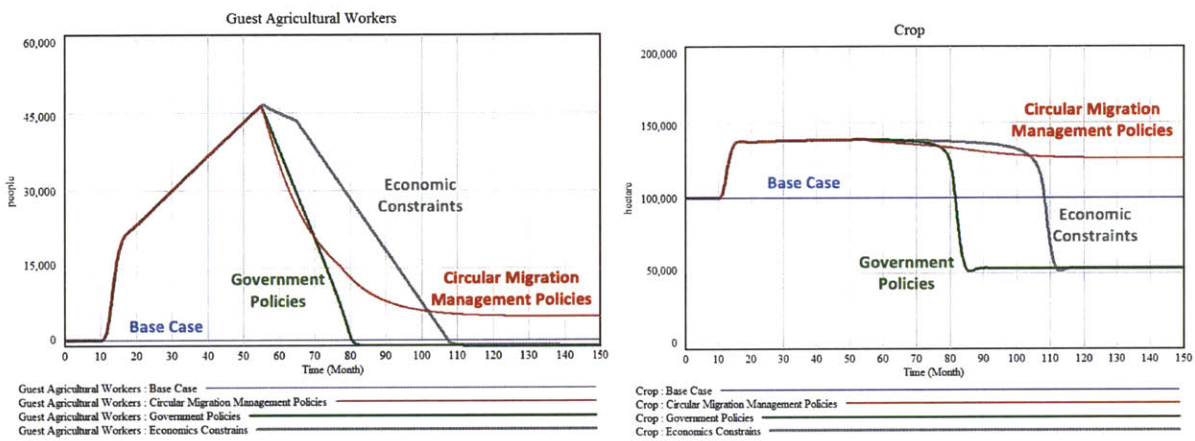


Figure 36: Guest agricultural workers (left) and planting level (right) for scenarios A, B, C and D (simulation for 150 months)

