

**To invest or not to invest in Higher Education: that is the question for the crisis-shaken Greek Government and households.**

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**Abstract**

This paper discusses the main findings of conducting primary literature review concerning the profitability of investments in Greek Higher Educational System in its current deteriorating state. It has been found that during the past seven years of crisis – the toughest a developed country has ever called to face - Greek youth has been more likely to end up in universities, since Higher Education is provided free by State Institutions and at the lack of other alternatives; in fact, under the current harsh circumstances, labour market demands are far less than optimal for young people. Therefore, the pool of over-qualified inactive population has been expanding, bearing unpredictable and under-researched social and economic impact. Human Capital Theory lent the lens to examine the motivation behind Greek Government's persistence to implement the current policies and Greek households' investments in Higher Education and explore youth's aspirations.

## **Introduction**

Greece has been struggling with unemployment for decades (Drakaki et al, 2014), while it recently ranked second with highest youth unemployment rates, following South Africa, in hot pursuit (OECD, 2016a). During the years of crisis, the country has been also heavily affected by underemployment for people aged 15-29 years old; indeed, graduates from Higher Education (HE, hereafter) face severe impediments in accessing labour market compared to those graduated from secondary education (Theodoropoulos et al, 2014). This situation is contrasting to Greek society's insatiable demand for over-education (Magoula and Psacharopoulos, 1999). Survey of Adult Skills' recent findings also, underline the deteriorating state of Greek HE and the problematic labour market absorption (OECD, 2016b). However, Greek Government's persistence to implement same policies and households' motivation to invest in their offspring's HE studies have not been captured in the current form of the national economy. Moreover, recent studies examine youth underemployment in OECD countries (and Cyprus), however Greece lacks relevant data. Primary datasets are therefore, needed for successful policy-making, while adjustments in youth aspirations should be reconsidered, since the latter exhibit symptoms of high hopelessness and depression due to increasing unemployment (Christodoulou et al., 2015; Economou et al., 2013).

## **Current levels of Development**

Greece is a developed country with high-income economy, high human development index and sufficient educational achievements (UNDP, 2016; World Bank, 2016); however it has been diachronically burdened by problems, often exclusively associated with developing countries. The most serious are corruption (TI, 2015), nepotism, snap elections, social inequalities and youth unemployment (European Parliament, 2015). Some of these problems are seen as the contributing factors to the country's economic recession, while others as the expected consequences. Countries which suffered previously from a financial turmoil, faced similar challenges, especially in the areas of labour market adequacy and societal stability (Flores-Crespo, 2007; Rangel, 2004). However, the Greek economic crisis differs from previous crises because the country is a member-state of the European Union (EU), single market and Eurozone and until the Great Recession of 2007-2009 (Grusky et al., 2011) there had been no similar precedent, i.e. a country-member of a powerful politico-economic union unofficially bankrupt, threatening its prosperity with a "domino-effect". To handle this effect, Greek Government in 2010, requested a loan from EU and International Monetary Fund (IMF) and announced austerity measures which would potentially restore national competitiveness in global market. Nonetheless, Greece is currently facing the seventh year of recession -the most dramatic, a Western country has ever experienced (Matsaganis, 2013)- while more recently, gained another grievous world record, that of being the first developed country not to honour its commitments to IMF.

Furthermore, Greek debt crisis is often tightly linked to another crisis, that of trust on behalf of country's European counterparts. This crisis was ignited after it was alleged that Greek Governments tampered with national financial statistics. Unsurprisingly, therefore, during the past seven years, the country has gained immense negative international publicity and the scenario of 'Grexit' puts periodically Greece's remain within European Institutions, at risk. More recently, UK's recent decision to leave EU was seen as a herald to Greece's exit, as well. In addition, the massive migratory flows combined with the country's incapacity to control its borders (Stournaras, 2008), threatens also the continuation of Schengen Agreement's implementation over Greece, in order to prevent migrants, who arrive illegally in Greece, to

move between member-states according to the rights and opportunities available (Papadopoulou, 2008). Therefore, behind the Greek financial depression, there are lurking other crises for Europe; a refugee crisis, since this is often the hosting continent of Middle-Eastern and North African refugees, the recent political crisis after 'Brexit' and a rising humanitarian crisis mainly in Southern Europe with the increasing rates of unemployment and the subsequent decreasing standards of living. Therefore, it could be concluded that these crises intersect and form a complicated and under-researched context.

## **Greek Higher Education**

HE in Greece is provided by AEIs (i.e. Higher Educational Institutions) and ATEIs (i.e. Higher Technological Educational Institutions); although only the first ones are called universities, while the latter are seen as technical schools and therefore, as less prestigious higher institutions (Dafou, 2009). ATEI were previously known as TEI (i.e. Technological Educational Institutions) and recently renamed, since "drastically increasing the cheaper non-university available places" would handle Greek society's demand for over-education (Psacharopoulos and Tassoulas, 2004: 250). Their renaming is often seen as an explicit example of 'diploma disease' (Dore, 1976).

Zmas (2015) exploring educational policies in Greece, concludes that since metapolitefsi<sup>1</sup>, there are three distinctive processes; the Democratisation, Europeanisation and Neoliberalisation of HE. The democratic university oriented hastily towards the protection of academic freedom in teaching and research; the universities became self-governed but state-protected and therefore, reluctant to compete and innovate. The necessity of Greek universities' adjustment however, to European criteria shed light upon Greek universities' pathogeneses. The Europeanisation of Greek HE is linked to its expansion and the phenomenon of "flying professors who stayed in the regional university two days per week" (Zmas, 2015: 500). Although, Greek governments approve legislation in order to 'cure' such phenomena, the academic community form a special caste of public servants and often exercise successfully veto against its implementation. Greece also joined Bologna Process in 1999 and committed to contribute to European HE internationalisation (Barrett, 2016). In fact, although International and European students shall attend Greek universities, these are practically discouraged since Greek is the official language of instruction. Greece as a European country should also adhere with "Europe 2020"; EU's strategic initiative to link HE with research and innovation and accumulate highly-skilled human capital for Europe's economic growth and prosperity. However, Greek professors are very often unwilling to publish after their appointment, since they have to work simultaneously in parallel jobs in order to complement their insufficient household income (Psacharopoulos, 2003).

The recent recession that has shaken Greek economy and labour market, may offer the "external argument" for the transition of the unsuccessfully Europeanised Greek university to its Neoliberal era (Zmas, 2015: 496). Indeed, the European funding has been gradually cut, while the shrinking of the national GDP along with the massive Greece's external obligations have left HE poorly funded. However, as Chalari (2012: 8) highlights, "Greeks perceive the economic, political and social alterations[...]in terms of 'crisis' rather than 'transformation' or 'reconstructing'". This may foreshadow Greek society's (including Government, households and youth) stubborn unwillingness to reform among others, the inefficient and outdated HE.

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<sup>1</sup>1974 regime change from military dictatorship to multi-party democracy.

## Reforms in HE

A recession facilitates the promotion of educational changes, however these are firstly imposed there, where political reaction could be effectively managed (Heyneman, 1990). For instance, in post-economic crisis Mexico, the Government promoted initially reductions on recurrent costs for teacher training and infrastructure, while the Education Employees' Syndicate exercised influence on teaching positions' assignments and teacher wages' increase (Santibañez et al., 2005). Similarly, although Greek economic depression may argue for the promotion of reforms in HE (Zmas, 2015), these are often met with the rage of powerful academics' and students' unions. Specifically, reforms already proposed and approved, have not been implemented and others abolished due to the associated political cost. Overall, country's volatile political situation impinges drastically upon any strategic planning and leaves HE in its current deteriorating state.

