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OVEREDUCATION: EVIDENCE FROM PORTUGAL

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Abstract

The levels of educational attainment have risen strongly over the last thirty years in Europe. In Portugal, the education system, particularly the higher education sector, expanded in late 80s. Parallel to this expansion have been growing up concerns about the incidence of overeducation in Portuguese labour market. This study presents an extensive review of literature about overeducation and ways of measuring the phenomenon, as well an evolutive description on higher education in Portugal and some recent developments at European and National level. The study was based on objective and empirical approach, focusing overeducation as a form of underutilization of educational skills and linking worker's formal education with the skills required to perform a job. Using the 1998, 2004 and 2009 data from Labour Force Survey collected by Office of National Statistics (INE), the present study analysed overeducation in Portugal, aiming to identify and quantify the existence of the phenomenon during the considered period. The study results revealed the existence of overeducation over the period, along with an increase of incidence, which varies with gender and being more relevant on women.

Keywords: Overeducation; Higher Education; Graduates; Labour Market; Portugal

Resumo

Nos últimos trinta anos os níveis de escolaridade aumentaram significativamente na Europa. Em Portugal, o sistema de educação, em particular o ensino superior, expandiu-se durante os anos 80. Paralelamente a esta expansão, cresceram também as preocupações sobre a incidência de sobre-educação no mercado de trabalho Português. Este estudo apresenta uma extensa revisão da literatura sobre o conceito e medição do fenómeno, assim como uma caracterização da evolução do ensino superior em Portugal e desenvolvimentos recentes a nível europeu e nacional. O estudo realizado baseou-se na abordagem objectiva e empírica, centrando a discussão na definição de subutilização da educação, comparando a educação formal adquirida pelo trabalhador com a educação requerida para desempenhar uma determinada profissão. Neste estudo foi analisada a situação portuguesa, recorrendo a dados do Inquérito ao Emprego recolhidos pelo Instituto Nacional de Estatística (INE), com referência aos anos de 1998, 2004 e 2009, com o objectivo de verificar a existência de sobre--educação e a sua evolução durante o período. Os resultados obtidos no estudo identificaram a existência de sobre-educação, conjuntamente com um aumento da sua incidência, a qual varia de acordo com o género, sendo mais significativo nas mulheres.

Palavras-chave: Sobre-Educação; Ensino Superior; Licenciados; Mercado Trabalho; Portugal

To my wife Fernanda and to my daughter Andreia

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List of Abbreviations

AT	Assignment Theory
BP	Bologna Process
CEA	Criteria of Empirical Analysis
CEDEFOP	European Centre for the Development of Vocational Training
CMT	Career Mobility Theory
CPS	Census Public Use Sample
DOT	Dictionary of Occupational Titles
EEC	European Economic Community
EU	European Union
EURYDICE	Network of Information on Education Systems and Policies in Europe
EUROSTAT	Statistical Office of the European Communities
GDP	Gross Domestic Product
GED	General Educational Development
GEPE	Cabinet of Statistical and Education Planning
GPEARI	Cabinet of Planning, Strategy, Evaluation and International Relations
GSOEP	German Socio-Economic Panel
HCT	Human Capital Theory
IALS	International Adult Literacy Survey
IEFP	Institute of Employment and Professional Training
IER	Institute for Employment Research
ILO	International Labour Office
IMF	International Monetary Fund
INE	Office of National Statistics
IQ	Intelligence Quotient
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupation
JCT	Job Competition Theory
JST	Job Signalling Theory
KBE	Knowledge-Based Economy
LFS	Labour Force Survey
MCTES	Ministry of Science, Technology and Higher Education

ME	Ministry of Education
MISI	Cabinet Coordinator of Information System
MTSS	Ministry of Labour and Social Solidarity
NCO	National Classification of Occupations of 1994
NEP	National Employment Plan
NOC	New Opportunities Centres
NOI	New Opportunities Initiative
NQC	National Qualifications Catalogue
NQS	National Qualifications System
NRP	National Reform Programmes
OECD	Organisation for Economic Co-Operation and Development
OI	Observatory of Inequalities
OMC	Open Method of Coordination
PCO	Portuguese Classification of Occupations of 2010
PSID	Panel Study of Income Dynamics
R&D	Research and Development
SIGO	Information System and Management of Supply Education and Training
SMT	Spatial Mobility Theory
TDO	Theory of Differential Overqualification
TP	Technological Plan
US	United States

Introduction

Education plays a key role in the modern economic and social development process. Sustainable economic growth in developed economies requires a population with high level of schooling.

Throughout the 20th century Portuguese economic growth was relatively constant, albeit more consistent after the 1950s. However, developments in education were quite irregular. During more than two thirds of the 20th century the median schooling level of the Portuguese population was just 4 years of schooling lag considerably behind of most European countries.

Despite a remarkable progress in past few decades, the educational attainments of Portuguese workforce remains rather fragile compared with other advanced economies. More recently, some other countries such as Japan and Ireland made a considerable advance in educational attainments, both currently with rather high schooling levels.

By contrast, Portugal began the "*Human Capital Century*", with a reduction in the number of compulsory years of schooling, from 5 years in 1919, to 3 years in 1930. This situation lasted for more than 30 years, and at the beginning of the last quarter of the century, the workforce in Portugal had the lowest schooling level of all OECD countries.

Developments in the supply and demand for skills, which characterised the Portuguese economy in the 20th century, conditioned its development pattern at the beginning of the 21th century. In the last three decades, through the increasing openness and world economic integration, technological changes in the Portuguese economy seem to have increased (Centeno *et al.*, 2010).

But increasing on globalisation and the enlargement of the European Union has reinforced competitive pressures on the Portuguese economy. The structural backwardness of Portugal, particularly in terms of education, may depress economic growth and the lack of formal education of the Portuguese workers has been pointed as one of the biggest problems of the Portuguese economy (Carneiro, 2008).

At the beginning of the 1980s the Portuguese workers had an extremely low schooling level. More than a decade and a half was needed to see a significant improvement in the qualification's structure.

After all, in the last three decades there was a profound educational transition in Portugal. This educational transition was particularly significant in higher education, whose levels of qualification of the labour force have been historically low.

Over the last two decades the country has experience a massive expansion of its higher education system and the numbers of students enrolled growth up.

The Lisbon Strategy has stressed the need to invest in the massive qualification of the workforce in order to improve Europe's competitiveness position and to promote social cohesion. Moreover, this policy agenda has had particular appeal in countries such as Portugal, where governments could present this expansion as way of catching-up other countries' levels of qualification (Teixeira *et al.*, 2011).

Meanwhile, the volume of educational activity was expanding rapidly. The number of people participating in education beyond compulsory schooling has grown from a small minority to a vast majority (OECD, 2009).

The debate on the expansion of educational attainments of workers has tended to go in cycles. The unreserved optimism of late 60s that education would solve problems of both growth and inequality, quickly gave way to predictions of massive waste of resources by creating overeducated individuals (Berg, 1970; Freeman, 1975, 1976; Rumberger, 1980, 1981).

The present study aims to find out what is really happening on Portuguese labour market, in particularly, what is meant by overeducation? Who has studied this phenomenon? How can it be measured? And finally, if in fact overeducation does exist in the Portuguese labour market.

This study will address these questions in an attempt to better understand the phenomenon.

The study is divided into three chapters. The Chapter 1 is organized in three sections: the first explores some possible definitions to overeducation and an extensive review of literature; the second discuss how overeducation can be explained by alternative perspectives of the labour market; and the third how can it be measured.

The Chapter 2 is structured in two sections: the first begins with a brief note on Portuguese higher education history and an overview about its figures; the second reveals some recent developments at European and National level and some challenges to the next future.

The Chapter 3 will constitute the empirical study. This chapter have three sections: the first introduces the study source and data set; the second outlines the methodology and the empirical construction for overeducation analysis; and the third presents the results of incidence of overeducation.