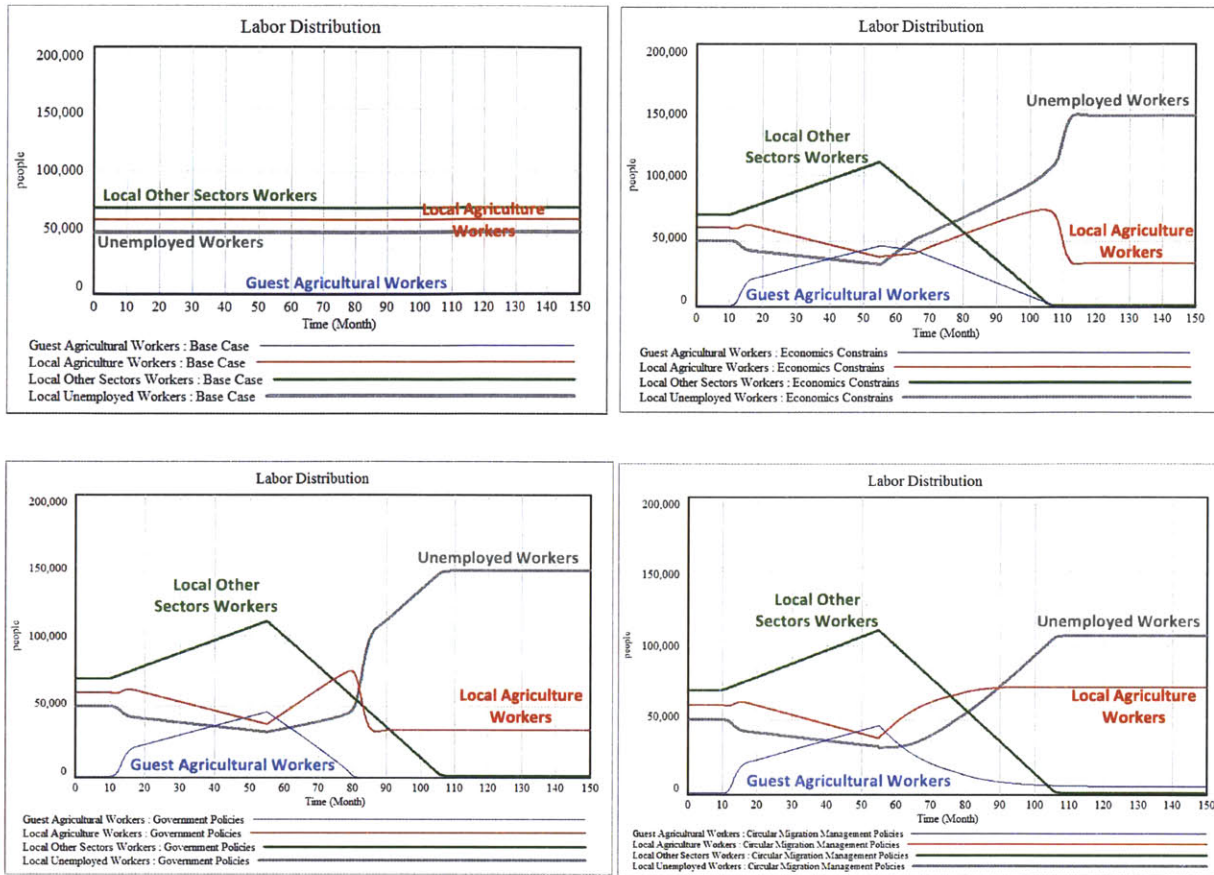


Figure 37: Scenario A (upper left), B (upper right), C (lower left) and D (lower right) for complete simulations (Time Horizon of 150 Months)

## 4.6 Model limitations

Even though the model has some limitations in terms of factors and policies implemented, and the assumptions considered in order to calibrate it, it can help policy makers to better understand the complexity of circular migrations processes. There are many factors analyzed in this thesis, but only a few of them have been included in the model. Some have been simulated in order to keep the model simple enough to illustrate its primary purpose: helping policy makers understand that overreactions during a crisis may not only fail to solve the problem, but may make it even worse.

Another limitation of the initial model is that it only described the dynamics within a single season. During the simulation of this first model, circular migration program managers in Huelva were able to compare different scenarios and decisions made by farmers and labor agencies. These various simulations provided insights about decisions made in terms of number of workers, and the logistics involved in the process of hiring in a single year. However, we decided to change the calibration of the model to focus on its dynamics during the last decade. We found the model could be more useful for policy makers on circular migration at the European Union and national government level in addition to provincial managers of the circular migration program.

#### 4.7 Chapter summary

In this chapter all the steps described in the approach have been implemented to build the model and simulate different scenarios. Based on the problem statement and dynamic hypothesis formulated in chapter 1, included drawings from reference modes and a time horizon, key variables and stakeholders were identified. Also, based on a stakeholder analysis and interviews, stocks, flows and variables were mapped establishing causality among them. Once causal loop diagrams were mapped and the nature of the loops analyzed, those which generate reinforcing or balancing behavior were identified. To augment the qualitative analysis, some equations were defined to facilitate the simulation.

The model simulated and tested four scenarios. In this part of the process, the data are introduced in the exogenous variables and stocks are initialized. Following the simulations, the model was validated by comparing the results with the reference modes in the first step. In this step, intervention policies from the national government and later adjustment by local administrators were implemented and simulated again.

## 5 DISCUSSION

The economic system has been stressed during a recent recession leading to unpredictable behaviors. When the number of unemployed increased, local administrators experimented for the very first time with the benefits of having a circular migration program. Because every year immigrants return home after the harvest, there is no risk of them staying illegally. That made possible the reduction of the number of contracts in origin and the prioritizing of farm jobs for local workers.

In Huelva we observe that even during a period of financial crisis, local unemployed workers who have unemployment benefits or at least family economic support prefer not to work on farms and to wait for employment offers in the construction and service sector. The tourism industry in the province of Huelva hires a large number of locals from mid-April until September. That creates an important problem for farmers who need to balance a labor supply restricted by a reduction in guest worker visas and a lack of commitment from local workers likely to abandon agriculture jobs in the middle of the harvest for better paid jobs in other industries. To avoid a situation in which farmers cannot hire legal immigrants nor committed local workers to finish the harvest in June, local administrators decided to guarantee a minimum number of visas to guest workers, and foster commitment from local workers. For the season of 2010-2011, 5,500 visas have been authorized according to an interview with Millán, Chairman of the Committee of Municipalities with circular migration in the province of Huelva [Millán, 2010b]. This is controversial among citizens who assume that jobs should be offered only to unemployed locals. The complexity of the behavior of the agricultural labor supply, together with policy makers' ability to negotiate with farmers, should motivate the need for a stable forecast of the number of guest worker visas in future seasons.

After observing the results and analyzing the simulations of the model, we have to emphasize the fact that government overreaction to the crisis makes the population feel that the problem is being solved because unemployment quickly stops increasing. This is deceiving because the

system responded to the policy provoking the desired immediate goal: to quickly increase local workers in agriculture and thus reduce unemployment. In fact, the structure of the system (in our model the reinforcing loop *Effect of Crisis*) contains a time delay and threshold that create a secondary effect of the policy that exacerbates the problem in the longer term.