'Eternal students', i.e. students that enter higher institutions but do not graduate within the expected time, is an alarming phenomenon for Greek State-funded HE. According to Article 33 amended in 2011, all students shall have completed in less than  $v^2 + 2$  years their studies. The outcome of this Article was the removal of 180,000 students from Universities' Records – some of whom registered as undergraduate students since 1950's. Although graduation rates for Greece is the lowest among all OECD countries (OECD, 2009), this law was in effect only until 2015, when a more recent Amendment proposed by the then newly-elected government of SYRIZA, brought back those removed and permitted to all students to continue their studies evermore. The cost of the latter cannot be considered as negligible at a national level, especially when the cost of student benefits is also added to the real cost of their studies, neither at a personal level, given that a minor number of students work while studying (Kyridis et al., 2017).

Since Greece is a European country, the State HE could not remain intact by the dominant debate over public and private universities across Europe. Indeed very recently, certificates issued by private colleges offering post-secondary education were recognised by the Ministry of Education, Research and Religious Affairs. This change might have been encouraged also by country's recent bleak financial situation, since the economic crisis pointed out State's inability to maintain every higher institution and need of merging or even disallowing departments. The insatiable demand for HE of Greek society and the subsequent, mass student migration abroad has been the main argument in the political agendas of the so-called in Greece "liberal" politicians. Although the establishment of private HE is still prohibited by the law, the vast majority of Ministers served since 1981, have completed at least one higher degree abroad. These Ministers can be found almost in every ministerial reshuffle called, both from the recently elected far-left and previously far-right elected Governments. In spite thus, of their ideology and their political stance toward private initiatives, they have opted for studying abroad and paying fees and/or other associated costs. Recent studies in the field (Papadakis and Kyvellou, 2017) highlight that professional rights' recognition of those graduated from non-formal education according to National Qualifications Framework, may boost international mobility and employment opportunities.

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<sup>2</sup>expected years of studying.

## Overview of labour market

In this paper, Greek labour market is reviewed, since in literature unemployment and over-education link to labour demands (Theodoropoulos, et al., 2015; Lamprianidis, 2011). Even though unemployment has been a constant factor for the Greek economy, official data support that rates have been taking alarming dimensions due to the ongoing crisis. Indeed, these rates have been uncontrollably increasing since the onset of Great Recession; from 9.6% in 2009, to 12.7% in 2010, 17.9% in 2011, 24.5% in 2012 and 27.5% in 2013, making researchers in the field to raise warning for unprecedented economic and cultural decline (Kyridis et al., 2017). Interestingly, although officially reported rates might be extreme, Greek society worries about being rounded in order to reflect partially only, the dimensions of this acute phenomenon. Indeed, more pessimistic analyses report that more than half the total population is excluded from labour market (Dalla et al., 2013).

Unsurprisingly therefore, youth unemployment promotes brain-drain<sup>3</sup> and impede severely upon national economy's recovery (Lamprianidis, 2011). During the past decade, the youth unemployment rates across EU have been raising; these range from 7% for Austria up to 50% for Spain and Greece (EC, 2012). Unfortunately however, the frequency of young educated migration is much higher for Greece, compared to other European countries, also affected by recession. In closing this section, it should be underlined that although un-/underemployment affect the total population in times of crisis, social vulnerable groups, such as youngsters and females, are likely to suffer more. Indeed, although women in Greece used to face severe impediments in accessing labour market, in the economic-crisis era these appear more sensitised, compared to males, towards professional racism –arguably sexism- and forced to opt for less desired careers, so as they can survive financially (Kyridis et al., 2012).

## Over-education; a Greek 'hexis'

Given the deteriorating HE and the increasing unemployment rates, it could be argued that Greek youngsters end up in universities, at lack of alternatives. Studies exploring 'over-education' (Livanos, 2010) however, conclude that a HE-degree is still seen as a vehicle toward mobility in Greek society. However, the recession along with the pre-existing problematic relation between education attainments and income level (Patrinos, 1995) pointed out that financial achievements determine social stratification in Greece nowadays, similarly to most Western countries, where neoliberalism promotes deregulation on labour market and "maximise(s) profit through [...] unemployed tanks' augmentation" (Kyridis et al, 2012: 26).

Although only a limited number of high school graduates enter Greek universities, they are not provided with sufficient or ideal career prospects after their graduation. Indeed, since over-education is interwoven in Greek society, traditionally large numbers of those students failed to enter State HE, attend universities abroad. In fact, Greece has, traditionally, the highest ratio of foreign to domestic university enrolment, amongst the world (Menon et al., 2007). Therefore, upon the repatriation of the latter, the pool of inactive graduates expands even more, bearing currently unpredictable and under-researched social and economic impact. On the contrary, Greek universities' students feeling pessimistic about their career prospects in Greece, plan their migration abroad. This Greek migratory flow is highly qualified, holding at least a Master's degree and/or having undergone doctoral training. By way of illustration, the

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<sup>3</sup>the migration of young well-educated population from less to more developed countries.

number of Greek graduates working today outside the country is estimated around 10% of the total population (Lambrianidis, 2011).

From a human capital<sup>4</sup> theory perspective, the monetary rewards that these lose due to their absence from labour market along with the associated private costs are huge for Greek undergraduate students. Indeed, due to limited entry to HE and high competitiveness of pre-entry examinations, Greek families often invest lavishly in their offspring's pre-entry preparation and while at university, ending up to exceed State's spending per student (Psacharopoulos and Papakonstantinou, 2005). Interestingly, Kyridis et al. (2017: 216) describe undergraduate students as hard-working, who "with their families' economic sacrifices have managed to enter university, expecting this investment (public and private) to provide them with [...] a job that ensures a decent living". Finally, even though positive social externalities such as democratisation and political stability, are associated with investments to human capital (McMahon, 2004), these do not argue for State funding. In fact, negative correlations between studies and political apathy have been reported since the pre-economic crisis era (Karatasos et al, 2007). Improving therefore, and not just expanding the provision of HE could be seen as a profitable investment at both a national and individual level, in the current form of national economy.

## **Final Words**

Greek society's traditional demand for over-education has boosted the supply of skilled working force, however the crisis-shaken labour market cannot effectively absorb them, bearing thus, unpredictable and under-researched social and economic impact. Since other South-European countries face similar challenges<sup>5</sup>, this study may provide an initial overview of the reasons behind the implementation of policies established in pre-economic crisis era along with the educational investments' motivation at a personal level. Moreover, the current Greek HE constitutes an exemplar of a system undergoing massive parallel crises and offers an exceptional opportunity to investigate on one hand, the impact of such extreme conditions upon governmental policies and individual decision-making and on the other hand, the adjustments which need to be reconsidered in youth's aspirations.

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<sup>4</sup>skills and talents accumulated through formal education, studies and apprenticeship.

<sup>5</sup>HE is State-funded and youth unemployment rates are alarming.

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# Doing Business in the Shadows: Informal Firms, Illegal Immigrants and the Government

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## Abstract

We develop a search and matching model with two sectors, a formal and an informal, and illegal immigration. The two sectors differ in several aspects, e.g., only firms that operate in the formal sector pay a payroll tax and severance payments; similarly, only workers employed in the formal sector pay an income tax and social security contributions. We study the effects of various labour market and immigration policies and calibrate the model to obtain quantitative estimates regarding the effects of these policies for Greece.

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## The Model

We consider an economy that has two sides: a formal and an informal one. Both sides consist of two sectors, one that produces an intermediate input and one that produces the final good. Throughout the paper, we take the final good to be the numeraire.

There is a continuum of workers, who are either natives (N) or illegal immigrants (M) and are indexed by  $i \in \{N, M\}$ <sup>2</sup>.

