

# Exploring the Underground Economy through System Dynamics to support Public Decision

Makers: *a preliminary qualitative analysis* <sup>[\*]</sup>

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## Abstract

To estimate and analyse the underground economy phenomenon, different methods and approaches have been provided in literature. However, such approaches are very often based on static and linear equilibrium models and seldom adopt simulation tools. This paper results from a research project conducted in the Sicily Region (Italy) aimed at investigating – through the System Dynamics methodology – main causes-and-effects relationships underlying the phenomenon of the “hidden workers” at both firm and self-employment level. By combining *micro* and *macro-analysis*, the authors present a preliminary causal loop diagram of the investigated phenomenon. Such feedback structure has been built through the support of managers and representatives of private and public organisations.

## Key-words

Underground economy, irregular workers, public policies, unintended consequences.

## 1. Introduction

In the last decades, in order to generate resources to finance the economic development policies many countries started to pay more and more attention towards the underground economy. In fact, it has been detected that such phenomenon represents a relevant percentage of the national Gross Domestic Product (GDP). According to researches conducted in the area of the OECD (Organisation for Economic Co-operation and Development) countries (Schneider, 2005), the average size of the shadow economy is around 16,4% of the national GDP. It is worth remarking that such a percentage varies from 9,5% to 28,3%. This phenomenon is also relevant in USA, where such rate is about 8,6% of the GDP (Schneider, 2005).

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OECD-Countries	Size of the Shadow Economy (in % of GDP) using the Currency Demand and DYMMIC Method					
	Average 1989/90	Average 1994/95	Average 1997/98	Average 1999/2000	Average 2001/2002 <sup>1)</sup>	Average 2002/2003 <sup>1)</sup>
1. Australia	10.1	13.5	14.0	14.3	14.1	13.8
2. Belgium	19.3	21.5	22.5	22.2	22.0	21.5
3. Canada	12.8	14.8	16.2	16.0	15.8	15.4
4. Denmark	10.8	17.8	18.3	18.0	17.9	17.5
5. Germany	11.8	13.5	14.9	16.0	16.3	16.8
6. Finland	13.4	18.2	18.9	18.1	18.0	17.6
7. France	9.0	14.5	14.9	15.2	15.0	14.8
8. Greece	22.6	28.6	29.0	28.7	28.5	28.3
9. Great Britain	9.6	12.5	13.0	12.7	12.5	12.3
10. Ireland	11.0	15.4	16.2	15.9	15.7	15.5
11. Italy	22.8	26.0	27.3	27.1	27.0	26.2
12. Japan	8.8	10.6	11.1	11.2	11.1	11.0
13. Netherlands	11.9	13.7	13.5	13.1	13.0	12.8
14. New Zealand <sup>2)</sup>	9.2	11.3	11.9	12.8	12.6	12.4
15. Norway	14.8	18.2	19.6	19.1	19.0	18.7
16. Austria	6.9	8.6	9.0	9.8	10.6	10.8
17. Portugal	15.9	22.1	23.1	22.7	22.5	22.3
18. Sweden	15.8	19.5	19.9	19.2	19.1	18.7
19. Switzerland	6.7	7.8	8.1	8.6	9.4	9.5
20. Spain <sup>3)</sup>	16.1	22.4	23.1	22.7	22.5	22.3
21. USA	6.7	8.8	8.9	8.7	8.7	8.6
Unweighted Average over 21 OECD countries	13.2	15.7	16.7	16.8	16.7	16.4

**Figure 1 - The Size of the Shadow Economy in OECD Countries<sup>1</sup>**

Many countries are oriented to repress and struggle the underground economy phenomenon, as by reducing its size, governments can collect a higher amount of taxes and, as a consequence, increase the amount of resources to fuel economic growth and to increase the welfare state.

To estimate and analyse the underground economy phenomenon, different methods and approaches have been provided in literature. Very often such methods assess the underground economy as share of the official GDP. It has been also shown that raising tax rates too high can drive firms into the underground economy. In order to cope with such unintended consequence, several alternatives have been suggested by researches: tax reform, deburocratisations, liberalisations, credit policies and, among the others, development economic policies. However, such approaches are very often based on static and linear equilibrium models and seldom adopt simulation tools.

This paper is based on a research project conducted in Italy (and, in particular, in the Sicilian Region) aimed to investigate through the lens of the System Dynamics methodology the main causes-and-effects relationships underlying the “irregular workers” phenomenon, at both firm and

<sup>1</sup> The table reported in Figure 1 is taken from Schneider (2005).

self-employment level. The aim of this project is to build a simulation model to support public decision makers in experimenting the effectiveness of different policies to counterbalance this phenomenon.

In the first part of the paper, the definition of the underground economy is provided. Main public policies adopted to repress and struggle this phenomenon are commented. Some references related to the Sicilian environment are given.

In the second part of the paper, research project phases and the methodology adopted are described. Finally, a preliminary feedback analysis underlying the investigated phenomenon is portrayed. Conclusions and further researches are also outlined.