External factors such as economic crises are things we cannot avoid. However, this type of crisis creates a natural response in the system. The only way to minimize its impact on local employment is by introducing new jobs into the system. Redistributing employment among the existing population is a short-term solution that unsettles the entire system and may cause destabilization in the long term.

Another factor that we have not considered explicitly in the model and that could provide better insights, if sufficient data are provided, is variation in cost production. Scenarios in which the wages for agriculture jobs are modified according to the labor shortfall could be simulated to analyze the cost benefits of local versus foreign workers. For the case in Huelva, according to the data collected during our interviews, wages are the same for local workers and guest workers. The wage is determined by farmer organizations at the beginning of the season and does not change during the season. Farmers said that the market is very competitive so they cannot increase wages order to make the jobs more attractive to local workers. Other social actors argue that the reason for not increasing the wages is because farmers know that they can find workers willing to do the job for less in foreign countries. In the model, wages are not included explicitly but are aggregated in the variable *Relative Attractiveness of Agricultural Jobs*.

Another concern was variation in prices for strawberries. We considered including this factor while building the model since as planting decreases, prices in the market should increase. If market prices increase one year, then the next year farmers should be more willing to plant more but also increase wages to meet the need to harvest the larger crop. This looked like very reasonable behavior given the structure of the systems.

However, we did not include the market price factor in the final model. In evaluating the information provided in several interviews we discovered that the strawberry market share was not sufficiently dominant to make a big impact on the prices. Eighty-five percent of the

strawberries produced in Huelva are sold in different foreign markets across Europe and growers must compete with an emerging strawberry production capacity in other Mediterranean countries.

Another implication of a collapse in the number of guest workers is a decrease in health care assistance in those towns who, during periods of high population, enjoy extra service hours. (Those services were especially inflated in order to increase the acceptance of an influx of foreign workers and thus avoid social conflict.) [Plan de Inmigración I, II en Andalucía, 2001, 2006].

Another negative effect of a reduction in the foreign population is a decrease in sales for local business (by reducing the number of people residing, for several months of the year, in these municipalities).

A key factor to consider during a drastic reduction of the immigrant populations is the delicacy of international relations with the sending country [Cembrero, 2010, ISELMU, 2010]. Voluntary return is being developed successfully since the receiving country commits to hiring returnees the following year. However, in 2008 the decrease in the number of visas created distrust among guest workers. Other possible consequence is the development of competing agriculture in guest-worker-sending countries. For example, Morocco has recently begun producing strawberries.

Many efforts and policies have been made to calm society and stakeholders during strong changes in the behavior of the system, and to be ready to reactivate the migration flow following economy recovery. There is a strong social awareness of the need for migrant workers, and the conviction that local workers will again abandon the fields as the crisis eases.

Three policies can make the circular migration program successful from both farmers' and policy makers' points of view: Strong collaboration among stakeholders; a well-designed housing network for guest workers provided by farmers and guaranties of return to home countries [Millán, 2010b]. This research has focused on other key factors that make the program sustainable in extreme conditions of stress: stress by economic changes (as we see in scenario B), and stress in terms of overreaction of central government applying policies with only a short-term view as we have seen in scenario C.

It is important to remember the social implications of labor recruitment and prevent the effects of possible accumulative future negative loops. We have focused on social innovation in the form of the management of circular migration, and we have considered the Huelva case to be successful from the perspective of the supply of workers—just-in-time—and by the induced effects on the economy, consumption etc. In future development of this work we must assess the importance of other social consequences of implementing circular migration.<sup>23</sup>

In this thesis we have built a model based on the dynamics of a particular implementation of a circular migration program in Southern Spain. The model illustrates how a financial crisis can stress a well-designed system and put its sustainability at risk. We have included in the model mitigation policies implemented by central government to correct behavior during difficult economic periods. Those policies are better understood using the model and provide insight about additional adjustments that local government and labor migration managers had to implement later in order to make some corrections.

The model also provides implementation guidelines for other agricultural regions for the implementation of similar labor supply management. Based on the case of Huelva and the different dynamics experienced during previous years, other governments could benefit from the analysis. Actually the model would provide an easier understanding of the factors and iterations to stakeholders seeking a solution to labor supply problems while avoiding illegal migration.