The mass of native workers is normalized to one, while that of illegal immigrants is also constant and denoted by  $M$ . Native workers seek employment in any of two intermediate sectors, whereas illegal immigrants can work only in the informal intermediate sector.

The mass of jobs in each intermediate sector is determined endogenously, as specified below. Time is continuous. All agents are risk neutral and discount the future at a constant rate  $r > 0$ .

### *Production*

We start with the formal side of the economy. An intermediate input  $L_F$  is produced using only (native) labor. More specifically, firms operate a simple linear technology

$$L_F = e_{NF}$$

where  $e_{NF}$  is the number of native (N) workers who are employed in the formal intermediate sector (F). Accordingly, a job in that sector can be filled only by a native worker and the outcome from such a pair is one unit of  $L_F$ . Moreover, there are firms of the final good operating in the formal side; they use  $L_F$  to produce the final good  $Y_F$  according to the following technology

$$Y_F = A_F L_F, A_F > 0$$

The informal side of the economy has a similar structure. There are two intermediates inputs  $L_{NI}$  and  $L_{MI}$ , which are produced using only native and immigrant labor respectively. More specifically,

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<sup>2</sup> We abstract from legal immigration. Alternatively, one can assume that legal immigrants are lumped together with natives.

$$L_{NI} = e_{NI} \text{ and } L_{MI} = e_{MI}$$

where  $L_{MI} = e_{ij}$  is the number of workers who are employed in the intermediate informal (*I*) sector and are of origin  $i = N, M$ . Accordingly, a position in the informal intermediate sector can be filled either by a native or by an immigrant.

There are also informal firms that produce the final good. They do so using the technology

$$Y_I = A_I L_I, A_I > 0$$

where

$$L_I = [x(L_{NI})^\rho + (1-x)(L_{MI})^\rho]^{\frac{1}{\rho}}$$

The final goods  $Y_F$  and  $Y_I$  are perfect substitutes; in particular, the total quantity of the final good  $Y$  is  $Y = Y_F + Y_I$ .

### *Markets*

Each of the two intermediate inputs,  $L_F$  and  $L_I$ , is sold in a competitive market. Thus, their prices are equal to their marginal products:

$$p_F = A_F$$

$$p_{NI} = A_I x \left( \frac{L_I}{L_{NI}} \right)^{1-\rho}$$

$$p_{MI} = A_I (1-x) \left( \frac{L_I}{L_{MI}} \right)^{1-\rho}$$

Finally, in the labor markets, there are search and matching frictions that prevent market clearing. More specifically, each firm possesses one vacancy and must decide first whether to open it in the formal (*F*) or in informal (*I*) sector. We use the index  $j \in \{F, I\}$  to distinguish between the two types of jobs. There is free-entry in both markets. After opening a vacancy, the

firm starts seeking for a worker. Similarly, native workers decide first whether to seek employment in the formal or in the informal sector (as mentioned above, illegal immigrants have no such option).

Job seekers and vacant jobs are matched randomly in a pair-wise fashion. The mass of successful job matches in the formal sector is determined by the matching function  $M_F(v_F, u_{NF})$  where  $v_F$  is the mass of formal vacancies and  $u_{NF}$  denotes the mass of unemployed native workers in the formal sector. Similarly, the mass of matches in the informal sector is given by the matching function  $M_I(v_I, u_{NI} + u_{MI})$  where  $v_I$  is the mass of informal vacancies and  $u_{NI}$  ( $u_{MI}$ ) is the mass of unemployed native (immigrant) workers in the informal sector. The matching functions  $M_j(\cdot)$ ,  $j = F, I$ , are assumed to be twice continuously differentiable, strictly increasing and strictly concave with respect to each of their arguments, exhibit constant returns to scale and satisfy the Inada conditions.

We follow the literature and define the labor market tightness in market  $j, \theta_j$ , as the number of jobs per unemployed worker; that is, in the formal sector  $\theta_F = v_F / u_{NF}$  and in the informal sector as  $\theta_I = v_I / (u_{NI} + u_{MI})$ . The rate at which vacancies in sector  $j$  are filled is  $q_j(\theta_j) = M_j / v_j$ ,  $j = F, I$  where  $q'_j(\theta_j) < 0$ . On the other hand, the rate at which unemployed workers (native or immigrant) find jobs in each sector is  $m_j(\theta_j) = \theta_j q_j(\theta_j)$ , where  $m'_j(\theta_j) > 0$ . Henceforth, to simplify the notation, we write  $m_j$  and  $q_j$  instead of  $m_j(\theta_j)$  and  $q_j(\theta_j)$  respectively.

### *Institutions*

There are some fundamental differences between firms and workers that operate in the two intermediate sectors. First, to maintain a vacancy in sector  $j$  a firm must pay an advertising cost  $c_j$ ,  $j \in \{F, I\}$ .

Second, firms that operate in the formal sector pay a payroll tax at a rate  $t_F$ , a tax on profits  $t_p$  and face some firing costs. We consider two components of firing costs: The first component includes various administrative costs captured by the parameter  $f > 0$ . These costs include the requirement to give the worker advance notice, procedures that the firm must follow if it wants to lay off, legal expenses in case of a trial, etc. The second component of firing costs is a severance payment, i.e., a transfer from the firm to the employee<sup>3</sup>.

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<sup>3</sup> In our model, there are no quits and every termination of employment is a no-fault dismissal.

As it is the case in most countries, we assume that the severance payment is proportional to the wage, that is, it equals  $\gamma w_{NF}$ , where  $w_{NF}$  is the wage rate of a worker who is employed in the formal sector (F) and is native (she is of origin N). On the other hand, firms that operate in the informal sector receive no subsidies and pay neither taxes nor firing costs. However, the government monitors the labor market and if a firm is caught operating in the informal sector, then it is forced to terminate the match and pay a penalty rate  $\eta$  on output<sup>4</sup>.

Such an event occurs with a probability (arrival rate)  $\delta$ . Hence,  $\delta\eta$  is the expected penalty rate paid by a firm in the informal sector.

Third, native workers who work in the formal sector pay an income tax at a rate  $t_w$ . On the other hand, workers in the informal sector do not pay taxes. Nevertheless, informal jobs are less stable for the following two reasons. First, the arrival rate of negative shocks is probably higher, i.e., the separation rate in the informal sector  $s_I$  is higher than that in the formal  $s_F$ . Second, as mentioned above, firms are audited at a rate  $\delta$  and if they are caught operating illegally then they have to terminate the match.

Finally, during unemployment, native workers receive a flow of income  $b_{Nj}$ ,  $i = N, M$ ,  $j = F, I$ , which captures the opportunity cost of employment, e.g., the payoff from home production, leisure and unemployment benefits. This income is net of any search cost that they incur when looking for a job. Typically, workers in the informal sector do not receive any unemployment benefits, that is,  $b_{MI} = 0$ . On the other hand, illegal immigrants do not receive unemployment benefits; nevertheless, they also incur a cost of searching for a job, which is, in general, higher than that faced by natives<sup>5</sup>.

We let  $b_{MI}$  denote the income of an immigrant in unemployment, which could be negative. Thus, we have  $b_{NF} > b_{NI} = 0 > b_{MI}$ . Moreover, throughout the paper, we assume that the output of match between a vacancy and a worker exceeds the income of the unemployed worker of the same type, i.e.,  $P_F > b_{NF}$ ,  $P_I > b_{NI}$  and  $P_I > b_{MI}$ .