## 2. Defining the Underground Economy

The study of the underground economy encounters several difficulties, not only in measuring the right size of the phenomenon, but also in defining the meaning of such a concept. Van Eck (1987) identified about 30 different terms that are used as synonymous for, or are closely related to, the underground economy. Among this terms, it is possible to recognise:

Alternate	Counter	Marginal	Peripheral	Twilight
Autonomous	Dual	Moonlight	Secondary	Unexposed
Black	Grey	Occult	Shadow	Unofficial
Cash	Hidden	Other	Submerged	Untaxed
Clandestine	Invisible	Parallel	Subterranean	Underwater
Concealed	Irregular			

**Table 1 – Synonymous for Underground Economy**

(Source: Van Eck (1987) mentioned in OECD (2002))

The terms reported in table 1, can have different meanings. For instance, one can hypothesise that concealed economy has the same meaning as hidden economy, or shadow economy, but this would be pure speculation that may confuse, both the academic community and also decision makers. There is no way of knowing what any of the terms might mean in any particular document unless the authors have included definitions (OECD (2002)).

The definition of underground economy adopted in this study is based on the conceptual framework provided by the System of National Accounts (SNA) that sets the international statistical standard for the measurement of the market economy.

The 1993 SNA (Para 6.34) asserts that “Certain activities may be both productive in an economic sense and also quite legal (provided certain standards or regulations are complied with) but deliberately concealed from public authorities for the following kinds of reasons:

- a) to avoid the payment of income, value added or other taxes;
- b) to avoid the payment of social security contributions;

- c) to avoid having to meet certain legal standards such as minimum wages, maximum hours, safety or health standards, etc.;
- d) to avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms.”

It also affirms that “Producers engaged in this type of production may be described as belonging to the ‘underground economy’”.

Some examples of activities belonging to the *underground economy* are where enterprises choose not to declare part or all of their income in order to avoid direct or indirect taxation; or choose not to respect employment regulations or immigration laws by hiring labour “off the books”, or decide to operate unofficially in order to avoid long and costly bureaucratic procedures, or where self employed workers declare fraudulently that they are unemployed in order to draw unemployment benefits. SNA (1993) also emphasises that the borderline between underground and illegal production is not entirely clear. “For example production that does not comply with certain safety, health or other standards could be described as illegal. Similarly, the evasion of taxes is itself usually a criminal offence.”

Two observations help to clarify the boundary. First, the lack of administrative authorisation alone is not sufficient to define an activity as illegal. Second, a distinction can be made between the various kinds of activities that break the law. On the one hand, illegality in a strict sense refers to acts violating the penal code. This kind of illegality is typical of illegal activities defined by the 1993 SNA. On the other hand, illegality in a broad sense refers to all other activities that break the law, in particular violation of rules and standards concerning taxes, social security/pension contributions, minimum wages, maximum hours, safety or health standards, etc. So the rule of thumb is that underground activities according to the 1993 SNA are those not complying with administrative rules, whereas illegal activities are associated with criminal behaviour.

### **3.1 The relevance of the underground economy in Sicily**

Statistics show that in Sicily the percentage of irregular workers is above the Italian average. Precisely, in 2002 such value was 26 %, while the Italian average rate was 14,2 % (Istat 2004).

Most of the irregular workers are concentrated in those economic industries where *micro* firms operates (less than 10 workers). Furthermore, such phenomenon is often common in the so called *marginal firms*. Marginal firms are characterized by a very low return on investments and managed towards short terms goals. In other words, such firms very often focus on single and specific orders rather than adopting growth oriented sustainable policies. Irregular workers have been often detected in industries, such as: building, agriculture, restoration, tourism, commerce and domestic

services. One of the main reasons that fosters irregular workers in the above sectors is the low level of skills required to employees.

It is worth noting that the highest percentage of irregular workers is observed in agriculture where the 44,6 % of total employees is not declared (ISTAT 2004). This means either not declared to the tax system or underpaid. Likewise, a high presence of irregular workers is also registered in the building industry 31,2 % (ISTAT 2004). Although, the service industry shows an average rate lower than the regional value, retail commerce and tourist activities show very high rates, respectively 45,4% and 67% (Regione Siciliana 2004).

Such a diffusion of the irregular work in Sicily is very often caused by firms attempt to reduce labor costs in terms of both salary and social security contributions. In fact, a lack of *entrepreneurial spirit* and a pervasive culture of illegality drive firms to find the easiest way to survive in the competitive system.

An important role is also played by immigrants coming from the Africa and Eastern Europe. Although in last years the number of immigrants regularly registered increased, the percentage of irregular immigrant is still very high.

### **3.2 Main recurring reasons underlying the underground economy in Sicily**

The reason for such a high percentage of irregular workers in Sicily can be explained by different factors.

From the point of view of the “entrepreneur”, the main reason for recurring to irregular workers is twofold: the high tax rate and the high labor and related costs (social security contributions, workplace safety, environmental responsibility, etc.). Concerning the first issue, since in Italy the average fiscal pressure on firms is above the 50% of the net income, the current tax rate is perceived as unfair. Moreover, very often labor and related costs are recognized by decision makers as unsustainable for the survival of the firms, which also claim an improvement of infrastructures to decrease operating costs. However, as most of Sicilian companies are micro firms and very often undercapitalized, recurring to the underground economy represents a way to survive.

From the point of view of the worker, the main reason that drive people to choose an irregular job position is related to the difficulty to find a placement, as, in 2005, the unemployment rate is still very high (about 16,2 % - Banca d'Italia 2006). However, as some social welfare policies support low income families, to some extent they favor the diffusion of a low propensity to look for a regular and official position. This low propensity is also encouraged by the high tax rate that regular and self-employed workers have to pay on their salary.