The present study ends with some concluding remarks.

Chapter 1

What do we know about overeducation?

1. Background

In the last decades, European countries have gone through a process of educational expansion, an important part of which has taken place in higher education.

The process of educational expansion in higher education is regarded by some as intrinsically good; even necessary, in order to meet an increasing demand for skills that would be naturally associated with the advent of knowledge society.

But with rapid expansion of participation in higher education, educational levels of the population in general are now much higher than before. With this expansion of higher education, there have been growing concerns about graduates that became overeducated in labour market, because demand for better qualifications does not followed the rhythm of supply growth.

There is now a substantial literature covering various aspects of imperfect job matching in relation to the educational attainments of workers and the educational requirements of jobs.

1.1 Definition

Concerns began earlier (Freeman, 1976a; Thurow, 1975 or Berg, 1970), but it was in the early 1980' that the concepts of overeducation and undereducation[1] took root in the economics of education literature, after seminal work by Rumberger (1981a) and Duncan and Hoffman (1981).

More than thirty years of research in the field have consistently established that overeducation can be defined in a number of ways. For example, if we take Rumberger work, we can discuss several alternative definitions of overeducation, considering three different perspectives:

i) *Declining Pecuniary Returns*

This definition deals with the higher earnings associated with more educated workers and overeducation exists when the pecuniary return to a particular level of schooling falls below its historically high level or declines relative to all other investments (Rumberger, 1981a: p.8).

[1] Conversely, undereducation refers to the extent to which individuals acquired education levels fall below those required by the job (McGuinness, 2006: p.415).

ii) *Unrealized Expectations*

Another definition of overeducation is based on the degree to which individuals realize their career expectations by participating in the educational system and overeducation exists when an individual's expectations concerning the labour market benefits from an investment in schooling are not realized (Rumberger, 1981a: p.10).

iii) *Underutilization of Educational Skills*

The final definition of overeducation is based upon the utilization of educationally developed skills within the labour market and overeducation exists for those individuals in the labour force who are employed in jobs that do not make full use of their education (Rumberger, 1981a: p.15).

However, as was identified by Rumberger, the definitions may overlap. For example, the first definition is based on actual earnings while the second is based on expectations about jobs. The latter could include earnings as one component. The second definition, which deals with expectations, is the most general since it could compass a number of labour market phenomena associated with education.

The first two deals with rewards (e.g., earnings and status) associated with educational attainment while the third deals directly with utilization of cognitive skills.

Due to the fact that the three definitions are based on different labour market phenomena, it is possible to observe the existence of overeducation according to one definition but not another (Rumberger, 1981a: p.18). However, some evidence indicates that overeducation could exist in the contemporary labour market according to all three definitions (Freeman, 1976a). Since evidence is conclusive, the problem of selecting the appropriate definition remains (Rumberger, 1981a).

1.2 Literature Review

The treatment of overeducation by employment researchers have begun with Ivar Berg's monograph (1970). Under the title *The Great Training Robbery*, Berg tried to demonstrate that the labour market was no longer able to absorb the output of university and college

graduates comfortably following the sharp rise in their numbers in the wake of the *baby boom*[2] and changes in educational preferences[3].

The repercussions were keenly felt in the form of unemployment and overeducation, accompanied by falling returns to education. As the *Bureau of Labor Statistics*[4] later established, the number of university and college graduates in undereducation jobs multiplied from about 1 million to 3.6 million in the short period from 1969 to 1980 (Hecker, 1992: p.5).

One methodological innovation made a very early appearance in the study by Kalleberg and Sørensen (1973), which presented a simple measurement strategy for the collection of empirical data on overeducation subject.

This approach was based on the *Dictionary of Occupational Titles/General Educational Development* (DOT/GED)[5] system and followed on from the work of Eckaus (1964) and Scoville (1966), who took the measurements, provided by the authorities for assessing the required skill level for jobs in the various occupational categories and adapted them for use by employment researchers. These multivariate data analyses did not control for significant factors yet, such as age.

In 1975, following thematically related preliminary studies (Freeman, 1971, and Freeman and Breneman, 1974), one of the main references in research, Richard B. Freeman, refocus the debate on overeducation.

Freeman started his approach with a question: *Overinvestment in college training?* (Freeman, 1975a). He was firmly convinced that the college system in the United States (US) had been producing a large surplus of qualifications since the sixties, which was not entirely due to the demographic effect of the *baby boom*.

[2] As a generic concept, baby boom is a large increase in the number of births relative to some previous year or average. The magnitude of the baby boom, especially in United States, took place in the post-World War II, from 1950s and early 1960s (Morgan and King, 2001).

[3] See also his subsequent works on this subject, such as Berg (1989).

[4] The *Bureau of Labor Statistics* of the United States Department of Labor is the principal Federal agency responsible for measuring labour market activity, working conditions and price changes in the economy. Its mission is to collect, analyze and disseminate essential economic information to support public and private decision-making – see more in link http://www.bls.gov/.

[5] See more details on Fine (1968).

Freeman tried to underpin this assertion in subsequent works, including one devoted to the issue (Freeman, 1976a)[6]; this period also saw the appearance of Freeman special studies devoted to specific occupational groups (Freeman, 1975b, 1975c and 1976b).

The "*discovery*" of the growing imbalance between the supply and the demand for higher education in the US labour market had already been made at that point[7], but it had not been sufficiently widespread.

The titles of Freeman's studies on the subject of overeducation suggested that the hypothesis underlying his research is an incontrovertible truth, and his sometimes drastic speculations on the consequences of the growing education surplus (e.g., "*destabilizing political consequences*" – Freeman, 1976a: p.189) achieved their aim and made Freeman one of the most-quoted author in literature on the subject, even thought numerous papers in a similar vein appeared at that time (see for example Jenkins, 1974; Rawlins and Ulman, 1974; Dore, 1976; Jaffe and Froomkin, 1978; Brinkmann, 1978; Suda, 1979; Denison, 1979, and a later work related to Canada, namely Dooley, 1986).

Later on, Russel Rumberger emerges in this discussion alongside Freeman, but did not find any empirical evidence to suggest that the relative position of university and college graduates in the labour market was deteriorating. However, he identifies a rise in overeducation (Rumberger, 1980).

In subsequent studies, Rumberger (1981b, 1981c and 1984) focussed on presenting evidence in support of his thesis that the development of the job structure in the US is marked by a slower rise in skill requirements than would be necessary to ensure that enough appropriately skilled jobs were available for the masses of new university and college graduates entering the labour market.

Rumberger even asks the question whether technical progress, contrary to common belief[8], actually leads to a reduction in the skill level required for the average job (Rumberger, 1981b: p.588; see also Rumberger, 1981a: p.67).

Rumberger studies are innovative in relation to Freeman's in that Rumberger shifts the concept of overeducation from the macroeconomic level to that of the individual one, because all of his measurements are based on the DOT/GED approach.

[6] For a review of the monograph, see Levin (1977).

[7] See for example Carnegie Commission on Higher Education (1973).

[8] See for example Cappelli, 1993, who examines the production system.

Rumberger's work on *Overeducation in the US Labour Market* (Rumberger, 1981a) – the most important on the subject of overeducation along with Freeman's *The Overeducated American* and perhaps also Sullivan's *Marginal Workers, Marginal Jobs* (Sullivan, 1978) – goes far beyond and previous literature in its comprehensive and thematically broad portrayal of the researched aspects of overeducation.

Another major innovation in the study of overeducation is to be found in Duncan and Hoffmann, 1981[9]. These two authors examined at an individual level the financial returns to necessary, surplus and deficit components of education, thereby establishing a direct link to the human capital approach. In place of the DOT/GED system, they used subjective data obtained directly from employees about the skill level required for their respective jobs. This information had originally been collected from the 1976 survey batch of the Panel Study of Income Dynamics (PSID). A similar approach underlines studies by Rumberger (1987) and Shokey (1989).