### *Asset Values*

In general, we let  $\Pi$  and  $V$  be the values associated with a filled and an unfilled vacancy, and  $E$  and  $U$  the values associated with an employed and an unemployed worker, respectively. More specifically, let  $\Pi_{ij}$  be the present discounted value associated with a firm in sector  $j$  that is matched with a worker of origin  $i$ . Then in steady state:

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<sup>4</sup> We assume that  $\eta$  is the penalty rate net of any administrative cost that is necessary to enforce the law

<sup>5</sup> Battisti et al. (2014) cite empirical evidence in support of this assumption.

$$r\Pi_{NF} = (1-t_p)[p_F - (1+t_F)w_{NF}] - s_F(\Pi_{NF} - V_F + f + \gamma w_{NF})$$

$$r\Pi_{NI} = (1-\delta\eta)p_{NI} - w_{NI} - (s_I + \delta)(\Pi_{NI} - V_I)$$

$$r\Pi_{MI} = (1-\delta\eta)p_{MI} - w_{MI} - (s_I + \delta)(\Pi_{MI} - V_I)$$

where  $w_{ij}$  is the wage rate of a worker who is employed in the intermediate sector  $j = F, I$  and is of origin  $i = N, M$  and  $V_j$  is the value associated with an unfilled (vacant) position in intermediate sector  $j$ . As mentioned above, the total firing cost in the formal intermediate sector is  $f + \gamma w_{NF}$  where  $f > 0$  is a fixed amount. Recall that jobs matched with natives in the informal sector have a higher separation rate than jobs matched with natives in the formal sector  $s_I + \delta > s_F$ .

The expected income streams accrued to an unfilled vacancy in the intermediate sector  $j=F, I$  are given by

$$rV_F = -c_F + q_F(\Pi_{NF} - V_F)$$

$$rV_I = -c_I + q_I[\varphi_{NI}\Pi_{NI} + (1-\varphi_{NI})\Pi_{MI} - V_I]$$

where  $\varphi_{NI}$  represents the probability that a vacancy meets a native worker ( $i=N$ ) in the informal sector ( $j=I$ ). More specifically,

$$\varphi_{NI} = \frac{u_{NI}}{u_{NI} + u_{MI}}$$

We turn next to values associated with the workers. The expected income streams accrued to employed workers are given by

$$rE_{NF} = \tau + (1-t_w)w_{NF} - s_F(E_{NF} - U_{NF} - \gamma w_{NF})$$

$$rE_{NI} = \tau + w_{NI} - (s_I + \delta)(E_{NI} - U_{NI})$$

$$rE_{MI} = w_{MI} - (s_I + \delta)(E_{MI} - U_{MI})$$

where  $\tau$  is a lump-sum transfer provided by the government to its citizens.

Similarly, the values associated with unemployed workers are:

$$rU_{NF} = \tau + b_{NF} + m_F(E_{NF} - U_{NF})$$

$$rU_{NI} = \tau + b_{NI} + m_I(E_{NI} - U_{NI})$$

$$rU_{MI} = b_{MI} + m_I(E_{MI} - U_{MI})$$

We also assume free entry in establishing either type of vacancy. Thus, in equilibrium, the expected payoff of posting a vacancy is equal to zero, that is,

$$V_j = 0, j = F, I$$

### *Wage Determination*

Once a worker meets a firm, they bargain over the wage rate. We assume that they essentially solve a generalized Nash bargaining problem given by

$$\max_{w_{NF}} [E_{NF} - U_{NF} - \gamma w_{NF}]^\beta [\Pi_{NF} - V_F + f + \gamma w_{NF}]^{1-\beta}$$

for the matches in the formal sector and by

$$\max_{w_{il}} [E_{il} - U_{il}]^\beta [\Pi_{il} - V_j]^{1-\beta}$$

for the matches in the informal sector, where  $\beta \in (0, 1)$  represents the worker's bargaining strength. The solution to each of these two problems gives, respectively,



$$(1-\beta)[(1-t_p)(1+t_f)-r\gamma][E_{NF}-U_{NF}-\gamma w_{NF}] = \beta(1-t_w-r\gamma)[\Pi_{NF}-V_f+f+\gamma w_{NF}]$$

$$(1-\beta)(E_{ij}-U_{ij}) = \beta(\Pi_{ij}-V_j)$$

The total surplus generated by a match in the formal and the informal sector is  $S_{NF} = \Pi_{NF} - (V_f - f) + E_{NF} - U_{NF}$  and  $S_{ij} = \Pi_{ij} - V_j + E_{ij} - U_{ij}$ ,  $i = N, M$  respectively. Notice that the severance payment  $\gamma w_{NF}$ , being a pure transfer from the firm to the worker, drops out of the definition of the surplus  $S_{NF}$ . Nevertheless, the compensation rate  $\gamma$  and the tax rates,  $t_f$  and  $t_w$  affect the workers' and firms' shares in the formal sector. More specifically, in the case of a formal match, workers get a share

$$\beta_F = \frac{\beta(1-t_w-r\gamma)}{\beta(1-t_w) + (1-\beta)(1-t_p)(1+t_f)-r\gamma}$$

and firms  $1-\beta_F$ . In the case of an informal match, on the other hand, workers and firms get a share  $\beta$  and  $1-\beta$ , respectively, of the surplus. By using the above asset value equations, we can derive the expressions for the wage rates.

Substituting for  $E_{ij} - U_{ij}$  and  $\Pi_{ij}$  we find

$$w_{NF} = \frac{\beta(r+s_f+m_f)\Delta[(1-t_p)p_f+rf] + (1-\beta)(r+s_f)\Gamma b_{NF}}{\Phi_f}$$

$$w_{NI} = \frac{\beta(r+s_i+\delta+m_i)(1-\delta\eta)p_{NI} + (1-\beta)(r+s_i+\delta)b_{NI}}{\Phi_i}$$

$$w_{MI} = \frac{\beta(r+s_i+\delta+m_i)(1-\delta\eta)p_{MI} + (1-\beta)(r+s_i+\delta)b_{MI}}{\Phi_i}$$

where  $\Phi_f = \beta\Gamma\Delta m_f + (r+s_f)\Gamma[\Delta - \gamma(1-\beta)m_f]$ ,  $\Gamma = (1-t_p)(1+t_f)-r\gamma$ ,  $\Delta = 1-t_w-r\gamma$  and  $\Phi_i = r+s_i+\delta + \beta m_i$ . In each case, the worker's wage when employed in a particular job is basically a combination of his outside option and his productivity in that job.

*Steady-State Composition of the Labor Force*

The following definitions apply regarding the different sub-groups in the labor force:

$$\begin{aligned} u_{NF} + e_{NF} &= \lambda \\ u_{NI} + e_{NI} &= 1 - \lambda \\ u_{MI} + e_{MI} &= M \end{aligned}$$

where  $\lambda \in (0,1)$  and  $1-\lambda$  represent the share of native workers in the formal and informal sector, respectively,  $M$  denotes the mass of illegal immigrants, and  $e_{ij}$  is the number of workers who are employed in sector  $j=F,I$  and are of origin  $i=N,M$ . The share  $\lambda$  is determined endogenously below. Moreover, in steady state, where the flows in and out of unemployment for each sub-group are equal to each other, we have

$$\begin{aligned} u_{NF} &= \frac{s_F}{s_F + m_F} \lambda, & e_{NF} &= L_F = \frac{m_F}{s_F + m_F} \lambda \\ u_{NI} &= \frac{s_I + \delta}{s_I + \delta + m_I} (1 - \lambda), & e_{NI} &= L_{NI} = \frac{m_I}{s_I + \delta + m_I} (1 - \lambda) \\ u_{MI} &= \frac{s_I + \delta}{s_I + \delta + m_I} M, & e_{MI} &= L_{MI} = \frac{m_I}{s_I + \delta + m_I} M \end{aligned}$$