The size of the underground economy reduces the National and Regional's tax income and, hence, the financial resources necessary to adopt policies that may trigger the economy. These relationships may give rise to a vicious circle that could seriously undermine the development of every economic system. In order to struggle the underground economy, different policies have been adopted at both national and regional level. However, to increase the effectiveness of such policies, some recent studies suggest designing strategies strongly related to the peculiar characteristics of each territory. For this reason, some Italian Region, such as Lazio, Puglia and Sicily, are in the process to adopt specific interventions to tackle this phenomenon.

### **3.3 An analysis of main public policies to repress the underground economy in Sicily**

As remarked in the previous paragraphs, the underground economy in the Sicilian Region is developed due to some structural factors, such as a large presence of *marginal* micro firms, a high fiscal pressure (at both firm and individual level) and provision of public subsidies to low income families (that often generate an economic convenience for family members to do not declare their job position).

In the last decade, public decision makers have focused their attention on two main areas of intervention:

- *Financial incentives to support firms*, with the aim to foster a long term economic growth;
- *Subsidies to support low income households*, with the aim to increase the welfare state and to sustain family consumptions.

Although the above policies could be appreciated in terms of ends, they failed to strongly repress the size of the underground economy, and in some cases they favor this *status quo*.

In fact, a relevant number of firms continue to stay in the hidden economy on the basis of an economic convenience. This can be verified, in particular, in those industries that register a relevant growth rate, and show – at the same time – an increase of the weight of the underground economy.

It is worth outlining that such behavior is also encouraged by a *latent control system* oriented to verify the existence of irregular workers in firms and of families that hide their income to get public subsidies. This phenomenon has also fostered the development of a *culture of illegality*, at both firm and individual level.

Labor policies should not be only oriented to intervene on structural paradigms, such as taxation, lack of controls and rigidity of the labor market, but also struggle the underground economy with *ad hoc* actions focused on specific activities, sectors and territories. In fact, several national policies for the submersion of the underground economy registered a very low success in Sicily, because they offered undifferentiated fiscal relieves in a contest where firms have serious difficulty to obtain

credit and where companies produce goods requiring a high intensity of manpower that are subject to the competition of firms operating in developing countries, which can benefit of sensibly lower labor costs.

Certainly, other factors contributed to the failure of national labor policies in Sicily and other Italian regions, such as:

- a lack of a serious intervention to make more convenient the submersion for firms and workers, since most of the national policies were only oriented to condone previous irregularities;
- an unclear and difficult procedure to follow in order to obtain the benefits relative to the submersion;
- the lack of labor inspectors, which are necessary for an effective policy of prevention and repression of the underground economy.

While the traditional approach of the national government to struggle the underground economy was mainly based on policies oriented to convince firms and workers to abandon the underground economy by proposing them a condone of previous irregularities, in Sicily, the local labor policies were mainly oriented to offer to firms a temporary (six years) cut of social security contributions.

Both the above illustrated approaches obtained low and only temporary results; for instance, in Sicily, most of the firms submerged only to stop inspection procedures that would have led to a penalty or to obtain the authorization to violate, for a certain time, work safety laws.

These results stress the necessity of the adoption of labor policies that are not focused on the symptoms of the underground economy but that contemplate an articulated set of actions oriented to improve structural conditions of a particular territory or industry. In this direction have been formulated the recent approaches to struggle the underground economy.

In particular, in Sicily most of the efforts have been oriented to change the dominant entrepreneurial culture which is prone to justify the underground economy as an acceptable way to obtain easy economic advantages. With this purpose, in Sicily the government constituted a committee for the submersion of the underground economy and a regional observatory for the irregular workers phenomenon. These institutions aim to analyze the underground economy in order to identify the main factors affecting the size of irregular work in the labor market. Furthermore, the commission promotes the creation of new entrepreneurial initiatives in order to stimulate economic growth, which can counteract the high unemployment rate that represents one of the main causes of irregular work.

These new institutions have fostered the adoption, by the local government, of a new approach for the repression of the underground economy, which is mainly based on the cooperation between the different public administrations and with social actors. Such cooperation is oriented to identify

incentives for the use of regular manpower and penalties for those firms operating in the underground economy. In particular, the new initiatives are aimed to hinder the presence of irregular firms in the economy by creating competitive advantages that are accessible only for those firms that can demonstrate to operate in respect of law. Such competitive advantages diverge from sector to sector in order to take into account the specific problems and characteristics of each economic activity. Furthermore, the new approach is oriented to improve the effectiveness of labor inspectors controls in order to increase the perception of sanction certainty and, hence, to reduce the culture of illegality. Such controls have been extended also to those people who perceive the unemployment subsidies. In fact, as we have already remarked, these subsidies increase unemployed people's income, which are, then, driven to look for an irregular job so to maintain their state of unemployed and continue to perceive the unemployment subsidies along with the salary from the hidden work (Schneider and Este, 2000; Bouev, 2002).

Recently, a new policy to contrast the underground economy has been presented to the Sicilian Parliament. Such a new policy presents some aspects of the old approach and some aspects of the new approach. Precisely, the new policy contemplates:

- the erasure of social security contributions for those firms who decide to transform their current short-term contracts into open-ended contracts or to hire people that have been unemployed for at least two years;
- the adoption of a "solidarity pact" according to which Sicilian workers accept a reduction of their salary with respect to the salary established for the same jobs at national level in order to stimulate regional recruitments;
- increase labor inspections and sanctions with the aim to increase penalty certainty and, hence, reduce the culture of illegality.