New dimensions were added by Burris (1983a), whose study was the first to explore the sociological and political aspects of overeducation. Until then, studies had only analysed individual sociological or political aspects, such as the effects of overeducation on health[10].

The studies by Jaffe and Froomkin (1978), Clogg (1979), Clogg and Sullivan (1983), Clogg and Shokey (1984 and 1985), Clogg *et al.* (1986) and Lichter (1988), proved that the rise in overeducation in the US was caused to a great extent by changes in the demographic structure of the potential labour force. And the study made by Burris (1983b) can be considered as part of this cluster, too.

In 1985, Tsang and Levin seek to present the first integral economic theory to explain the persistence of overeducation; the study focuses primarily on productivity issue[11]. The main dimensions of productivity losses that result from overeducation are given in several ways such as: lesser degree of job satisfaction (Khan and Morrow, 1991; Johnson and Roy, 1995; and de Witte and Steijn, 1998), poorer health (Amick and Lavis, 1998), higher incidence of shirking, absenteeism, narcotics, and alcohol consumption at work, and "*sabotage*" (Tsang and Levin, 1985; also Haugrund, 1990).

[9] See also the Duncan and Hoffmann study of 1978, which was the forerunner of this work.

[10] See for example Kasl, 1974; House, 1974; Coburn, 1975; and Caplan *et al.*, 1980.

[11] For a critical appraisal, see de Grip, 1989; for a reply to this criticism, see Tsang and Levin, 1989.

But in general terms, the findings of the author's aforementioned studies can serve to explaining the persistence of overeducation in the labour market by demonstrating that it makes economic sense for employers to hire overeducated staff, because they are expected to be more productive than other less educated candidates.

By 1986, the postulate that overeducation was gradually developing into a critical problem within the US labour market had come to be regarded as an established fact, but it was subjected to critical examination for the first time by Smith (1986). This methodologically based study, which was sharply critical of the measurement strategies[12] used in support of the said postulate, had a limited impact.

Outside the US, the expansion of educational provision was the subject of controversy in various countries[13]. In the European sphere, the only comprehensive monograph on overeducation came from Germany (Büchel, 1998).

One of the main innovative methodological elements of this study is that it was the first to adopt the existing instruments of dynamic unemployment research systematically for use in the analyses of overeducation. In this way, on the basis of panel data, it was possible to analyse the probability of individuals being recruited and staying with or leaving their firm, to determine long-term income effects.

One important preliminary work, especially with regard to the categorisation of overeducation, was performed in the studies by Büchel and Weißhuhn (1997 and 1998).

Other references from Germany came through Schlegelmilch (1987) that presented a monograph analysing data on overeducation among graduates.

Plicht *et al.* (1994) presented the first broad-based study of the suitability of jobs held by university graduates in Germany. Their approach may not correspond exactly to the DOT/GED strategy, but it is related because does not have recourse subjective assessment of job-requirement levels by the respondents themselves. Although it is designed as a cohort study without longitudinal examination of individuals, the authors postulate that the high percentage of young graduates in jobs for which they are overeducated is due to the fact that overeducation is a natural phenomenon at this stage of a graduate's career.

This interpretation was put into perspective by Büchel (1996): although the risk of involuntary overeducation is higher at the start of a career than after a period of occupational

[12] To cover the main frame of Measuring Overeducation see section 3.

[13] For a general review see Teichler (1996).

experience, it has proved that structural and cohort effects have played a dominant role during the nineties. In other words, the percentage of graduates who tend to run a higher risk of overeducation on account of their membership of particular status groups (e.g., women and graduates of technical colleges) was rising steadily, and membership of these groups was largely unalterable in the course of a career.

The situation of academically trained career starters is examined by Büchel and Matiaske (1996) on the basis of longitudinal data from the German Socio-Economic Panel (GSOEP). It emerges from this study that a high risk of overeducation at the start of a career attaches to certain "*soft*" academic disciplines which are mainly chosen by female students. An interaction analysis shows that the gender effect is governed by the student's choice of subject.

Overall, most of the other literature relating to the more recent discussion of the phenomenon of graduate overeducation in Germany may be divided into two categories:
- The *first category* comprises highly specific surveys of graduates, differentiated by subject specialisation[14] or by specific departments of individual universities[15];
- The *second category* comprises papers presented at conferences on the subject of graduate career prospects and subsequently published in the report of proceedings.

In Germany the latest discussions about the future of graduate employment are focusing on overeducation and unemployment as closely related phenomena[16].

In the Netherlands, there are several analyses of job/education matches. If we focus exclusively on the studies devoted to overeducation, it emerges that Dutch employment researchers, compared with their colleagues in the European Union (EU), have been the most contributors on this subject.

The first studies were undertaken by Hartog (1985a and 1986). His approach is very similar to that of Duncan and Hoffmann (1981), though he does not cite the latter work. Like Duncan and Hoffmann, he rejects unilateral determination of pay rates for the Dutch context, either by the supply side through formal qualification (the human capital theory) or by the

[14] Most of these have been conducted by the University and College Information System (HIS) in Hanover. The HIS studies are reports on graduates in specific states or subjects, based on the system's own surveys – see for example Minks, 1992 and 1996; Minks and Filaretow, 1993; Lewin *et al.*, 1994a and 1994b. But one of the central problems with these studies lies in the database, which only covers the first years of a graduate's career.

[15] This type of survey is conducted by "*interested parties*", i.e., students in one the departments in question, often as one of their degree papers.

[16] See for example Schreyer, 1999 and Wissenschaftsrat, 1999.

demand side through job requirements (the job competition model). He provides evidence of the explanatory capacity of the assignment theory[17].

Extending this approach, Hartog and Oosterbeek (1988) identify a gradual rise in overeducation in the Netherlands over a period of time. On another hand, Groot (1993a) refines the approach of Duncan and Hoffmann (1981), by devoting special attention to the link between training activities and mismatches. Overeducation, Groot says, as an adverse effect on total income from employment and has on the returns to in-service training.

In more recent papers on the subject, Hartog (1997 and 1999a) passes critical judgement on the body of research into overeducation. As far as future research perspectives are concerned, the author puts the case for longitudinal analyses, more theoretical input, more ambitious evaluation procedures, and analytical approaches in which supply and demand effects are considered.

In the study by Hartog and Jonker (1998)[18], the authors have access to the Brabant Survey, which includes IQ measures. Having the opportunity to control for individual ability opens the door to new aspects. The authors find that the impact of this variable on the risk to work overeducated is relatively low.

In other studies (Hartog, 1999b, c and d), Hartog once again warns against investing overeducation with pejorative connotations, referring to the positive, albeit limited, returns to surplus years of education which were previously identified by Duncan and Hoffmann (1981).

There are a number of other studies focused on particular aspects. On the one hand, Borghans and Smits (1997) show that an increasing percentage of overeducation in labour can also impair the earning potential of adequately educated employees.

De Witte and Steijn (1998) discover a direct link as well as frustration effects in overeducated employees. Batenburg and Witte (1998) identify a rise in the mismatch rate within the Dutch labour market over the period from 1977 to 1995. Groot and Maassen van den Brink (1999a and b) demonstrate the sensitivity of the measurement strategies used to identify jobs which are incommensurate with their incumbents' qualifications. The study by Borghans and de Grip (1999) examines determinants of overeducation, categorising them by whether or not they are compatible with the allocation theory. However, a clear result does not emerge. Van der Velden and Van Smoorenburg (1999) compare results gained from the

[17] To cover the main frame of Theoretical Reflections on Overeducation see section 2.

[18] For Brabant Survey see also Groot (1993b).

so-called objective and subjective measurement approach, and conclude that overeducation measured with an objective approach is clearly overestimated. On the other hand, they do not find hints for an underestimation of overeducation when applying the subjective approach.