Next, we can write the expression regarding the probability that a firm finds a native worker in the informal sector as

$$\varphi_{NI} = \frac{u_{NI}}{u_{NI} + u_{MI}} = \frac{1 - \lambda}{1 - \lambda + M}$$

### *Steady-State Equilibrium*

As mentioned above, native workers must decide in advance whether to search in the formal or in the informal sector. In making their decision, they compare the values of being in each of the two sectors. In equilibrium, they are indifferent between entering the formal or the informal sector. Therefore, the no-arbitrage condition is given by

$$U_{NF} = U_{NI}$$

This equality can be written as:

$$\frac{\beta m_F (1 - t_W + s_F \gamma) [(1 - t_p) p_F + r f] \Delta + \Gamma \Delta (r + s_F) b_{NF}}{\Phi_F} = \frac{\beta m_I (1 - \delta \eta) p_{NI} + (r + s_I + \delta) b_{NI}}{\Phi_I}$$

*Definition.* A steady-state equilibrium is a set  $\{g_j^*, e_{ij}^*, u_{ij}^*, w_{ij}^*, \lambda\}$  where  $i \in \{N, M\}$  and  $j \in \{F, I\}$ , such that

1. The intermediate input markets clear
2. The capital market clears
3. The free-entry condition for vacancies of each sector  $j$  is satisfied
4. The Nash bargaining condition between a worker of origin  $i=N, M$  and a firm in sector  $j=F, I$  holds
5. The numbers of employed and unemployed workers of origin  $i$  in sector  $j$  remain constant
6. The no-arbitrage condition regarding workers' mobility between sectors is satisfied

Substituting in the free-entry conditions, we derive the following two equations

$$\frac{c_F}{q_F} = \frac{\Theta_F [(1 - t_p) p_F + r f] - (1 - \beta) \Psi \Gamma b_{NF}}{\Phi_F} - f$$

$$\frac{c_I}{q_I} = (1 - \beta) \frac{\varphi_{NI} [(1 - \delta \eta) p_{NI} - b_{NI}] + (1 - \varphi_{NI}) [(1 - \delta \eta) p_{MI} - b_{MI}]}{\Phi_I}$$

where

$$\Theta_F = (1 - \beta) \Gamma \Delta - \Gamma \gamma (1 - \beta) m_F - \gamma \beta (r + s_F + m_F) \Delta,$$

Next, substituting the steady-state values of  $L_F$  and  $L_I$  into the price equations of  $p_{NI}$  and  $p_{MI}$  yields

$$p_{NI} = A_I x \left[ x + (1-x) \left( \frac{M}{1-\lambda} \right)^\rho \right]^{\frac{1-\rho}{\rho}}$$

$$p_{MI} = A_I (1-x) \left[ x \left( \frac{1-\lambda}{M} \right)^\rho + (1-x) \right]^{\frac{1-\rho}{\rho}}$$

Next, substituting the expressions for  $p_F$ ,  $p_{NI}$  and  $p_{MI}$  forms a system of three equations that describes the behavior of the three variables  $\{g_F, g_I, \lambda\}$

Having determined  $g_F^*$ ,  $g_I^*$  and  $\lambda^*$  we can obtain the equilibrium values for all the other variables by substituting in the appropriate equations.

## Calibration

We calibrate the model using data from Greece. We choose the parameters of the model to match the period 2000-2007 in Greece, Spain and Italy. One period in the model represents 3 months, so all the parameters are interpreted quarterly.

In order to perform the model calibration, we have chosen parameter values according to the relevant literature, the national legislation, and the statistics provided by various formal offices for statistics. Specifically, we start by calculating the separation rate in the formal sector ( $s_F$ ), using data from Eurostat. We follow the method suggested by Shimer (2005). Separation rate is

calculated using the formula  $s_t = \frac{U_{t+1}^s}{E_t (1 - 0.5 f_t)}$ , where  $U_t^s$  is the number of native workers

unemployed for under a quarter in quarter t,  $E_t$  denotes the number of employed workers in

quarter t and f is the job finding rate, given by the formula  $f_t = 1 - \frac{U_{t+1}^s - U_t^s}{U_t}$ . We assume that

the separation rate in the informal sector is equal to the one in the formal sector, that is  $s_F = s_I$ .

We use data from Eurostat to obtain the value for the overall unemployment rate,  $u_{rate}$ . Next, we obtain the size of undocumented immigrant workers, M, from the European Commission's Clandestino project.

Next, we turn to the value of the proportion of native workers that choose to work in the formal sector,  $\lambda$ . We follow Hazans (2011) who calculates the percentage of labor force employed in the formal sector in southern Europe.

We set the probability to get audit,  $\delta$ , equal to 0.05, which falls in the range suggested by the literature <sup>6</sup>

Next, we set the production parameter  $\rho=0.85$  as in Ottaviano and Peri (2011). We also set  $x$  equal to 0.5 and  $AF=1$ .

We calculate the size of the informal sector using data from Schneider & Williams (2013).

Following Chassamboulli and Palivos (2013) we calculate the interest rate in the following way: using data from Eurostat, we calculate the average yield to 10- year government bonds and using data from the World Bank we calculate the average growth rate of the Consumer Price Index over the period 2000-2007, for all three countries.

Following the common practice, we set the elasticity of the matching function  $\varepsilon=0.5$ , which satisfies the range given by Petrongolo and Pissarides (2001). We also follow the literature, setting workers bargaining power  $\beta=0.5$ , so that the Hosios condition is met (see Hosios, 1990)

We use data from the OECD to calculate the value of the unemployment benefits of the native workers in the formal sector,  $b_{NFrate}$ . We calculate the value of the various taxes, namely  $t_F$ ,  $t_w$  and  $t_p$  using data from the OECD taxing wages. Finally, we set the penalty rate,  $\eta$ , as in Di Porto *et al.* (2016)

We set the value of the administrative cost,  $frate$ , as in Mortensen and Pissarides (1999) and set the severance payment,  $\gamma$ , equal to 1.

Calibrated Values		
unfrate	0.080717	Unemployment rate of Natives in the formal sector
Unirate	0.139545	Unemployment rate of Natives in the informal sector
m I	0.352703	Rate at which a worker finds a job in I sector
e NF	0.652691	Employment Rate of Natives in F sector
e NI	0.249532	Employment Rate of Natives in the intermediate Informal sector
e MI	0.048358	Employment Rate of Immigrants in I sector
LI	0.143257	Labor Force in the Informal

<sup>6</sup> See for example in Pappa *et al.* (2015), Boeri and Garibaldi (2007)

		Sector
AI	1.248364	Production Function Parameter
p F	1	Price of the product of Natives in F
p NI	0.574328	Price of the product of Natives in I
p MI	0.734614	Price of the product of Immigrants in I
$\Phi$ I	0.237051	Model Parameter
WNF	0.74464	Wage of natives in F
$\Delta$	0.5965	Model Parameter
f	0.78	Administrative cost
$\Gamma$	1.23682	Model Parameter
b NF	0.171091	Unemployment income of Natives in the Formal sector
$\Phi$ F	0.0376	Model Parameter
brate	0.019764	Captures leisure, home production etc.
bNI	0.009689	Unemployment income of Natives in the Informal sector
WNI	0.490268	Wage of natives in I
bMI	-2.58801	Unemployment income of Natives in the Informal sector
WMI	0.294161	Wage of immigrants in I
Search	-2.59382	Captures the extra cost that immigrants bear
$\varphi$ NI	0.837666	Relative size of Native workers to Immigrant workers in the informal sector
$\theta$ F	0.290524	Model Parameter
$\Psi$	1.24752	Model Parameter
cF	0.263863	Cost of maintaining a vacancy in Formal Sector
cI	0.742632	Cost of maintaining a vacancy in Informal Sector

## Results

In our first policy experiment we find that an increase in the inspection rate leads to a higher destruction of informal jobs, which comes along with an increase of the flow of native

workers into the formal sector and lower job creation in the informal sector. Moreover, due to lower income taxes, the separation rate of native employees is lower and the flows of workers from informal to formal work are higher. Therefore, we observe an increase in formal employment as well as a reduction of the relative size of the informal sector, as well as an increase of the overall surplus.