Circular migration is being fostered by the European Pact on Immigration and Asylum [EU European Pact on Immigration, 2008] to help manage legal migration and control irregular migration. However, many regions in Southern and Eastern Europe countries have not developed it yet due to its complexity. Good practice in circular migration requires the accumulation of

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<sup>23</sup> Some social actors in rural municipalities specializing in strawberries express negative ideas about the way in which the recruitment is organized: Why are farmers now only hiring women? Is this discriminatory? What about the effects of hiring only women for their countries of origin? Are they hired only for the strawberry harvest or for other unspecified work? European markets are very sensitive to racism, xenophobia, discrimination, and so on, and bad publicity (as in the case of the El Ejido in Almeria, several years before, in the same Andalusia region) [Checa, 2001] could produce accumulative negative effects, that could threaten the economy of this area, and throw the model into doubt in the future. Another point is the necessity of reinforcing the focus on integration, but adapting integration policies to fit the timing of the harvest season.



experience.<sup>24</sup> [Morrison, 2008], playing with the model can help not only countries in Europe that face agriculture labor shortfalls, but also countries in Africa that would benefit from having remittances without risk of brain drain. In the words of Millán, the Chairman of the Committee of Municipalities with circular migration in the province of Huelva [Millán, 2010b]:

*“without a methodology, they [circular migration stakeholders in other settings] would most probably need to go through the entire process that Huelva experienced during the last 20 years in order to create a well implemented circular migration program.”*

Our research highlights the importance of international cooperation between source and host countries. Past experiences in circular migration in Southern and Eastern European countries [Fargues, 2008] show that circular migration is a tool serving not only host countries. The collaboration between the EU and employment offices in source countries is what makes the program successful. In the case of Huelva, previous experience with Senegal demonstrated this. Corruption in the Senegalese employment office to benefit only certain citizens has made this implementation fail.

However, the case of Morocco is an example of how a receiving country can help origin country administrators improve their systems. As a result of its partnership with Huelva, ANAPEC has experienced fast growth and professionalism<sup>25</sup> [EuropeAid, 2008]. This example was followed in the creation of four additional regional agencies focusing on opportunities for guests in Europe (job offers from European employers received and processed and the pre-selection of potential candidates). A comprehensive partnership with non-EU countries of origin and well-organized transit is necessary to encourage synergy between migration and development, and in the long run avoid brain drain.

Finally, the voluntary return of migrants is fundamental for the success and sustainability of the program. During the season of 2010 in Huelva, 87% of guest workers returned to their home countries after the harvest season [Millán, 2010a]. To these three main factors we also have to mention the important coordination between FUTEH and the Andalusia Employment Service

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<sup>24</sup> Learning by doing is also a dynamic process [Morrison, 2008].

<sup>25</sup> Recently ANAPEC has been considered an example of an effective employment agency in other countries in Africa.

(SAE). A circular migration program could not be successful or efficient in supplying labor supply unless a management association such as FUTEH coordinated all activities among the stakeholders.

As part of the program, a mobility management service should focus on the logistics of labor population mobility. Transportation and visa processing play important roles that require coordination with the Spanish consulate in Tangier and police authorities in Algeciras in order to facilitate the movement of a large number of people. One of the issues that concern the countries of origin governments is brain drain. To avoid the loss of skilled workers, ANAPEC and FUTEH work together during the pre-selection of the workers.

As we indicated before, immigration is intimately linked to economic trends between regions of the world. At the same time, global economic factors shape different regions and industries [Kim, 2001]. For that reason, another factor we can see in our study is the character of co-development, where in the case of Huelva, many of the workers gained enough skills to have the opportunity, at least in some cases, to start their own businesses once they return to their countries of origin. The remittance, together with the opportunity to gain exposure to innovative agriculture and additional educational programs, give guest workers an opportunity for personal development.

## 6 CONCLUSIONS AND FUTURE RESEARCH

### 6.1 Conclusions

This thesis provides an explicit characterization of a particular circular migration program in Southern Europe. Specific insights about the counterintuitive consequences of certain governmental interventions are illustrated for policy makers. This thesis has used a multidisciplinary approach in research by combining extensive analysis of literature, on-site interviews with stakeholders and strong collaboration with experts in sociology at the University of Huelva. By building a system dynamics model and simulating several scenarios this thesis can be utilized by governments and other social actors, local administrators and circular migration managers to reveal the complexity of circular migration and its counterintuitively beneficial role in economic recovery; in fact, it helps stabilize the labor supply in times of high uncertainty. To describe circular migration programs and answer the research question this thesis has achieved the following objectives:

- **Identifying the key factors in a circular migration program:**

The key factors that characterize the system are the relative attractiveness of agriculture jobs, farmers' willingness to plant, and local administrative adjustments such as a minimum quota of guest workers and period of stay. The scenarios simulated showed how these factors affect labor shortfalls even in financial crisis periods. Also, government overreaction to economic turbulence by reducing the number of visas and fostering return is a central point of discussion in this research because these actions may put the sustainability of the system at risk.