Besides the aforementioned works, there are several relevant essays in Dutch, such as Hartog, (1985b), Oosterbeek, (1986), Groot, (1993b), Groot and Maassen van den Brink, (1996), Oosterbeek and Webbink (1996), and Groeneveld (1997), which testify, as in the case of Germany, to a wealth of research on the subject of overeducation.

In the United Kingdom, Sloane *et al.* (1996) were the first to devote a study to the subject of overeducation. Their work is based on the research approach adopted by Duncan and Hoffmann (1981) and delivers similarly structured findings. On the contrary, Battu *et al.* (1998 and 2000) test the theory of differential overeducation (Frank, 1978a) and arrive at a negative result.

In a longitudinal study, Battu *et al.* (1999) show that overeducation has adverse effects on job satisfaction and income. They produce the noteworthy finding that social background does not affect the probability of a mismatch[19].

Alpin *et al.* (1998) examine overeducation and undereducation in a wide-ranging study. Their ambitious quest to establish whether overeducation of individuals is a temporary phenomenon had little success, because they only have access to right-censored data on the job duration. This question cannot be answered on the basis of such data.

But Battu *et al.* (1999) find that displacement effects caused by overeducation do occur in the upper echelons of the labour market, but that unskilled workers in United Kingdom are not being ousted to any great extent by overeducation recruits.

Finally, one of the more unusual longitudinal studies in the domain of overeducation research was presented by Dolton and Vignoles (1997). They observe that most employees who start their career in a job for which they are overeducated do not manage to make the transition to appropriate employment in the first six years.

For France there are studies by Forgeout and Gautié (1997), in which the percentages of over and undereducated employees in the younger age brackets are assessed by qualification level, and job duration for the years 1986 and 1995, as well as a study by Vincens (1995), which treats the problem of overeducation in a rather general fashion (pp. 149-150).

With regard to Spain, there are relevant studies by Alba-Ramírez (1993) and Beneito *et al.* (1997).

[19] Cf. Patrinos (1995 and 1997) who arrives at the opposite result for Greece.

Alba-Ramírez finds evidence for the job-matching and career mobility theories. Beneito *et al.* (1997) examine the question whether surplus years of schooling should be regarded as complementary components of human capital or substitutes; their test shows that the latter is the more accurate assessment.

For Austria there is a study on access to blue collar occupations for apprentices when they complete their training (Ofner, 1994). Ofner finds that, two years after obtaining their certificate of apprenticeship, about one-third of the former apprentices who have jobs are overeducated.

In Greece, studies on overeducation have been produced by Patrinos (1995 and 1997). This author arrives at similar overeducation rates for Greek graduates to those recorded in western Germany. As might be expected, Patrinos finds evidence of wide divergences between academic disciplines. One especially noteworthy finding is that overeducation is disproportionately high among graduates from humbler backgrounds[20].

Other studies are based on the idea of overeducation as an imbalance between the supply of higher qualifications and the demand for them, an idea that was widespread in the early days of the discussion; these include works by Tsoucalas (1981), Psacharopoulos (1988), Glytsos (1990) and Lambropoulos and Psacharopoulos (1992).

Last but not least, the Portuguese situation has been the subject of studies by Kiker *et al.* (1997) and Mendes de Oliveira *et al.* (2000). Kiker *et al.* (1997) adopt a similar approach to Duncan and Hoffmann (1981) and confirm the allocation theory. Mendes de Oliveira *et al.* (2000) refine the same Duncan and Hoffmann approach and demonstrate that the returns to surplus and deficit years of schooling are heavily dependent on job duration[21].

2. Theoretical Reflections on Overeducation

The previous section reviewed an extensive literature and the mainstream points on several approaches concerning overeducation. Regardless of which definition one chooses, the study of this phenomenon raises the important question: how can overeducation be

[20] This finding is consistent with Büchel (1997), who identifies a positive correlation between income prospects and the education level of the parental household, thereby challenging the oft-expressed view that a university degree is a social leveller.

[21] To summarise section 1, see Annex A.

explained by different theories of the labour market? This section will attempt to answer to that question.

As we have seen before, when individuals have higher levels of educational attainment than is strictly required for their jobs they are said to be overeducated, but there are some conceptual problems with the widespread acceptance of this definition.

There is no accepted unified theory of overeducation (McGuinness, 2006), although some authors have attempted to conceptualize and explain the problem within the framework of semi-formal economic models (for example Freeman, 1976a; Rumberger, 1981a; and Duncan and Hoffmann, 1981). The framework for this task starts with acknowledging that are several, often competing, perspectives, on the operation of the labour market. Nevertheless, authors differ with respect to their assumptions, their world view, aspects of the labour market that they address and, of course, their diagnoses and prognoses about overeducation. The perspectives differ in their explanations of overeducation and in the definitions of overeducation that they recognize; not all models would recognize overeducation according to all three definitions. In fact, not every model would even recognize a condition referred to as overeducation.

Thus, the intent of this section is to explore what each theoretical view has to say.

2.1 Human Capital Theory

The Human Capital Theory (HCT)[22] assumes that the educational mismatch is a transitory and short-term phenomenon. The origin of this imbalance is due to the uncoordinated functioning of the mechanisms which shape the characteristics of labour supply and demand. For example, if we assume that productive activities in the economy are carried out by using a flexible technology which employs three productive factors (capital, skilled labour, and unskilled labour), an increase in the supply of skilled labour where the demand for it remains constant will result in its price falling and, therefore, in a change in relative prices of the productive factors.

The model predicts the resulting effects on labour supply and demand. On the demand side, business will adapt to the new situation by substituting – so far as technology allows – capital and unskilled labour for skilled labour because the latter element becomes relatively

[22] See Becker, 1964 and Mincer, 1974.

cheaper. On the supply side, this change implies a fall in the profitability of the additional schooling years required to convert an unskilled worker into a skilled one.

The neoclassical model of the functioning of the labour market, on which the HCT is based, assumes that the information available to economic agents is perfect. This means that firms know the marginal productivity of each worker and that the competitive process results in wages being dependent on this productivity level.

This model recognizes the existence of a direct relationship between the workers' educational level and their productivity and, therefore, their wage level. However, in general, the assumption of perfect information in the marketplace does not hold. For instance, the information available to employers about their workers' characteristics does not enable them to establish their productivity.

In this context, the job screening model (Spence, 1973; Arrow, 1973) suggests that, workers' educational level acts as an indicator enabling employers to identify the most capable and, possibly, the most productive workers. This is recognised by the workers themselves and therefore acts on those workers who wish to stand out against their competitors in the job market as an incentive to invest in their own education.

2.2 Job Competition Theory

This theoretical approach[23] suggests that the existence of educational mismatches in the labour marketplace is a permanent phenomenon.

The Job Competition Theory (JCT) offers a demand side explanation for the existence of overeducation, in contrast to the supply side approach of the HCT and Career Mobility theories. Central to the job competition theory is the assumption that workers compete in the labour market for high wage jobs. Competition between workers creates a job queue, in which jobs are ranked by earnings.

On the demand side, competition between firms for high productivity workers creates a labour queue. In the labour queue workers are ranked by their potential training costs for the firm. As formal education and on-the-job training are assumed to be complements, training

[23] See Thurow, 1975.

costs are lower for individuals with more education. Hence, workers are ranked by education level in the labour queue, and highly educated persons are matched to high paying jobs[24].

Whilst the underlying structure of the labour market is similar in the JCT and HCT, unlike the HCT approach, the JCT assumes that productivity and earnings are related to job characteristics. That is, in the JCT, earnings are driven by demand side factors alone and the worker's education attainment has no impact on earnings. Overeducation arises when there is an increase in the educational attainment of workers. This causes a shift in the distribution of workers in the labour queue, forcing the low-skilled into low paid jobs or out of the labour market. Consequently, overeducation leads to low-skilled workers being "*bumped down*" into lower wage jobs or "*crowded out*" of the labour market into unemployment. Furthermore, overeducation reduces the return to education as high-skilled individuals are forced to accept jobs lower in the job queue.