Policy/Variable	Unirate	unfrate	emi	eni	Lamda	urate	enf	yiyratio
delta= 0.055 , t W=0.37	0.1499 15	0.0807 17	0.0477 75	0.2502 78	0.7055 85	0.103 688	0.6486 32	0.2757 14
delta= 0.053, t W=0.35	0.1457 97	0.0807 17	0.0480 06	0.2499 81	0.7073 52	0.102 212	0.6502 56	0.2750 25
delta= 0.053, t W=0.3	0.1457 97	0.0807 17	0.0480 06	0.2499 81	0.7073 52	0.102 212	0.6502 56	0.2750 25

Policy/Variable	w NF	w NI	w MI	YI	YF	S1	S2
delta= 0.055 , t W=0.37	0.5953 67	0.4072 92	0.2443 75	0.178837	0.648632	1.3951 44	1.38639
delta= 0.053, t W=0.35	0.5599 92	0.3887 64	0.2332 58	0.178837	0.650256	1.6012 46	1.59557 3
delta= 0.053, t W=0.3	0.3423 04	0.2455 02	0.1473 01	0.178837	0.650256	2.9483 73	2.95362 1

It seems that a combination of some deterrence policy, such as increasing the inspection rate, or the penalty rate if caught, combined with an incentive policy, such as deteriorating a tax rate or the firing costs, yield better results than using a single policy. In the next table we can see that single incentive policies can have a positive impact in all wages, but have no impact on other important economic factors. Finally, as this is a preliminary version of the paper, some interesting policy experiments on the size of the irregular immigration will be added soon, namely an amnesty and deportation.

Policy/Variable	w NF	w NI	w MI
f=1.2	0.747388	0.492271	0.295362
f=0.97	0.748057	0.492864	0.295718
f=0.92	0.748203	0.492993	0.295796
f=0.87	0.748349	0.493122	0.295873

Policy/Variable	w NF	w NI	w MI
t P=0.29	0.748621	0.493363	0.296018
t P=0.27	0.748631	0.493372	0.296023

t P=0.25	0.74864	0.49338	0.296028
t PI=0.23	0.748649	0.493388	0.296033
t P=0.21	0.748659	0.493396	0.296038
Policy/Variable	w NF	w NI	w MI
gamma= 0.9	0.751867	0.495488	0.297293
gamma= 0.95	0.750236	0.494419	0.296652
gamma= 0.85	0.753505	0.496563	0.297938
gamma= 0.8	0.755151	0.497642	0.298585
gamma= 0.75	0.756805	0.498727	0.299236

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## Appendix

In the following table we describe the parameter values used in the calibration:

<b>Calibration : Parameter Values</b>		
sF	0.0072	Separation Rate in Formal sector
mF	0.082	Rate at which a worker finds a job in the Formal sector
uRATE	0.1	Unemployment rate
M	0.0562	Illegal Immigrants Normalized: Number of Illegal Immigrants/Number of Native Workers( Labor Force)=280.000/4981936.667
lamda	0.71	(1-0.281) percentage of labor force employed in formal sector in Southern Europe
sI	0.0072	Separation Rate in Informal sector
delta	0.05	Probability to get audit
ex	0.5	Production function parameter
y	0.5	Production function parameter

ro	0.85	Production function parameter
YIYFRATIO	0.274	Relevant size of the Informal Sector
AF	1	Production function parameter
r	0.0035	Interest rate
beta	0.5	Worker's Bargaining Power
bNFrate	0.21	Unemployment income in F sector (as a percentage of wage)
tP	0.031	Tax on product
frate	0.78	Administrative firing cost
tF	0.28	Payroll tax
tW	0.4	Income tax
gamma	1	Severance payment
eta	0.42	Penalty rate

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## Transport Infrastructure contribution in welfare

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### Abstract

Besides the severity of its fiscal problems, Greece has, over the past several years, gradually but persistently lost international competitiveness, resulting in widening current account deficits, a deteriorating international investment position, and a poor record of inward foreign direct investment according to outlook report of OECD, 2016. Faced with increased financing constraints in transport infrastructure development, Greek government needs support for investment appraisals which enable their resources to be allocated in the most efficient way, with maximum return to society. The assessment of socioeconomic contribution is the key objective of this paper. The definition of the socioeconomic impacts based on concept of econometric input output analysis as well as the welfare metrics in national scale. According a top down approach the key dimensions that affect the economic growth and social welfare are presented and the relevant indexes presenting their innovation in time are given. Conventional wisdom is to provide estimations on added value to social issues caused by the transport development and present the methodology framework for measuring the contribution of transport development in social value chain. Greece is the case study of this paper, providing results from the contribution of large transport infrastructures in national welfare. The application key findings are essential for managers and decision makers to support actions and plans towards economic recovery of an economy presenting strong seasonal characteristics (because of tourism) and suffering from recession.

## **Introduction**

Transport infrastructure investment are often intend to revive a region's economic competitiveness, particularly that of a region under economic recession. Regions that are most likely to benefit from transport infrastructure investments, in terms of increased economic efficiency and equity, are those which are found in a transitional stage of development. Due to investment in transportation infrastructure capital, these regions are likely to experience greater growth in wages and jobs, than regions that are not in recession (Leck et al.2008).

Transportation and economic development interact with each other as transport makes significant direct, and indirect contributions to the economy and increases the cycle of economic activity. In particular, air transport infrastructure, as an indicator of a network's concentration and its ability to move passengers from their origin to their destination is a vital component of a country's socioeconomic development, because it creates wider economic benefits of trade in services and goods, tourism, investment, productivity and innovation. Even though the benefits of the air transport are essential, limited research is published regarding the linkage of air connectivity and other business sectors (such as tourism), the spillover effects on regional economy and the overall contribution of air connectivity to socioeconomic development.

## **Methodology for Transport Infrastructure socioeconomic impact assessment**

A wide range of models and techniques are used for evaluating the impacts of transportation improvements on economic growth. The quantification of economic (income) and social (employment) impact due to transport infrastructure is estimated through economic impact analysis. Economic impact analyses usually employ one of two methods for determining impacts. The first is an input-output model (I/O model) for analyzing the regional economy. These models rely on inter-industry data to determine how effects in one industry will impact other sectors, (Dimitriou et al., 2011). Based on this data, multipliers are calculated and used to estimate economic impacts, (Dimitriou et al., 2015) Another method used for economic impact analyses are economic simulation models. These are more complex econometric and General Equilibrium Models (CGE). They account for everything the I/O model does, plus they forecast the impacts caused by future economic, prices and demographic changes, (Knaap et al. 2011, Gjerde et al.2016).

The transport industry has a substantial economic impact, both through its own activities and as an enabler of other industries. There are two levels of economic effects: the first level ensues through the generation of employment, income, and capital investment “naturally” occurring in the process of producing transport services and the second level of effects are the dynamic economic “catalytic” or “spin-off” benefits, in particular the direct/inward investment including tourism development stimulated by aviation. Transportation Research Board report (TRB 2008), provide a concept to estimate the economic effects of transport services, typically relying on the following approaches: input-output models (multipliers), the assessment of costs and benefits, and the analysis of catalytic effects. Applications of input-output models have traditionally centered on the national level, but modifications to the method of account for the increasing interest of the inclusion of specific local characteristics and regional economic development are popular, (Dimitriou et al., 2015).