- **Illustrating a case of study of circular migration in Southern Europe:**

This research described the transition of labor in the province of Huelva in the agriculture sector in recent decades. It has undergone various phases: from

Spanish nationals to foreign men, from Moroccan men to Eastern European women, and from Eastern European women to African women. All three phases occurred within a period of approximately 20-30 years.

Subsequently, social conflicts started when an economic crisis increased unemployment in Huelva. At that time, interventions by government forced one extra phase of replacement: African women committed to finishing the harvest by Spanish workers who considered agricultural jobs to be unattractive. The crisis showed that, beyond socio-cultural discourses, the priority was the harvest, regardless of who was going to pick the fruit and provided that production continued to be profitable to employers.

- **Analyzing the conditions that make circular migration successful during an economic crisis in terms of consistency of labor supply**

After analyzing stakeholders and simulating different scenarios we have demonstrated how economic forces and over-aggressive policies can disrupt the normal state of affairs detrimentally.

Economic growth/recession stresses the system which responds as planned by increasing/decreasing the number of guest workers. However, as we have seen during the simulations, government interventions that try to decelerate local unemployment during crisis time may force the system to respond with more unemployment.

Also, the model shows clearly, under certain documented assumptions, local administration and circular migration managers in the province of Huelva implemented policies that enabled them to overcome economic and political stress.

- **Assess the dynamics of circular migration and policies in the province of Huelva**

Finally, the result of the simulation and discussion offer an interesting reference for policy makers and can serve as a guide for further implementation in other regions in Europe. Different policies applied during the last 20 years show the experience of this pioneering program in Europe continues to improve and be adapted in other countries.

This thesis does not recommend policies. It reports descriptive research in which the case of study of the province of Huelva contains sufficient elements and material to illustrate possible recommendations. This research demonstrates how good practices of circular migration serve as a tool not only to provide workers to farms, or prevent illegal immigration, but also, function as a strategic resource to prevent high unemployment during crisis periods, and unintended consequences of over-aggressive policy interventions.

The circular migration program implemented in Huelva served as an example of social innovation that was driven by multi-stakeholder collaboration to match the labor demand to the labor supply in the agriculture sector. It effectively evolved from labor supply from local workers, then shifted to Eastern Europeans, Africans, men and women and then circled back to the local labor supply. The model facilitated the simulation of scenarios that illustrate how adaptive policies can enable macroeconomic equilibrium in environments in which circular migration can be implemented.

Due to the complexity of the system and the limitations of the model further research is needed in this emerging field. Below we propose implications for future research.

## 6.2 Future Work

One future project that could follow this thesis could be a continuing investigation of the management of the logistics of a circular migration program for a specific season: A focus on a single season could be simulated and complemented using value-stream mapping to illustrate the

complexity of the process and to show how certain delays and processes affect the harvest and decision making in labor management.

Another research question could be how a decrease in the number of hectares planted affects the number of indirect jobs created by the agriculture sector. As mentioned above, guest workers are hired for the harvest, but agricultural activity involves other indirect jobs. The model is prepared to connect those variables that allow analysis of the behavior of other sector jobs and their implications on the overall unemployment rate.

In addition, an important aspect to consider when developing a circular migration program is the availability of housing during the harvest season. In previous years some immigrants decided to invest in the purchase of a house and create settlements. Now, the managing office of the program requires farmers to provide good housing to guest workers who apply to perform this type of labor.

Finally, the model built for this thesis could be improved to include factors related to the social integration of the workers and how that affects populations in both host and home countries.