In spite of lower returns to educational investment, it is rational for individuals to invest in education as workers need to defend their position in the labour queue (Thurow, 1975: p.96). The JCT predicts that overeducation persists, and that it creates economic costs in the form of suboptimal investments in education, allocate inefficiencies and increase income inequalities.

2.3 Career Mobility Theory

Another variation of HCT is the Career Mobility Theory (CMT)[25]. This theory suggests that individuals may be prepared to accept jobs with low returns on education provided and this is accompanied by a higher probability of promotion. In this context, overeducation is a purely temporary phenomenon and additional returns on education will be obtained later.

As in the HCT, education, experience and training are assumed to be substitutes, and each of these components of human capital are positively related to productivity and earnings. That is, the CMT suggests that new entrants to the labour market with high levels of formal education accept positions for which they are apparently overeducated whilst they gain experience and occupation-specific human capital through training.

[24] In the general form, workers are ranked by their background characteristics, which include age, gender, ability and education, and the ranking of workers varies among jobs. Whilst this form of the model more accurately reflects the job matching process, through incorporating differences in the quality and type of educational qualifications, it leaves the basic predictions of the model unchanged (Thurow, 1975: p.86-87).

[25] See Sicherman and Galor, 1990.

Like in HCT, overeducation is a temporary phenomenon for individuals, who progress from being in positions for which they are overeducated to higher occupations in which they make full use of their qualifications.

However, unlike the HCT, the CMT assumes that optimising individuals choose jobs for which they are overeducated in order to improve their future market prospects.

The CMT implies that overeducation is a standard feature of a well functioning labour market, and is factored into decisions made by individuals and firms. Consequently, there are negligible economic costs associated with overeducation.

2.4 Assignment Theory

The Assignment Theory (AT)[26] is another approach that employs matching theory to incorporate both demand and supply side factors into the analysis of overeducation.

This model rests on the assumption that worker productivity is positively related to education. However, not all similarly educated workers are equally productive in all jobs. Indeed, workers have a comparative advantage in specific jobs.

The problem of overeducation arises when workers are not allocated to jobs in which they have a comparative advantage. Hence, overeducation is a form of allocative inefficiency whereby skills are underutilised. This has a negative impact on productivity.

Under the AT, overeducation persists until a more efficient allocation of individuals to jobs can rise, through improved matching processes or policies to reduce inefficiencies. Therefore, educational mismatches can be a permanent problem in the labour market, which means that this theory is a theoretical framework that includes the HCT and JCT.

2.5 Alternative Theories

A number of alternative theories have also been used to explain the existence of overeducation. These are the Job Signalling Theory (JST), Spatial Mobility Theory (SMT), and the Theory of Differential Overqualification (TDO).

[26] See Sattinger, 1993.

2.5.1 Job Signalling Theory

In the Job Signalling Theory (JST), firms are assumed to have imperfect information about the productivity of workers. In response to this problem, individuals use education as signal of quality. The quality of the workers' education certificates serves as a manifest indicator of the latent variable *future productivity*. However, the certificate only acts as a signal, a screening mechanism and a filter in the recruitment situation. Once the new recruit starts to work, he or she can be extensively tested, evaluating their efficiency, which was the basis on which the recruitment decision was made, in other words, the approach we are discussing here. If some certificates and/or their holders prove unproductive when put to the test this will scarcely change employers' decision-making criteria, since employees with higher educational qualifications are more productive on average than their less-educated colleagues, which means that what counts is the level of expectation.

Nevertheless, the fact that a certificate attesting to a higher level of education is not only directly rewarded but also indirectly, because it serves as a key to skilled employment, tends to increase demand for higher qualifications within the education system, irrespective of market demand for labour (Büchel, 2001: p.464). Above all, overeducation arises when there is a *signalling balance*[27] under which it is optimal for individuals to invest in more education than strictly required to perform the tasks of their jobs (Spence, 1973: p.368).

This implies a systematic overinvestment in education, which occurs when the costs of investing in education are low, or when the expectations of individuals or firms about education levels are inflated. Whilst overeducation can arise in a *signalling balance*, it is a Pareto inferior equilibrium in which overeducation persists[28].

2.5.2 Spatial Mobility Theory

The Spatial Mobility Theory (SMT) suggests that individuals in small local labour markets with limited capacity to migrate or commute are more likely to be overeducated (Büchel and van Ham, 2003). For example, Simpson (1992) pictures the economy as a group

[27] A signalling balance occurs when a firm's expectations about the signals displayed by potential employees are confirmed (Spence, 1973: p.360-361).

[28] Both the JCT and JST cannot explain undereducation, where workers have less education than is required for the job.

of *local labour market islands*, between which moves are costly. The costs of information flows and mobility between islands restrict workers' attempts to secure jobs located on other islands. Within the framework offered by Simpson, job-seeking behaviour is spatially systematic in two ways:

i) Workers will seek jobs located as closely as possible to their place of residence in order to economise on search and mobility costs;

ii) Workers will seek jobs that require the skills they have acquired, but if no suitable jobs on their own "*island*", and mobility costs to "*escape*" are too high, workers might "*bump down*" and accept a job below their level of qualification.

The availability of suitable employment opportunities is central to the above theoretical considerations. First of all, migration tolerance is limited because a residential move may engender considerable costs, for example, the loss of location-specific capital[29]. Especially for dual-earner households, where one residential location has to be combined with two work locations, in that case, migration tolerance is limited[30]. Second, commuting tolerance refers to the maximum time a worker is willing to commute for a job. For most workers in modern societies, 45 minutes of commuting is the absolute maximum[31]. According to Madden (1981) gender differences in household roles are important in influencing women to accept jobs closer to home, especially when children are presented in the household, women are restricted in their spatial mobility[32].

The SMT framework is that individual spatial flexibility in combination with the spatial distribution of suitable job opportunities, relative to the place of residence, largely determines the risk of overeducation. This risk of overeducation tends to be highest for those workers restricted to a small regional labour market.

2.5.3 Theory of Differential Overqualification

A remarkable theoretical approach to the explanation of a greater risk of mismatch between education and job requirements for married women in restricted markets was

[29] See for example Hey and Mckenna, 1979.

[30] See for example Mulder and Hooimeijer, 1999; Jarvis, 1999.

[31] See for example Van Ommeren, 1996.

[32] See for example Baccaïni, 1997; Rouwendal, 1999.

developed by Frank, 1978. The TDO starting point is an income-maximising jobseeker. The expected rate of pay is governed by the skill level of the job alone, like the expectations in the JCT and the production theory (Frank, 1978: p.362). In this case, the economically rational strategy for a single individual is simple: the individual identifies that vacancy in the market system for which he or she is least overeducated.

The sampling distribution of the degree of education depends on the total number of vacancies in all markets combined[33]; this follows from the fact that mobility of an individual within his or her own region is not restricted[34]. The expected degree of education for the single searcher approaches zero as the total number of vacancies in all markets approaches infinity.

In the case of married couples, the search problem is more complex. Assuming an inclination towards paid employment on the part of both spouses, their aim is to maximize the joint income. The optimisation process is further complicated by the assumed condition that both spouses will have to find work in the same local job market. Four general properties of the expectations with regard to a married couple are identified:

i) The expected amount of the added overequalification degrees of a searching couple will exceed the expected degree of overeducation for a single searcher;

ii) The expected degree of overqualification of a husband will be lower than the one expected to his wife, if his education is higher than hers (and vice versa).

iii) The expected degrees of overqualification for both partners will approach zero as the total number of vacancies in the market system approaches infinity;

iv) The expected degrees of overqualification for couples are not, as in the single-worker case, independent of the distribution of vacancies across local labour markets. The expected degrees of overqualification increase as vacancies are more evenly distributed across local labour markets (always assuming that migration is a possibility for the couple).