The expected result of this policy is to increase the number of regular workers by 20.000 units. According to the lawmakers this result will be mainly obtain by a relevant reduction of the number of irregular workers.

In our opinion, the success of this new labor policy depends on its capacity to increase the economic convenience of both firms and workers to exit the underground economy. In fact, the decision to regularize a hidden labor contract is based on the firms' attempt to reduce labor costs and increase flexibility and on people's necessity to find the most convenient job in terms of both salary and working conditions (safety, social security benefits, workers' rights, warranties against firing, etc.).

#### **4.1 The research project phases and the methodology adopted**

The methodology adopted in this research follows the phases approach suggested in literature (Richardson and Pugh III, 1981; Maani and Cavana, 2000), which it has been proved to be very effective in complex systems. In particular, Maani and Cavana approach consists of 5 main phases:

1. Problem structuring
2. Causal Loop Diagram (CLD) modelling
3. Dynamic modelling
4. Scenario planning and modelling
5. Implementation and organizational learning

Although authors are involved in a research project, that has been designed according to the above outlined approach, aimed at analysing the characteristics of underground economy in Sicily, this paper focuses only on the first two phases.

#### **4.2 Problem structuring**

The main objective of this phase is to identify the most relevant aspects of “irregular work” phenomenon in Sicily (Italy). To reach this goal, several activities have been carried out.

First, an analysis of the available literature, both at the national and international level, have been conducted to better detect, understand and frame the phenomenon.

Second, in order to involve in the project main private and public authorities, it has been organized a seminar focused on the underground economy and irregular workers phenomena and their main effects on the regional socio-economical system. This event offered the opportunity to share ideas, data, information and main critics about adopted public policies. Invited speakers were managers and representative of regional or local public and private institutions, such as:

- National Insurance Institute for Industrial Injuries (*INAIL*)
- Revenue Guard Corps (*Gaurdia di Finanza*)
- Labour Court (*Tribunale del Lavoro*)
- Local Industrial Association (*Associazione degli Industriali*)
- Italian General Federation of Commerce and Tourism (*Confcommercio*)
- Italian Union of Chambers of Commerce (*Associazione delle Camere di Commercio*)
- Regional task force on irregular work (*Commissione lavoro nero*)
- Labour Unions (*CGIL, CISL, UIL*)
- Italian Federation of Artisans and Small Enterprises (*CNA*)

Three professors of the University of Palermo provided an analysis of the underground economy by adopting a multifaceted approach. In particular, a legal, sociological and psychological perspective have been adopted.

Finally, to deeper understanding the underground economy and the irregular workers phenomena, and the role played by the previous mentioned institutions, 10 semi-structured interviews with the regional and local managers of the previous institutions have been done.

These activities allowed us to identify and focus on the main variables of the socio-economic system underlying underground economy and irregular workers dynamics.

On the basis of the research activities outlined above, the present study is based on the following hypothesis:

- public policies adopted to contain and contrast irregular workers produce effective results only if short and terms effects are made explicit and policy resistance phenomena figured out.

In order to investigate such a complex and multifaceted phenomena, a systemic dynamic approach has been adopted.

#### **4.3 Causal Loop Diagram (CLD) modelling and preliminary test**

According to the system dynamics approach, the identified variables in the previous phase had been linked together to shape a preliminary causal loop diagram (CLD). This preliminary CLD allowed us to recognize main sub-systems underlying the structure of the observed phenomena, and to make explicit relationships between the identified sub-systems.

To validate this qualitative model, a *two-days workshop* with regional and local managers of private and public institutions (that provided a talk or attended the previous seminar) have been organised. Such event gave us the opportunity to discuss the analysed phenomena and to record different opinions and critics about the hypothesized CLD. During such event, a group model build approach has been adopted (Vennix, 1996).

#### **5.1 A preliminary feedback analysis underlying the underground economy**

In the following paragraph it will be analyzed the cause and effect relationships between the main variables underlying the underground economy phenomenon.

The analysis allowed identifying three main sub-systems:

- the economic sub-system;
- the judiciary sub-system;
- the households services and public subsidies sub-system.