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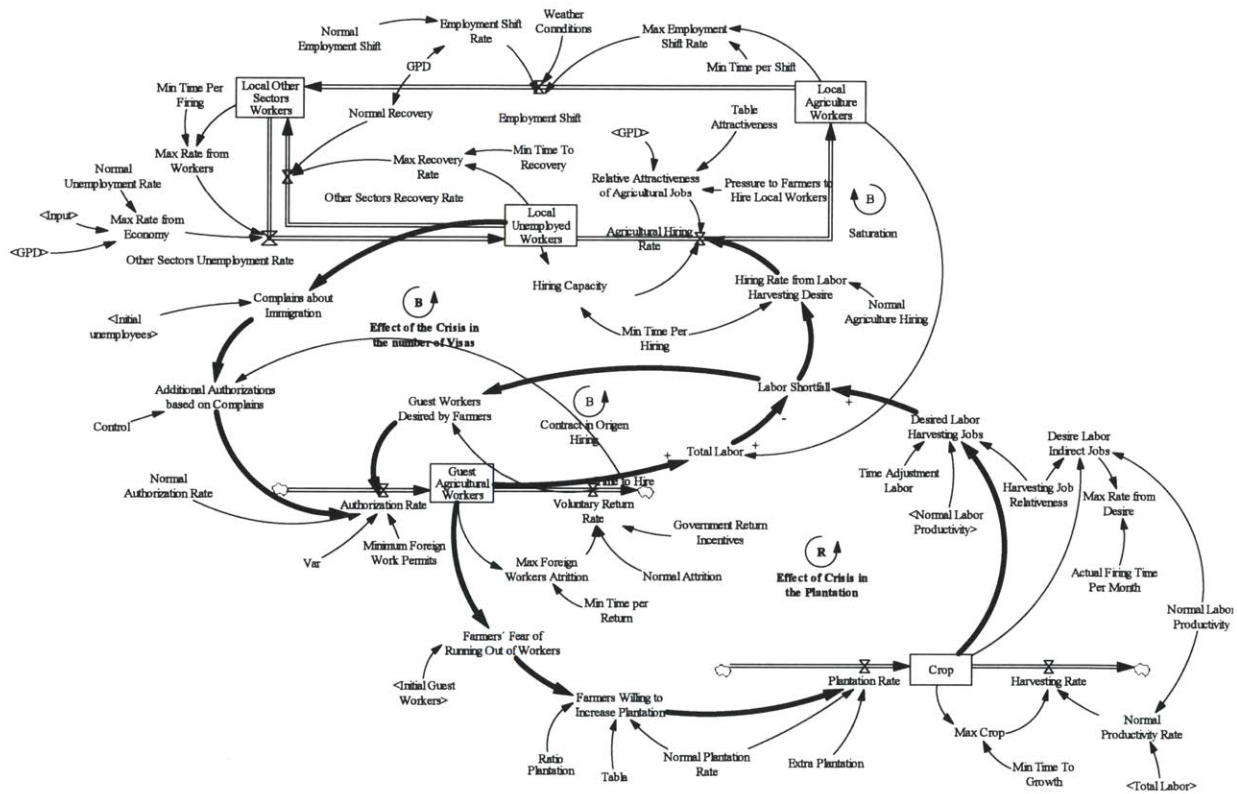
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## APPENDIX

### Model



### Model documentation

Actual Firing Time Per Month=

1

Units: Month

Additional Authorizations based on Complains=

-Complains about Immigration/Time to Hire\*Control

Units: people/Month

Number of visas authorized by the central government based on the number of complains filed by the unemployed population

**Agricultural Hiring Rate=**  
 $\text{MIN}(\text{Hiring Rate from Labor Harvesting Desire} * \text{Relative Attractiveness of Agricultural Jobs}, \text{Hiring Capacity})$   
 Units: people/Month  
 Rate of hiring local unemployed workers in the agriculture industry

**Authorization Rate=**  
 $\text{MAX}((\text{Normal Authorization Rate} + \text{Additional Authorizations based on Complains} + \text{Guest Workers Desired by Farmers}) * \text{Var}, 0) + \text{Minimum Foreign Work Permits}$   
 Units: people/Month  
 Spanish governmental instrument designed to recruit non-EU originating agricultural workers

**Complains about Immigration=**  
 $\text{MAX}(\text{Local Unemployed Workers} - \text{Initial unemployees}, 0)$   
 Units: people  
 Number of unemployed workers complaining about immigration based on the difference between reference points before the economic growth

**Control=**  
 1  
 Units: Dmnl [0,2,0.1]

**Crop= INTEG (**  
 $\text{Plantation Rate} - \text{Harvesting Rate}, 100000)$   
 Units: hectare  
 Number of hectares planted

**Desire Labor Indirect Jobs=**  
 $\text{Crop} / \text{Normal Labor Productivity} * (1 - \text{Harvesting Job Relativeness}) / \text{Min Time To Growth}$   
 Units: people

**Desired Labor Harvesting Jobs=**  
 $(\text{Crop} / \text{Normal Labor Productivity} * \text{Harvesting Job Relativeness} / \text{Time Adjustment Labor})$   
 Units: people  
 Number of workers needed for the harvest based on productivity and number of hectares planted