Concerning these expectations properties, the sheer complexity of which will overwhelm any couples trying to maximise their household income. Therefore, the search for a pair of jobs will be constrained geographically and only infrequently will be the best job offer for both spouses occurs in the same location. If the husband's job choice dominates of the wife's responsibilities for children, married women will face the greater constraints, whether as tied

[33] On the concept of local labour markets, see for example Topel, 1986.

[34] Frank chooses not to include transaction costs in the calculation underlying a migration decision.

stayers or tied movers and we expect married women to experience greater overeducation than either married men or single men or women.

In particular, this theory suggests that married women are more likely to be overeducated as their job choice is dictated by the husband's choice (Frank, 1978). As such, women can become "*tied movers*" and have higher levels of underemployment and overeducation[35].

3. Measuring Overeducation

The above sections of this chapter present a literature review on overeducation and theoretical reflections on this topic. In this section, we focus on how to measure overeducation?

The Organisation for Economic Co-Operation and Development (OECD) notes that "*invisible underemployment*" (the term used by OECD to denote overeducation) refers to individuals who are working in jobs where their skills are not utilised, and by its very nature is difficult to measure (OECD, 1995a: p.45).

What the OECD is expressing is that there is no consensus among researchers on the measurement strategy, which is why no internationally standardised tables of comparative national statistics can be compiled for overeducation.

3.1 The Objective Approach

In the early days of empirical analysis of overeducation in US, the objective DOT/GED approach was the standard process for measuring the discrepancy between an employee's level of educational attainment and the actual education level required for his or her job.

The measurement process is considered to be objective, when it does not rely on the employee's own subjective assessment of the required education level. The basic principle of the measurement strategy is that it measures the required education level for a job by reference to its occupational category (e.g., personnel records collected by Ministry of Labour – see Kiker *et al.*, 1997); all important microeconomic details of this occupation are recorded.

Each occupation listed in *Dictionary of Occupational Titles* (DOT) is allocated a level of *General Educational Development* (GED) from a scale of GED values[36].

[35] To summarise section 2, see Annex B.

In the second stage of the process, this educational development level is translated into an equivalent number of years of schooling[37].

Once the formal qualification level in the form of the highest reported educational certificate has also been converted into an equivalent in years of schooling, the number of surplus or deficit years of education can easily be established by subtracting one amount from the other; thus, overeducation (in years) equals years of schooling completed minus GED levels (in years)[38].

The validity of this methodology has been criticised on several grounds, namely:

i) The first problem lies in the diversity of skill levels required for different jobs within a single occupational category, which the GED system does not take into account[39];

ii) The use of one-digit code to evaluate the level of education required for a job does not reflect the complexity of training-requirement profiles: the GED scores are not detailed enough to produce sensitive measures and have validity problems of their own (Clogg and Shockey, 1984: p.254). Besides, the conversion of GED into required years of schooling is not standardised (Rumberger, 1987).

iii) Finally, the GED system, which dates from the sixties, does not respond to changes in the requirements for specific occupations, such as those resulting from technological progress[40].

3.2. The Subjective Approach

The reservations about the DOT/GED approach, which were expressed above, relate to both the steps that need to be taken to establish the education requirement for the practice of a particular occupational, i.e., the assignment of GED scores to the occupations in the DOT list

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[36] Attempts were made to introduce an alternative scale (Specific Vocational Preparation – SVP), but it failed to establish a foothold in the field of overeducation research (cf. Fine, 1968; Scoville, 1966; and for an explicit appraisal, Kalleberg and Sørensen, 1973: p.221).

[37] See Eckhaus (1964).

[38] See for example Rumberger (1981a: p.58).

[39] Estimates of the mean years of required schooling in an occupation are constructed by aggregating jobs, thereby ignoring variation in the mean years of required schooling across jobs within an occupation, Halaby (1994: p.48).

[40] Cf. Clogg *et al.*, 1986: p.382; for a complete summary of the validity and reliability problems of the DOT/GED approach, see Rumberger, 1981b: pp.59 *et seq.*).

and to calculate the GED equivalent in years of schooling. It follows from this that improvement, especially if it relates to the reliability of the mismatch indicator, should focus exclusively on the process of determining of the education level required for the job.

One effective way of tackling the problem is to ask employees themselves for a subjective assessment of the education and qualification level required for their jobs. Respondents may be asked from a scale of requirement categories or to assess to qualification level in terms of a number of years of education or training[41]. The questions are sometimes varied.

Another common question asks for the qualification required to obtain the relevant job; this is the approach adopted in the Panel Study of Income Dynamics (PSID), though McGoldrick and Robst (1996: p.281) rate the PSID question inferior to the GSOEP.

Although there are no reports about reliability problems stemming from incomprehension[42], the subjective nature of the question undoubtedly poses its own reliability problem, such as:

i) It is conceivable, for instance, that reported requirement levels will tend to relate to conditions of recruitment at a particular time rather than present job descriptions;

ii) It is not impossible that cognitive dissonance might cause overeducation employees to imagine a higher requirement level than that which actually obtains[43];

iii) It may be expected that differences in required skill levels for people with equivalent qualifications will be sufficiently identifiable.

This measure may contain much noise, due to differences in standards the individuals' employ. However, it will certainly bring out differences among equally educated individuals in the demands that their jobs put on them (Hartog, 1985a: p.282; for a similar line of argument, see Witte and Kalleberg, 1995: p.301).

For all its recognised flaws, the subjective approach is generally held to be more effective than the DOT/GED system (Hartog and Oosterbeek, 1988: p.186).

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[41] This is the case in German Socio-Economic Panel (GSOEP) study and in other surveys such as the employment survey conducted by the Federal Institute for Vocational Training (BIBB) and the Institute for Employment Research (IAB) in 1991 and 1992.

[42] Cf. Hersch, 1991: p.141.

[43] See Hartog and Oosterbeek, 1988: p.186-187; on this aspect of data collection, and see also Kalleberg and Sørensen, 1973: p.236.

3.3. The Empirical Approach

The third approach is used when there is no direct question on overeducation and referred to as the empirical method.

Mismatching is said to occur when the level of education is more than one standard deviation above or below the mean (mode or median). This cannot be directly compared with the above measures as it ignores minor differences between actual and mean education.

This difference is more striking when the question asked under (3.1.) and (3.2.) requires a simple yes or no response. It also implies a symmetry between over and undereducation, which is rarely found in practice and thus is likely to provide biased estimates.

Indeed, it is doubtful whether we should refer to over or undereducation in this context. If we consider individual occupations some will require rigid qualifications, such as in the professions, whilst in others educational qualifications may be relatively unimportant. It is, however, useful to consider whether the distribution of educational qualifications within particular occupations is narrow or broad (Büchel *et al.*, 2003: p.16).

3.4. An Innovative Approach Case

Finally, as a refinement of the familiar measurement strategies presented in subsections above, Büchel (2001: p.504) introduced a new process to measure overeducation. It was based on the conventional approach, with an innovative element: inclusion of a third indicator to validate the overeducation variables which were initially obtained from the information on employee's formal education and job-requirement levels.

The disadvantages of this strategy are a slightly higher rate of missing values and category entitled "*implausible combination of the three basic variables*". In addition, there is also an optional "*mixed*" category to cover cases in which the information conveyed by the three basic variables does not permit a clear distinction to be drawn between a job/training mismatch and a case of overeducation.

In this last section of chapter one, the diversity of measurement strategies illustrated in the foregoing paragraphs underlines the soundness of Rumberger's postulation of the need for standardised measurement of overeducation (Rumberger, 1994: p.281)[44].