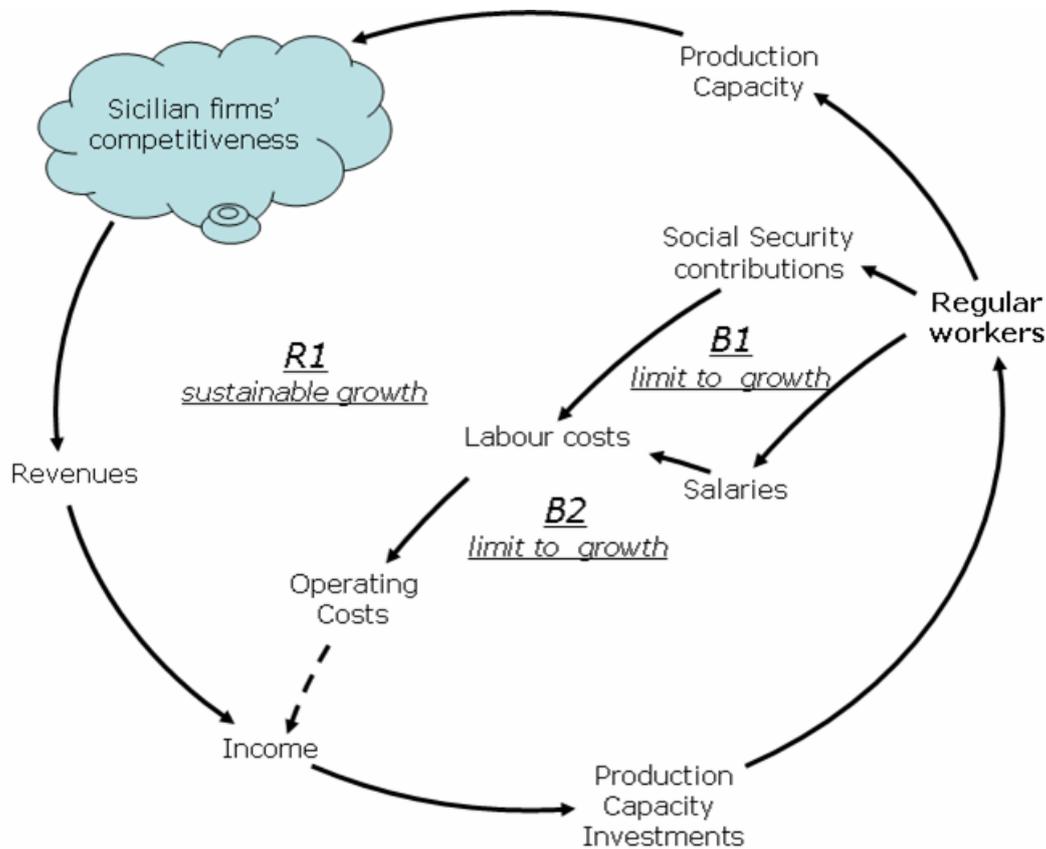
#### **5.2 The economic sub-system**

This sub-system mainly focuses on the key factors driving firms to hire irregular workers.

According to the first reinforcing loop ( $R_1$ ) - so called “physiologic firm development” - the higher *Sicilian firms’ competitiveness* – all conditions being equals – the higher their *revenues* and *income*

<sup>2</sup>. The increase of the *incomes* allows firms to invest more in *hiring regular workers* which increase *production capacity* and, hence, *firms' competitiveness*.

However, an increase of the number of the *regular workers* implies higher *labour costs* (salaries and social security contributions), which enhance company *operating costs* and reduce *firms' incomes* and, consequently, *investments* ( $B_{1-2}$ ).



**Figure 2 – Reinforcing and balancing loops underlying firms' growth**

*Investments* in personnel may be also oriented towards *irregular workers*, as related costs are perceived lower than regular workers. Such decision also contributes to increase firms' *production capacity* and *competitiveness*. As a consequence, firms will get higher *incomes* to be invested in new *irregular workers* hiring ( $R_2$ ). Although such a policy may determine a reduce worker productivity, such a phenomenon is counterbalanced by two main factors:

- a) a lower salaries cost ( $R_3$ ), and
- b) a reduction in social security contribution costs ( $R_4$ ).

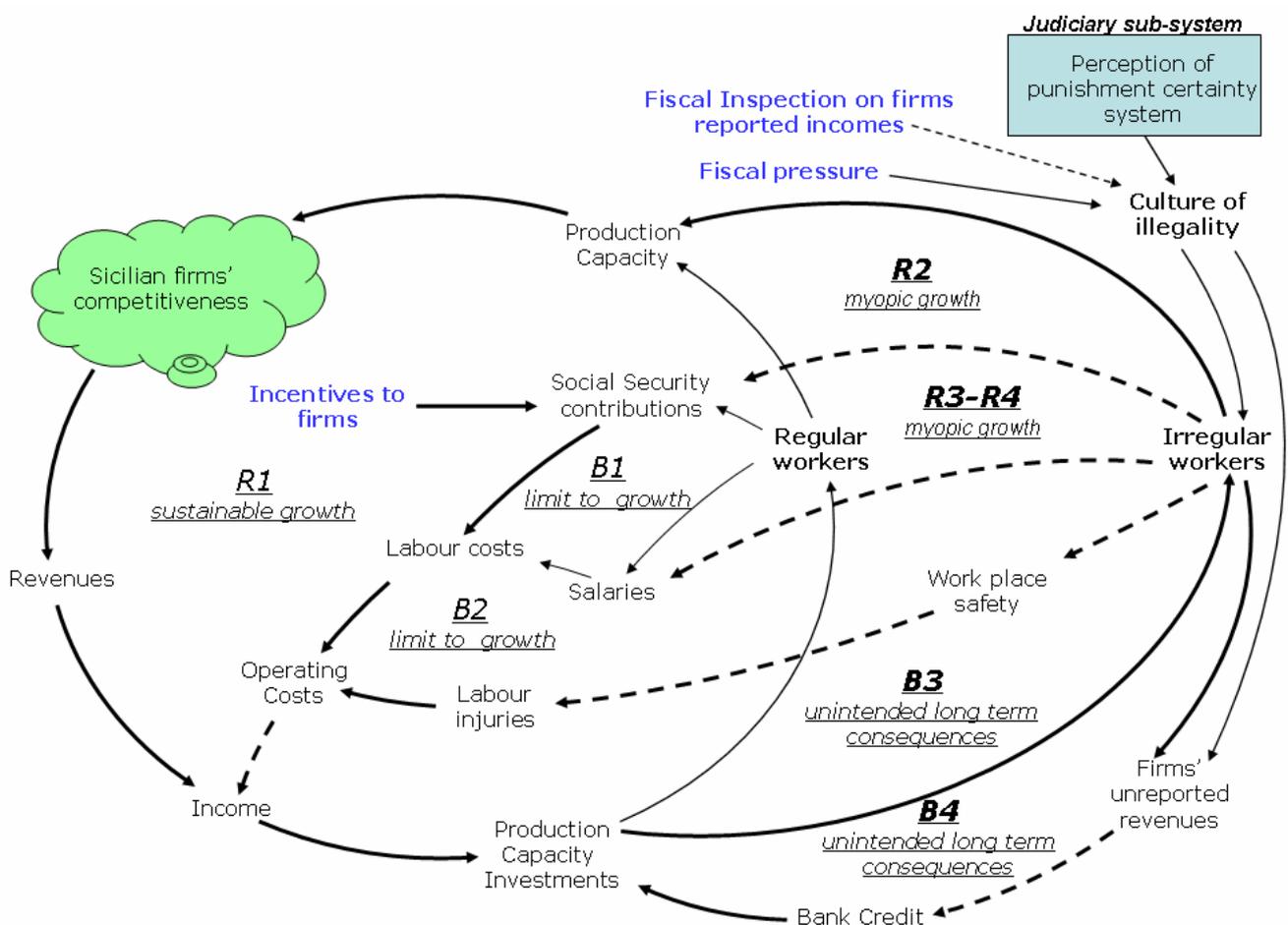
However, irregular workers imply some side effects.