The impacts due to transport infrastructure are divided into four distinct categories: direct, indirect, induced and catalytic. The direct contribution of the transport in the national economy is measured by the direct contribution to employment (jobs created) and the contribution to GDP (income generated), and is quantified as the total number of jobs created because of the region's transport. The indirect contribution to employment and income is quantified as the total number of jobs in the region that support the transport activity, including the suppliers to transport. The Induced effect is referred to the income generated from the expenditures (consumption and investments) of the direct and indirect employees. Therefore, induced contribution captures the secondary impacts to the economy as direct/indirect sales, and payroll impacts are circulated to supporting industries through multiplier effects. Catalytic impact capture the extent to which transport contributes to a national/regional economy beyond any effects that are directly or indirectly associated with the transport industry itself.

The induced and catalytic contribution on regional or national economy is estimated based on Input-Output (I-O) analysis. I-O is used to estimate how the change in demand for one business sector affects other sectors and the economy, based on the national I-O tables that represent the production structure of an economy by given the income generated in each economic sector for a given time. The I-O tables are compiled in accordance with the European System of Accounts 2010 (ESA 2010), harmonized by Eurostat's standardized questionnaire, which distinguishes 64 products (classification CPA2008) and 64 industries (NACE rev 2. A64). Each European State Member compiles its own national accounts, through an institution appointed by its government, such as its National Statistical Office or its National Central Bank. The latest available tables that are used in this application are for the reference year 2010. Based on matrix calculations these tables are converted into a set of coefficients (multipliers) that depict the link among the sectors of economy, (Dimitriou et al., 2015).

### **Case study - Air Transport socioeconomic impact in Greece**

The air transport activity deals with air carriers and airport operations, aircraft maintenance, air traffic control and activities directly serving air passengers, such as check-in, security services, baggage-handling, on-site retail and catering. These jobs represent the jobs in aviation primary firms that serving the region under examination. The indirect jobs are jobs linked to aviation fuel suppliers; facilities management and construction companies; the providers of products sold in airport retail shops, and a wide variety of supporting activities related to the air transport services sector (call centers, IT, etc.). These activities exist because of the aviation business in the region. For air transport, there are many and different sources of catalytic economic impact, covering most of the business activities and trade. The estimation of the catalytic effects of aviation in tourism is based on average international tourist spending multiplied per O/D.

Greece has been selected for the application mainly for two reasons, because Greek economy is heavily dependent on the tourism sector and it is long term suffering financial stress. Tourism is a key driver towards national economy recovery and decisions on improving air connectivity and new investments in Greek airports in order enable long term economic growth are on the top of the government agenda. The modelling framework and the application results are given in an essential manner flexible to use in similar applications. The results highlight key messages to decision makers and stakeholders regarding the air

connectivity and economy linkage and provide an essential tool to estimate the impact of alternative policies and investments in industries related to air connectivity, aviation and tourism.

### *Greek economy profile*

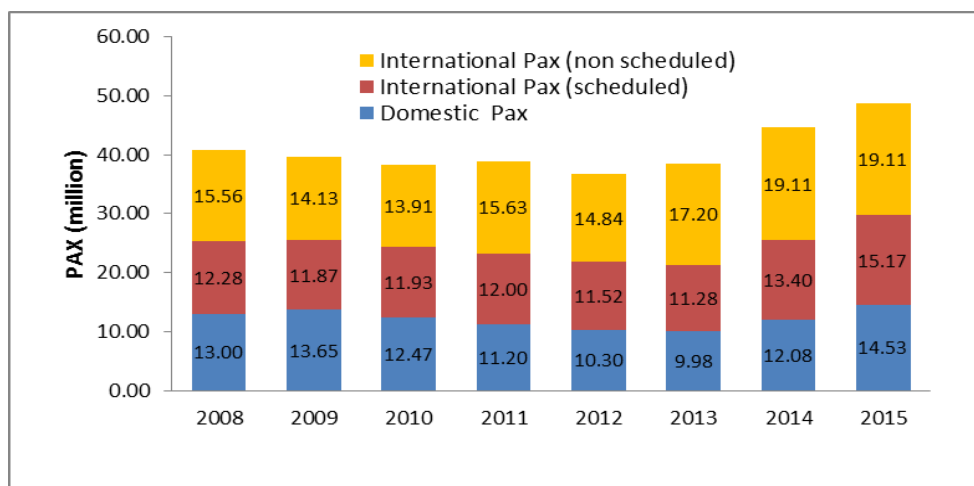
Adoption of the Euro in the 2000s allowed Greece easy access to foreign borrowing that financed a significant expansion of government spending. Private credit growth following financial liberalization also boost household consumption and after having achieved high growth rates until 2006, showed signs of recession in 2007, whereas from 2009 onwards the recession has been intensified considerably due to country’s fiscal imbalances. The need for consolidation has led the country to embark on a trilateral mechanism of financial support, comprising the EU. The restrictive income policy and drastic limitation of public expenses during the past few years had a negative impact on GDP, as analytically depicted in Table 1. Concerning social values, the growing unemployment rates in Greece is a major problem of the social life. According to OECD (2016), Greece shows one of the highest shares of long-term unemployment among OECD countries, as the unemployment in Greece remains stuck at close to its highest level in years 2011-2015 since the onset of the economic crisis as analytically depicted in following Table 1.

**Table 1: GDP (market prices) and total employment for Greece, 2008-2016 (Source: OECD, Eurostat 2016)**

	2008	2009	2010	2011	2012	2013	2014	2015	2016
GDP (in market prices- thousands)	241,990	237,534	226,031	207,028	191,203	180,654	177,940	175,697	175,887
Employees (in thousands)	4,610	4,556	4,389	4,054	3,694	3,513	3,536	3,610	3,673

### *Key features of air Transport in Greece*

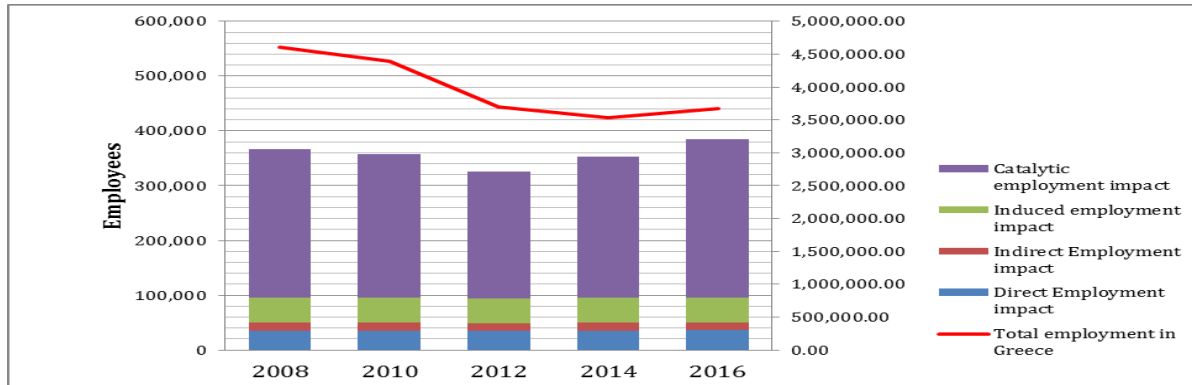
Over the past eight years, the air transport industry in Greece has experienced the effects of economic recession, a weak Greek economy recovery and rising fuel prices. The industry has shown its resilience by adapting itself to satisfy the needs of a very competitive market. This growth was driven by both the foreign visitors’ dynamic growth of as well as the Greek travellers’ robust rise as analytically depicted in Figure 1, demonstrating the considerable enhancement of Greek airports connectivity.