[44] To summarise section 3, see Annex C.

Chapter 2

Education in Portugal: facts and current issues

1. Brief History on Portuguese Higher Education

From the creation of the first Portuguese university in the 13th century to the present day, three main periods of time should be considered: the classical, the modern, and the contemporary period.

The first period includes the long time span from 13th century to the first half of the 20th century, at the end of which four universities have already existed: two in Lisbon, one in Coimbra, and one in Porto.

The second period, mostly concentrated around the 1970's, saw the foundation of a network of seven new public university institutions, in the main cities of the country, and a confessional one (The Catholic University).

The third phase, covering the two last decades of the century, produced four new public universities, a large network of public polytechnic institutes and very significant number of private higher education institutions, from universities to polytechnic institutes and independent polytechnic schools (Soares and Trindade, 2004: p.349).

In the beginning of 1970's, with the exception of artistic education, higher education in Portugal had four public universities – Coimbra University, the University of Lisbon, the Technical University of Lisbon and the University of Porto.

Along with these were commercial and industrial institutes that today are Institutes of Accounting and Engineering and integrated into the Polytechnic Institutes of Coimbra, Porto, and Lisbon. The Catholic University represented the non-public sector.

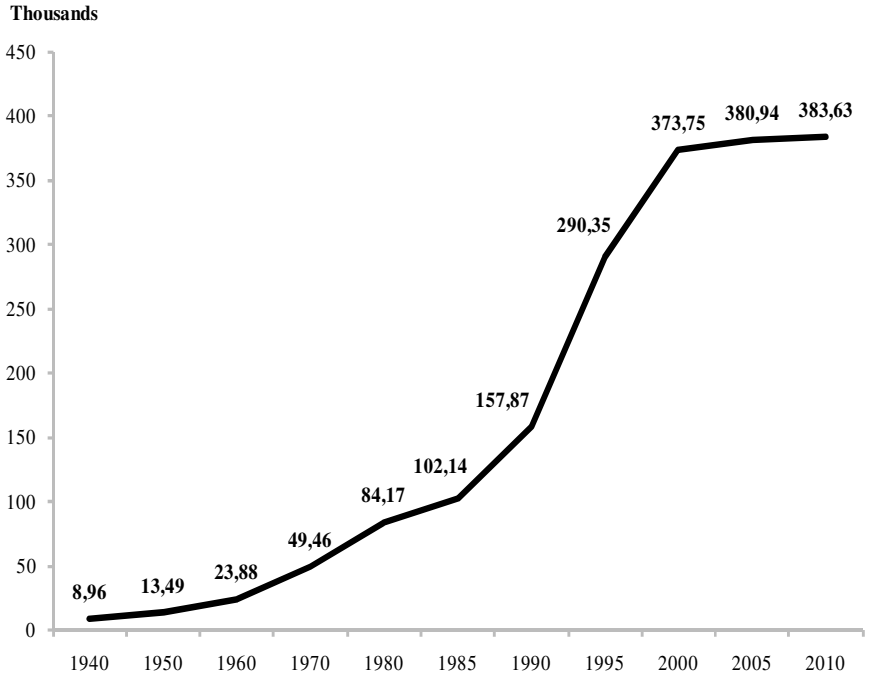
From 1970 to April of 1974, corresponding to the period known as "*A Reforma de Veiga Simão*", new universities, university institutes and polytechnic institutes were created trough the Decree Law 402/73 (Machado and Taylor, 2004: p.9).

In 1973, a new legal framework for higher education system was established at the same time as a decision was taken to create new public universities and polytechnics. These changes were questioned after the revolution from 1974 and suffered various transformations during the first years of the new regime (Teixeira, Amaral and Rosa, 2003).

Political instability in the years after the revolution was rampant. From 15 May 1974 to 22 July 1976 there were six provisional governments and from 3 August 1976 to 21 September 1981 there were eight constitutional governments (Teixeira, Amaral and Rosa, 2003: p.184).

Until the 1974 revolution the Portuguese higher education system was an elitist system with very low enrolment rates, mainly composed by students from the more affluent, privileged classes. The Figure 1, show an evolution of students enrolment in higher education, for the last seven decades.

Figure 1 – Evolution of the Overall Number of Students Enrolled in Higher Education in Portugal, 1940-2010.



Source: INE in link http://www.ine.pt - Statistics of Education and ME-GCIES from 1985; Cabinet of Planning, Strategy, Evaluation and International Relations from Ministry of Science, Technology and Higher Education (GPEARI-MCTES) in link http://www.gpeari.mctes.pt/ - Statistics of Higher Education System – Enrolments in Higher Education; Pordata in link http://www.pordata.pt – Theme: Education.

The right to education, at any level, was not guaranteed by the old 1933 Portuguese Constitution. In contrast, the new 1976 Constitution has recognized the right of all Portuguese to education, as well as the freedom to teach and to learn (articles 43 and 47). It also guarantees the right to establish private and co-operative institutions (article 43) but determines that the State will provide for the needs of the whole population (article 75) and will recognize and supervise private and co-operative education (article 74) (Amaral and Teixeira, 2000: p.249).

The reasons behind the first attempt to create a polytechnic system remained valid after the Revolution of April 1974.

Furthermore, the demand for higher education, due to longer schooling of the population, people's higher expectations and unemployment, had brought more pressure to increase the capacity of the higher education system and since then, there has been an increase in demand that was contained by the government's decision to introduce a generalised *numerus clauses* system.

In fact, in 1976, the *numerus clauses* system were introduced in medicine and veterinary medicine and, in 1977, extended to all higher education system (Eurydice, 2000).

The Law 61/78 introduced changes that eliminated some "*intermediary*" higher education characteristics of Polytechnics, by formally considering their grades as "*high education level*" graduates.

The structure of the system, was mainly established between 1977 and 1980, the creation of most polytechnic institutions dating from 1979 and 1980.

This binary organization of the higher education system was confirmed by the Education Framework Act of 1986 (Law 46/86, 14 October) referred also as The Comprehensive Law of the Education System. This Law defined the main objectives of higher education as teaching and research, cultural production and the development of entrepreneurial and scientific spirit and reflexive thought.

According to this Law, higher education should train graduates able to be integrated into the different professional sectors and to participate in the development of society and continuing education; and also to promote research activities aiming at the development of science and technology, humanities and arts and to contribute to cultural creation and diffusion.

The 1980s were a period of stabilization within the political and economic environment, allowing some consolidation of higher education system. The network of public universities expanded in number and size, and the polytechnic sub-sector was emerging.

However, the restrictions imposed by the *numerus clauses* and the growing number of secondary education graduates created, by the mid-1980s, an increasing gap between the number of candidates and the number of vacancies in higher education (Teixeira, Amaral and Rosa, 2003: p.192).

1.1 The Private Sector of Higher Education

During the late 1970s and the mid 1980s, Portugal pursued a process of convergence that aimed at massification and diversification of the system (implementing the binary system and promoting the private system); conferring increased institutional autonomy to the public sector; regulating the growth of the higher education system by means of access policies.

Since the early 1980s government policy has been directed at expanding participation rates in higher education. Initially, most of this expansion was the result of the government's decision to encourage the development of private institutions, which had the advantage of providing an answer to the increasing demand for higher education without extra strain on the public purse. It was only after joining the European Economic Community (EEC) in 1986, actually known as European Union (EU) that Portugal invested significantly in public higher education with the financial support from the European Funds.

Diversification and regionalisation of higher education were an important political argument in favour of establishing the polytechnic network. Polytechnics would offer vocationally oriented training distinct from university education, and their location was distributed across the country with institutions in almost every district, contributing both to regional diversity and development.