<sup>2</sup> *Sicilian firms' competitiveness* is also affected by other factors, such as Globalisations, Competitors pressure, Product Quality/Price ratio offer, and so on. Such variables are not taken into consideration, because they are considered out the boundary of the investigated system.

For instance, an increase of *irregular workers* can produce a *work place safety* reduction and, consequently, a raise of *labour injuries*. As a result, a firm may suffer higher costs, that reduce incomes and production capacity investments ( $B_3$ ).

Furthermore, a larger presence of *irregular workers* implies higher firms' unreported revenues, and hence, greater difficulties to obtain bank credit. This may contribute to lead decision makers to decrease irregular workers ( $B_4$ ).

Even though these two main balancing phenomena may reduce firm's convenience to hiring irregular workers, delays and firm's complexity may contribute to low the relevance of such side effects in decision makers' mental models.



**Figure 2a – Reinforcing and balancing loops underlying intended and unintended effects of hiring irregular workers**

### 5.3 The judiciary sub-system

This sub-system focuses on the key-variables describing the processes of inspections by the public authority about the presence of irregular workers in firms, the tax and punishment policies for firms that hire irregular workers, and the related labour judicial system.

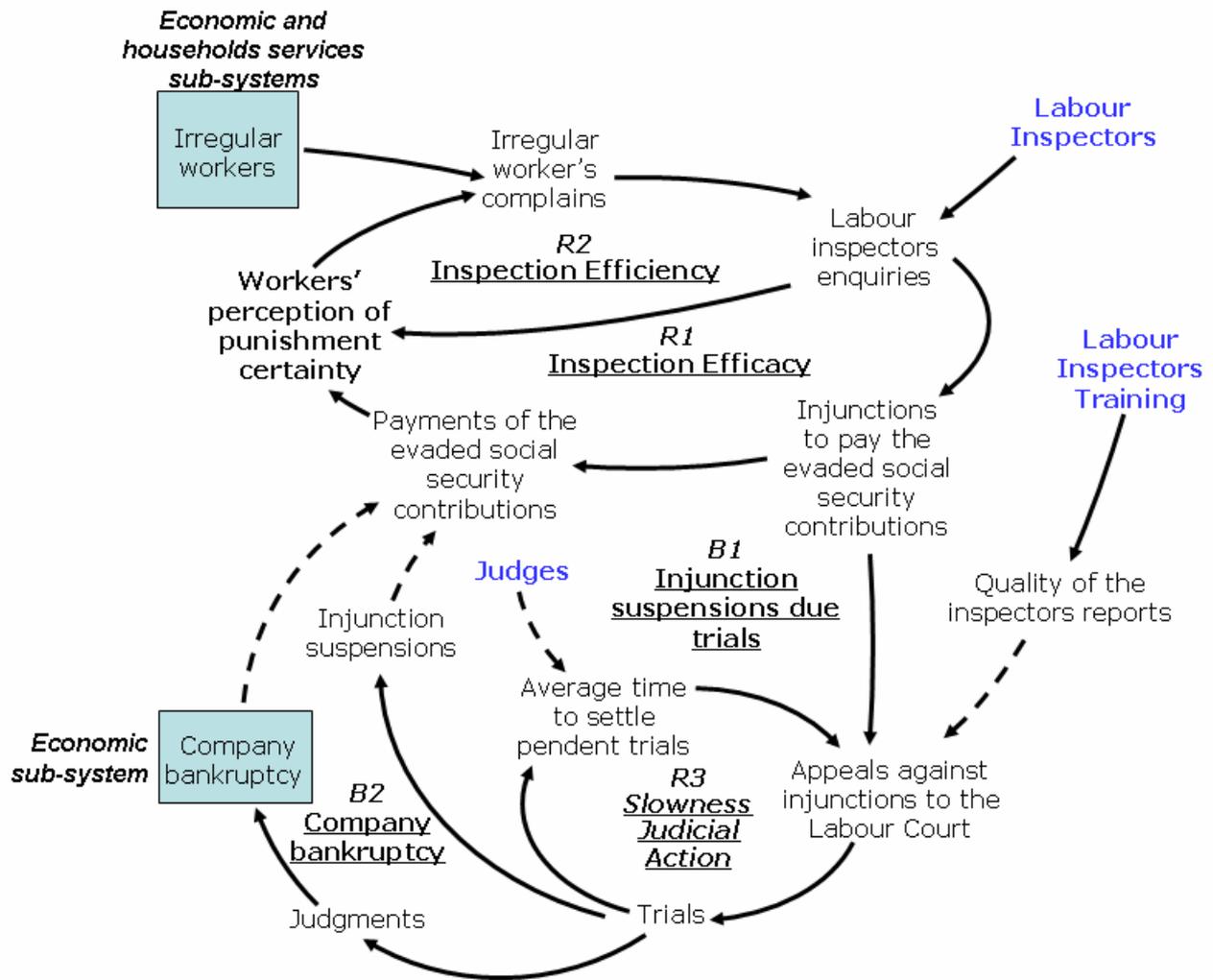
According to the conducted analysis, a higher number of *irregular workers* causes the increase in their *complaints* to the public authority about their labour treatments. This implies the rising in *labour inspectors' enquiries* that increases the number of *injunctions to pay the evaded social security contributions*. This produces an increase in *payments of the evaded social security contributions*, which enhances *workers' perception of punishment certainty* and, consequently, the number of *irregular workers' complaints* (R<sub>1</sub>).