**Employment Shift=**  
 $\text{MIN}(\text{Employment Shift Rate}, \text{Max Employment Shift Rate} * \text{Weather Connditions})$   
 Units: people/Month  
 Rate of attrition in the agriculture industry by local workers that found another job in other sectors such as tourism or construction

**Employment Shift Rate=**

Normal Employment Shift\*GPD  
Units: people/Month

Extra Plantation=  
 $20000 * PULSE(60, 1) * 0$   
Units: hectare/Month

Farmers Willing to Increase Plantation=  
 $Ratio\ Plantation * Normal\ Plantation\ Rate * Tabla(Farmers' \ Fear\ of\ Running\ Out\ of\ Workers)$   
)  
Units: hectare/Month

Farmers' Fear of Running Out of Workers=  
 $ZIDZ( (Guest\ Agricultural\ Workers - Initial\ Guest\ Workers) , (Guest\ Agricultural\ Workers + Initial\ Guest\ Workers) )$   
Units: Dmnl [0,2]  
Number of farmers willing to decrease planting next year as a consequence of the perception that without enough guest workers the harvesting will not be done

Government Return Incentives=  
 $1 + STEP(2.5, 55) * 0$   
Units: Dmnl  
The government incentivizes the voluntary return of foreign workers in order to give priority for agriculture jobs to local workers and reduce the toll on social services designed for Spanish citizens

GPD=  
 $1 + STEP(0.25, 10) * 0 - STEP(0.65, 55) * 0$   
Units: Dmnl [0,2,0.01]  
Gross Domestic Product as a measure of the financial crisis.  
This factor in the base case is 1. When the crisis start in Spain in month 10 has value 1.25. Then in month 55 the absolute value is 0.6

Guest Agricultural Workers= INTEG ( Authorization Rate-Voluntary Return Rate, Initial Guest Workers)  
Units: people  
Number of guest workers available and ready to travel from their country of origin to Spain

Guest Workers Desired by Farmers=  
Labor Shortfall/Time to Hire  
Units: people/Month  
Number of foreign workers demanded by farmers based on the labor shortfall

Harvesting Job Relativeness=  
1  
Units: Dmnl [0,1,0.1]



Harvesting Rate=  
MIN(Normal Productivity Rate,Max Crop)  
Units: hectare/Month  
Rate of harvesting based on the availability of total  
agriculture labor

Hiring Capacity=  
Local Unemployed Workers/Min Time Per Hiring  
Units: people/Month

Hiring Rate from Labor Harvesting Desire=  
(Labor Shortfall/Min Time Per Hiring)+Normal Agriculture Hiring  
Units: people/Month

Initial Agriculture Workers=  
60000  
Units: people

Initial Guest Workers=  
1000  
Units: people

Initial Local Other Sectors Workers=  
70000  
Units: people

Initial unemployees=  
50000  
Units: people [0,60000,1000]

Input=  
1+STEP(Step Height 0,Step Time 0)+  
(Pulse Quantity 0/TIME STEP)\*PULSE(Pulse Time 0,TIME STEP)+  
RAMP(Ramp Slope 0,Ramp Start Time 0,Ramp End Time 0)+  
Sine Amplitude 0\*SIN(2\*3.14159\*Time/Sine Period 0)+  
STEP(1,Noise Start Time 0)\*Pink Noise 0  
Units: Dimensionless  
Input is a dimensionless variable which provides a variety of  
test input patterns, including a step, pulse, sine wave, and  
random noise.

Labor Shortfall=  
Desired Labor Harvesting Jobs-Total Labor  
Units: people  
Agricultural labor shortfall based on the total number of  
workers (includes local agricultural workers and guest workers)

Local Agriculture Workers= INTEG (  
Agricultural Hiring Rate-Employment Shift,  
Initial Agriculture Workers)  
Units: people  
Number total of workers (local and guest) hired by farmers

Local Other Sectors Workers= INTEG (  
Employment Shift+Other Sectors Recovery Rate-Other Sectors Unemployment Rate  
,  
Initial Local Other Sectors Workers)

Units: people

Number of local workers hired in service/construction sectors

Local Unemployed Workers= INTEG (  
Other Sectors Unemployment Rate-Agricultural Hiring Rate-Other Sectors Recovery Rate  
,  
Initial unemployees)