**Figure 1: Total passengers (Pax) in Greece 2008-2015 (source: HCCA, 2016)**

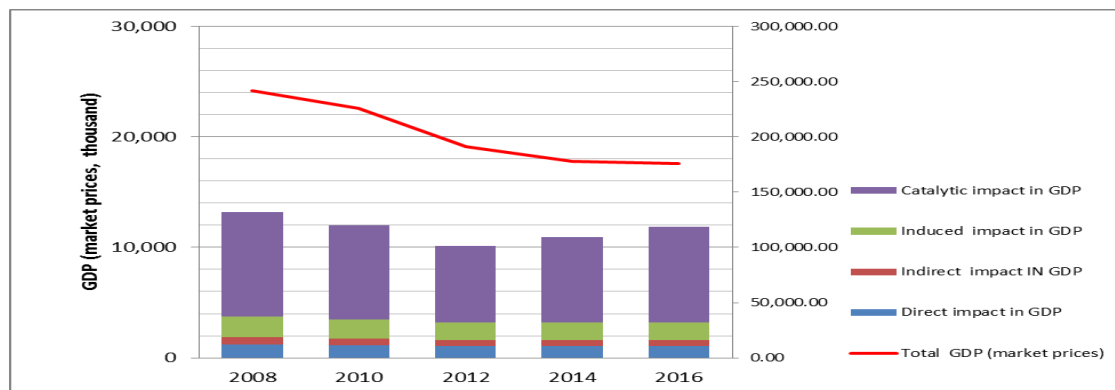
## Results: Socioeconomic effects footprint analysis of air transport in Greece

The effects of air connectivity in Greek economy are quantified based on the modeling framework of IO analysis presented in the modelling framework section. The application is for time period between 2008 and 2016. Air connectivity employed more than 365 million people in 2008 (analysis base year) and despite the significant growth of unemployment it reached around 385 million in 2016. While most of the economic sectors have been shrink resulting less employment, air connectivity expanded providing strong support to economic system. This fluctuation is presented in following figure.



*Figure 2: Fluctuation of overall air transport contribution on employment*

In terms of generated income, the effects of air connectivity are essential. While the total income in Greek economy is reduced about 25% between 2008 and 2016, the income caused by air connectivity is reduced less than 7% in the same time, providing evidence of the aviation business resilience. The analysis of effects for each category, as it is calculated by the I-O analysis framework. The catalytic effects in 2016 were significantly increased reaching the level of €8.6 billion, representing the pre-economic crisis performance. In other words, the air transport system reacting appropriately and tackle the obstacles of economic recession, providing strong evidence of recovering. By observing the fluctuation of income contribution to national GDP, as it is presented in Figure 4, the over contribution of international air connectivity to the economy is essential growing into the economic recession period, from around 6% in 2008 to around 7% in 2016. In other words, while more of the business sectors is facing strong downturns, the international air transport activity is reacting positively and resulting higher contribution in national income.



*Figure 3: Fluctuation of overall air transport contribution on Greek national GDP (2008-2016)*

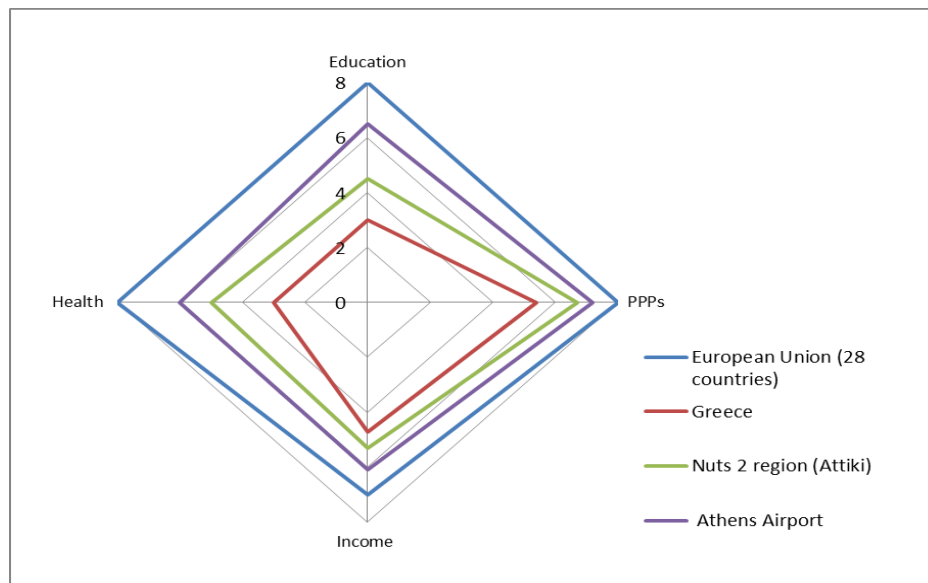
## Air Transport Infrastructure and Welfare contribution

National visions for transport infrastructure improvements need to reflect wider objectives, including not only those related to previous economic growth and development but also those related to welfare contribution. (Hammes et al.2016;Niehum et al.2016).

Evaluation processes for transport infrastructure improvements need to be adapted to the changing objectives and contributions to welfare, including the estimated impact on:

- Health
- Education
- Purchasing Power based on overall consumption per inhabitant
- Average Income per employee

Evaluation need to be improved to capture the full range of the above components of impact on welfare expected over the longer periods involved. Once these improvements are made, along the components of the welfare described in Figure 4above, better transport strategic infrastructure investments with clear contribution on welfare can be expected. For the case study as analyzed in Figure 4 above a strategic transport infrastructure's (main airport in Greece, Athens International Airport) contribution in welfare is very high and boosts the overall levels on welfare of the catchment area and drives the components of national welfare towards the higher average levels of European Union .



*Figure 4: Welfare impact analysis for large infrastructure in Greece*

### Concluding remarks

The methodology concept and modelling approach provided essential benefits to support decisions on investments prioritization, infrastructure or services privatization and sustainable strategic planning, providing essential tool to scenario assessment, to improve connectivity and enable long term socioeconomic development. The results indicate that air transport is essential for Greece and thorough the last year's economic downturn is resulting higher dependence to aviation mainly because the tourism and air transport linkage and the high spill-over effect of both industries to national economic model. Therefore, air transport is a



crucial issue that planners and decision makers should be concentrated towards economic recovery and decisions impact aviation business, especially, for the aviation related ground infrastructures (ownership scheme, investments etc.) must be reviewed under the view of the impact on local economy and business resilience.

Finally an evaluation of transport infrastructure impact on welfare is needed to get investments in strategic infrastructure back on track, in countries as Greece, that are in recession and whose strategic transport infrastructure is not rated highly enough. The strategic infrastructure needs and investments need to include improvements across all major factors that affect welfare. Once these improvements are made, along the components of the welfare described previously better transport strategic infrastructure investments with clear contribution on welfare can be expected. Finally the results suggest that large transportation infrastructures spur economic growth and strengthen social values and generate employment directly but also through indirect and induced multiplier effects across the economy. The estimated results provide a strong evidence of the existence of long run cointegrating relationship among economic growth, infrastructure investment and unemployment reduction investigating the high level of coverage of national socioeconomic targets caused by new large transportation infrastructure projects. Therefore in order to achieve the objective of accelerated economic growth and strengthen social values by next years, government authorities and stakeholders need to increase and sustain the level of large infrastructure investments. This is imperative to support decision makers to invest in such infrastructures and ensure sustained reduction in current inequalities in income distribution and reduce the high levels of poverty and unemployment.

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