Furthermore, *workers' perception of punishment certainty* is also positively affected by an increase in *labour inspectors' enquiries* (R<sub>2</sub>).

However, an increase in *injunctions to pay the evaded social security contributions* determines the rise of *appeals* against such injunctions to the Labour Court. This produces an enhancement of the number of *trials* that augments *injunction suspensions*, and in turns reduces the *payments of the evaded social security contributions*. As a consequence, a lower *workers' perception of punishment certainty* reduces the number of their *complaints* to the public authority. This causes a reduction in the number of *labour inspectors' enquiries* and *injunctions to pay the evaded social security contributions* (B<sub>1</sub>).

Furthermore, an increase in *appeals* causes the enhancement of the number of *trials*, that produces a significant lengthening of the *average time to settle pendent trials*. This leads to a growing in *appeals* to Labour Court (R<sub>3</sub>).

The raise of *trials* also implies a higher number of *judgements*, that in turns can lead to *company bankruptcy* (due to the relevant cost of the punishment to be paid). Consequently, the amount of *payments of evaded social security contributions* also declines. The *workers' perception of punishment certainty* decreases, as well as the number of *irregular workers' complaints* to the public authority. This causes a reduction in *labour inspectors' enquiries* and in the number of *injunctions to pay the evaded social security contributions*. This produce lower *appeals* against such injunctions to the Labour Court and *trials* (B<sub>2</sub>).



**Figure 3 – Reinforcing and balancing loops underlying labour inspections and trials on payments of the evaded social security contributions**

#### 5.4 Households services and public subsidies sub-system

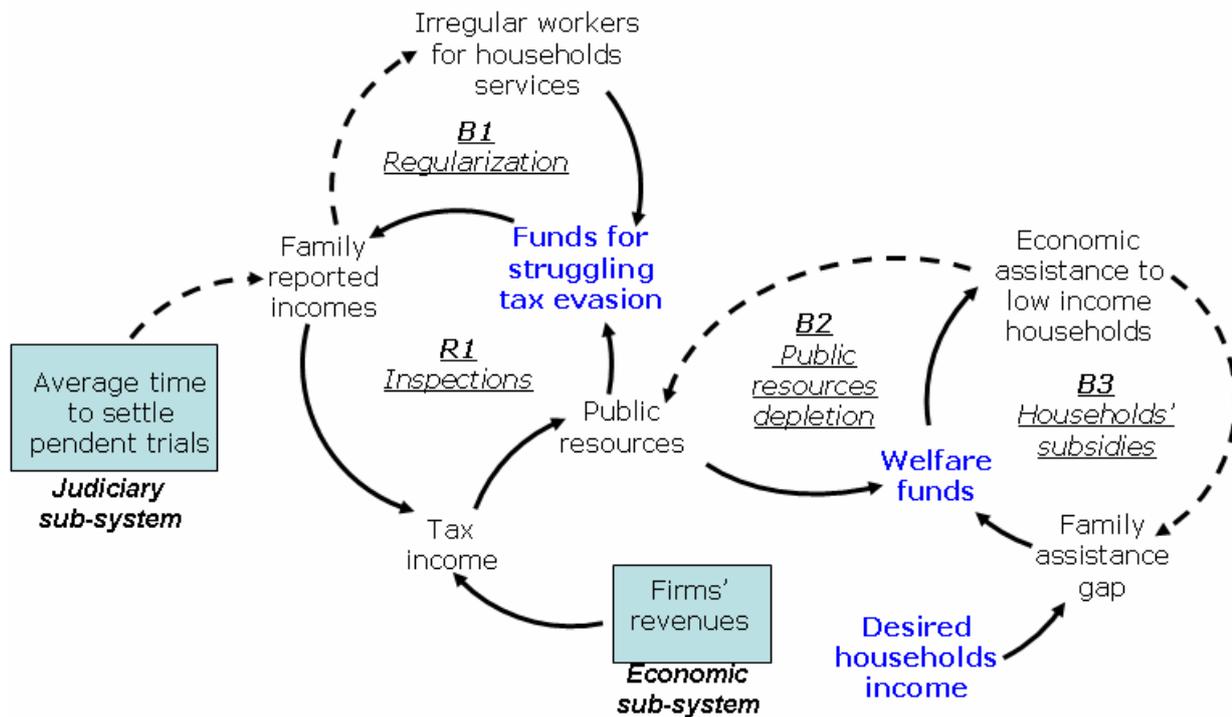
This sub-system focuses on investments of public resources to support households through incentives and subsidies.