Units: people

Number of local workers registered as unemployed

Max Crop=  
Crop/Min Time To Growth

Units: hectare/Month

Max Employment Shift Rate=  
Local Agriculture Workers/Min Time per Shift

Units: people/Month

Max Foreign Workers Attrition=  
Guest Agricultural Workers/Min Time per Return

Units: people/Month

Max Rate from Desire=  
Desire Labor Indirect Jobs/Actual Firing Time Per Month

Units: people/Month

Max Rate from Economy=  
MAX(Normal Unemployment Rate\*Input\*1/GPD,0)

Units: people/Month

Max Rate from Workers=  
Local Other Sectors Workers/Min Time Per Firing

Units: people/Month

Max Recovery Rate=  
Local Unemployed Workers/Min Time To Recovery

Units: people/Month

Min Time Per Firing=  
1

Units: Month

Min Time Per Hiring=  
1

Units: Month

Min Time per Return=  
1+10\*STEP(1,55)\*0

Units: Month

Minimum length of duration of stay in the host country by guest workers

Min Time per Shift=  
1

Units: Month

Min Time To Growth=  
1

Units: Month

Min Time To Recovery=  
1

Units: Month

Minimum Foreign Work Permits=  
 $500 * \text{STEP}(1,55) * 0$

Units: people/Month

Minimum number of visas guaranteed for foreign workers  
independent of the number of complaints filed by unemployed

Normal Agriculture Hiring=  
1000

Units: people/Month

Normal Attrition=  
 $1000 + \text{STEP}(5000, 65) * 0$

Units: people/Month

Normal Authorization Rate=  
1000

Units: people/Month

Normal Employment Shift=  
1000

Units: people/Month

Normal Labor Productivity=  
1

Units: hectare/people/Month

Normal Plantation Rate=  
 $1 * 61000$

Units: hectare/Month

$1.23125 * 60000$

Normal Productivity Rate=  
Total Labor \* Normal Labor Productivity

Units: hectare/Month

Normal Recovery=  
 $1000 * \text{GPD}$

Units: people/Month

Normal Unemployment Rate=  
2000

Units: people/Month

Other Sectors Recovery Rate=  
MIN(Max Recovery Rate,Normal Recovery)

Units: people/Month

Rate of hiring of local employed workers in service/construction  
sectors

Other Sectors Unemployment Rate=  
MIN(Max Rate from Economy,Max Rate from Workers)

Units: people/Month

Rate of unemployment in the service and construction sectors

Plantation Rate=  
Normal Plantation Rate+Extra Plantation+Farmers Willing to Increase Plantation

Units: hectare/Month

Number of hectares planted every month based on a reference  
plantation rate plus an additional rate determined by the  
willing for farmers to increase or reduce it

Pressure to Farmers to Hire Local Workers=  
 $1-0.3*\text{STEP}(1,10)*0+1.3*\text{STEP}(1,55)*0$

Units: Dmnl [0,2,0.1]

Effort spent in convincing farmers to hire local workers instead  
of guest workers. Part of this effort relies on increasing wages  
and incentives

Rate=  
Wages Differences/Time Ad

Units: 1/Month

Ratio Plantation=  
4

Units: Dmnl [0,5,0.1]

Relative Attractiveness of Agricultural Jobs=  
Table Attractiveness(GPD)\*Pressure to Farmers to Hire Local Workers

Units: Dmnl [0,1,0.01]

Attractiveness of agriculture jobs among local population  
relative to jobs in the service and construction sector. Other  
variables such as wages and difficulty are aggregated here

Tablea(  
 $\{(-1,-1)-(-1,1),(-0.969419,-0.622807)\},(-0.993884,-0.114035),(0,0),(0.987768$   
 $,0.0964912)$ )

Units: Dmnl

Table Attractiveness(  
 $\{(0,0)-(2,2)\},(0,1.99123),(0.507645,1.95614),(1,1),(1.49847,0.0701754),(1.99388$   
 $,0.0175439)$ )

Units: \*\*undefined\*\*

Time Ad=

1

Units: Month

Time Adjustment Labor=

100000/61000

Units: Month

Time to Hire=

1

Units: Month

Total Labor=

Guest Agricultural Workers+Local Agriculture Workers

Units: people

Var=

1

Units: Dmnl [1,100,1]

99\*PULSE(0,65)

Voluntary Return Rate=

MIN(Max Foreign Workers Attrition,Normal Attrition\*Government Return Incentives

)

Units: people/Month

Workers contracted in origin must return to their home country  
once the harvesting is done

Wages Differences=

Local Wages-Immigrant Wages

Units: Dmnl

Weather Connditions=

1

Units: Dmnl