From the analysis of the adopted public policies, it emerges *public resources* can fuel *funds for struggling tax evasion*, which are necessary to increase the number of fiscal inspections on *family reported incomes*. The more fiscal inspections the higher the family reported income and, hence, *tax income* that increases *public resources* (R<sub>1</sub>).

An increase in *funds for struggling tax evasion* produces a higher *family reported income*, which enhances a reduction in *irregular workers for family services* and, consequently, reduces the need of further investments in *funds for struggling tax evasion* (B<sub>1</sub>).

In order to guarantee *economic assistance to low income households*, *public resources* can be used to increase *welfare funds*. However, a higher welfare expenditure implies a reduction in *public resources* (B<sub>2</sub>).

Furthermore, given a *Desired households income*, an increase in *economic assistance expenditures* decreases the *family assistance gap*, which reduces the need of further investments in *welfare funds* (B<sub>2</sub>).



**Figure 4 – Reinforcing and balancing loops underlying subsidies and incentives effects on irregular workers for household services**

## 6. An analysis of public policies to struggle the irregular work phenomenon

The analysis of the above subsystems underlines main policy levers that can be adopted by public policy makers to struggle the irregular work phenomenon:

- firms' incentives;
- fiscal pressure;
- fiscal Inspection on firms reported incomes;
- investments in funds for struggling tax and social security contribution evasion (i.e., hiring and training labour inspectors);
- subsidies to low income families.

The provision of incentives to local firms is generally oriented to foster company investments by public grants or to reduce labour costs by a cut of social security contributions. The first incentive stimulates company growth and, as a consequence, the hiring a new workers. On the contrary, the reduction of social security contributions makes more convenient for firms to hire regular workers or to regularize the existing irregular workers.

Funds for struggling tax and social security contribution evasion can be used for the following activities:

- increasing the number of fiscal inspections on firm and family reported income,
- enhancing the number of labour inspections,
- improving labour inspectors skills by adequate training programs,
- augmenting the number of labour judges (to reduce the average time to settle a trial).

Subsidies to low income families are aimed to sustain households' consumptions. However, such subsidies present some side-effects since they increase the available family income and, consequently, they can drive people to give up looking for a regular job in order to keep receiving the subsidies.

## **7. Conclusions and further researches**

This paper aims at supporting public decision makers to better understand and frame complex socio-economic systems through a system dynamics approach. In fact, by making explicit feedback relationships between different (but strongly interrelated) sub-systems – such as economic, judiciary and households services and public subsidies – public decision makers can distinguish short and long terms effects and phenomena that may prevent the desired outcomes of the applied policies.

Furthermore, in a system characterised by multiple decision makers, a causal loop diagram approach proved to strongly contribute to foster debating and sharing alternative decisions to struggle the irregular workers phenomenon.

Although the research project conducted by authors is an embryonic stage, the causal loop diagram developed showed to be very effective in supporting decision making reasoning.

However, further steps are necessary. First of all, before building a stock and flow diagram, not only a collection of data and further information are fundamental, but also a more accurate test of the feedback structure built has to be considered.

## References

- Banca d'Italia, 2006. *Note sull'andamento dell'economia della Sicilia nel 2005*.
- Bouev, M. 2002. "Official regulations and the shadow economy: a labour market approach". *William Davidson Working Paper Number 524*, William Davidson Institute at the University of Michigan.
- Istituto Nazionale di Statistica (ISTAT), 2004. *La misura dell'economia sommersa secondo le statistiche ufficiali*.
- Maani K.E., Cavana RY (2000). *System Thinking and Modelling: Understanding Change and Complexity*. Pearson Education (NZ): Auckland.
- Richardson G.P., Pugh III A.L. 1981. *Introduction to System Dynamic Modeling with DYNAMO*, Productivity Press.
- Regione Siciliana – Presidenza Dipartimento Programmazione, 2004. *Dal sommerso all'emersione: la realtà siciliana*. Report on "La valutazione degli esiti occupazionali degli interventi del POR Sicilia 2000-2006".
- Schneider, F. 2005. Shadow Economies around the world: What do we really know?, *European Journal of Political Economy*, Elsevier, vol. 21(3), pages 598-642, September
- Schneider, F. and Enste, D.H. 2000. "Shadow economies: size, causes and consequences". *Journal of Economic Literature*, 38 (1), 77-114.
- System of National Accounts, 1993. produced jointly by the OECD, the United Nations, Statistical Division, the International Monetary Fund, the World Bank and the Commission of the European Communities.
- Van Eck, R. 1987. Secondary Activities and the National Accounts, Working paper, *Central Bureau of Statistics*, Voorburg.
- Vennix J. (1996). *Group Model Building*, Wiley.