In order to achieve such development, in January of 1979 the Minister of Education authorized the first private higher education institution by the Free University Cooperative for Education a temporary permit to initiate operations. The Decree Law 426/80 of 30th September, formally recognized the Free University, and the Decree Law 59/83 of 11st July allowed the institution to offer study programmes in two main cities: Lisbon and Porto.

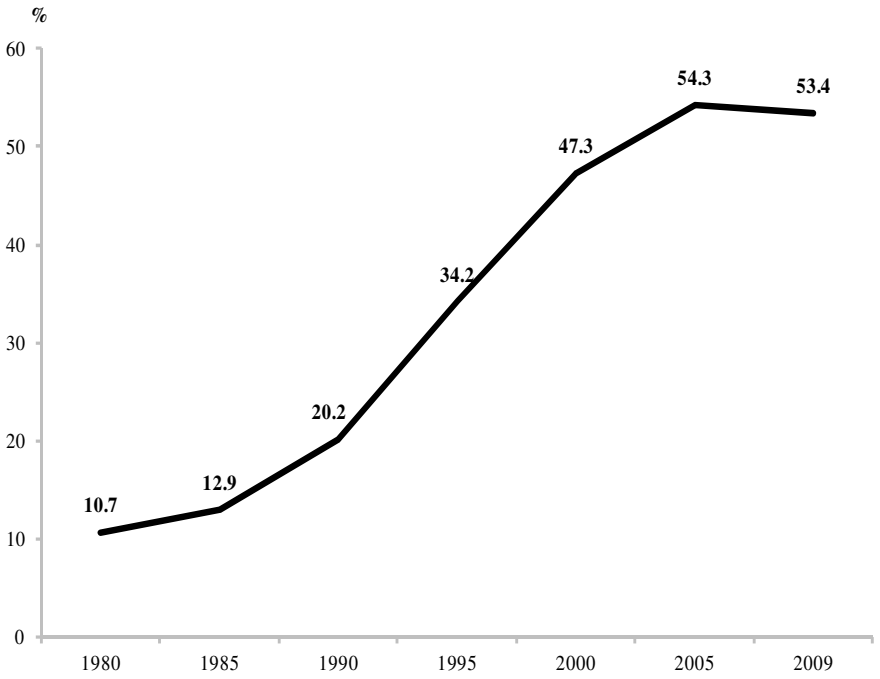
In the mid-1980s, the idea of significantly increasing the role of the private sector gained political support as its expansion enabled and increase in the enrolment rate with a minor cost to public finances.

The growth in the number of private institutions motivated the publication of a Decree Law, establishing a specific legal basis for a private higher education in 1989 (Decree Law 271/89, 19th August). In 1994, it was reviewed and a new Decree Law was published (Decree Law 16/94, 22nd January). Later on, was amended by Law 37/94, 11st November (Eurydice, 2000).

But in 1983/84 the share of enrolments was 76.2% in public universities, 12.6% in public polytechnics and 11.2% in the private sector. In 1989/90 those shares became, respectively 63.5%, 15% and 21.5%.

Figure 2 examines this situation through gross enrolment ratio (GER[45]) in higher education and its "*great expansion*", before and after implementation of private sector in Portugal.

Figure 2 – Evolution of Gross Enrolment Ratio in Higher Education in Portugal, 1980-2009.



Source: INE in link http://www.ine.pt - 50 Years of Statistics of Education; Pordata in link http://www.pordata.pt – Theme: Education.

Moreover, the private sector was seen as capable of promoting a supply that was better balanced (from a geographical and disciplinary perspective) and more suitable for labour market needs. Private higher education was able to get strong political support from its very beginning.

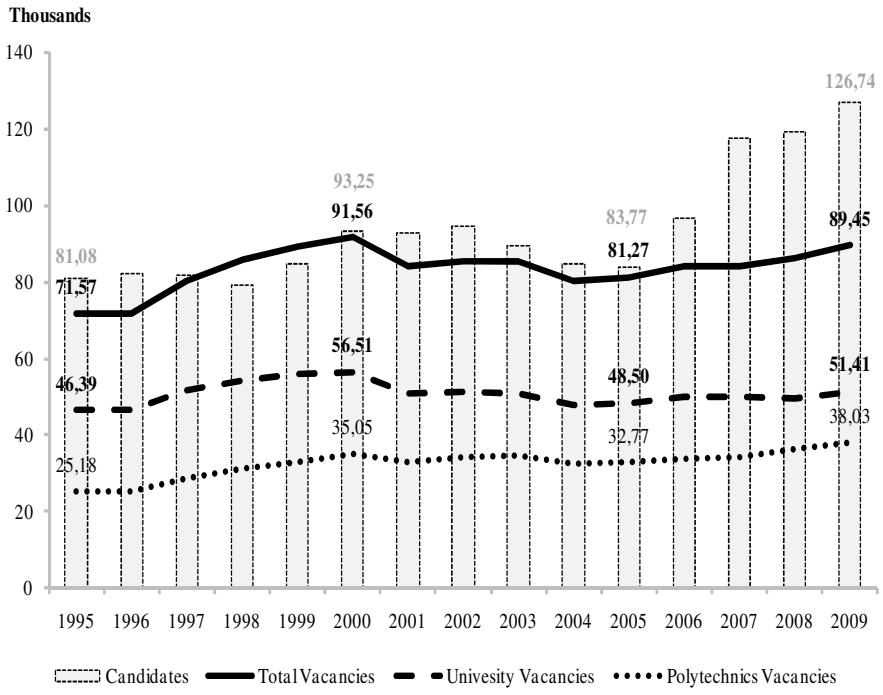
[45] Gross Enrolment Ratio in a specific level of education, regardless of age, expressed as a percentage of the eligible official school-age population corresponding to the same level of education in a given school year. For the tertiary level, the population used is that of the five years (actually three years) age group following on from the secondary school leaving in link http://glossary.uis.unesco.org/glossary/en/home.

The Minister Roberto Carneiro, while Minister of Education (1987-1991) created the conditions for the "*explosive*" development of the private sector. Not only did approve a large number of new institutions but also decided to lower the requirements for access to higher education. Roberto Carneiro, was the promoter of the private sector in higher education (Amaral and Magalhães, 2003).

Carneiro assumed the private sector as an important ideological instrument for strengthening Portuguese democracy, and as a tool for social and economic development (Correia, Amaral and Magalhães, 2002).

Many students that until 1989 were unable to become students in higher education were offered a unique opportunity. They could now enter higher education even with a zero in the access examinations provided that there were available vacancies (Amaral and Magalhães, 2003).

Figure 3 – Evolution of Vacancies and Candidates in Higher Education in Portugal, 1995-2009.



Source: Cabinet of Planning, Strategy, Evaluation and International Relations from Ministry of Science, Technology and Higher Education (GPEARI-MCTES) in link http://www.gpeari.mctes.pt/ - Statistics of Higher Education System: Candidates and Vacancies in Higher Education; Pordata in link http://www.pordata.pt – Theme: Education.

In Figure 3, we see the main effect from this offer expansion. Since 1995 the number of candidates exceeded the number of vacancies, and the government decided to change it from uncontrolled expansion to increased quality.

The Minister of Education Marçal Grilo, implemented legislation passed in 1993 by Minister Couto dos Santos, imposing again national examinations at the secondary education.

Marçal Grilo reversed the access rules established by Roberto Carneiro by allowing higher education institutions to set minimum marks in the access examinations for higher education, thus putting an end to the strange situation that allowed students to enter higher education with zero marks in the access examinations (Amaral and Magalhães, 2003). With this procedure, the new students must compete for a vacancy on a national tender.

In summary, the private sector of higher education in Portugal was connected with a particular type of developments in governance and public finance, which stimulated the emergence of a different context for public intervention. The rapid development of the private sector in the Portuguese higher education represented a unique feature in the context of other West European countries (Amaral and Teixeira, 2000: p.246).

1.2 Higher Education in Figures

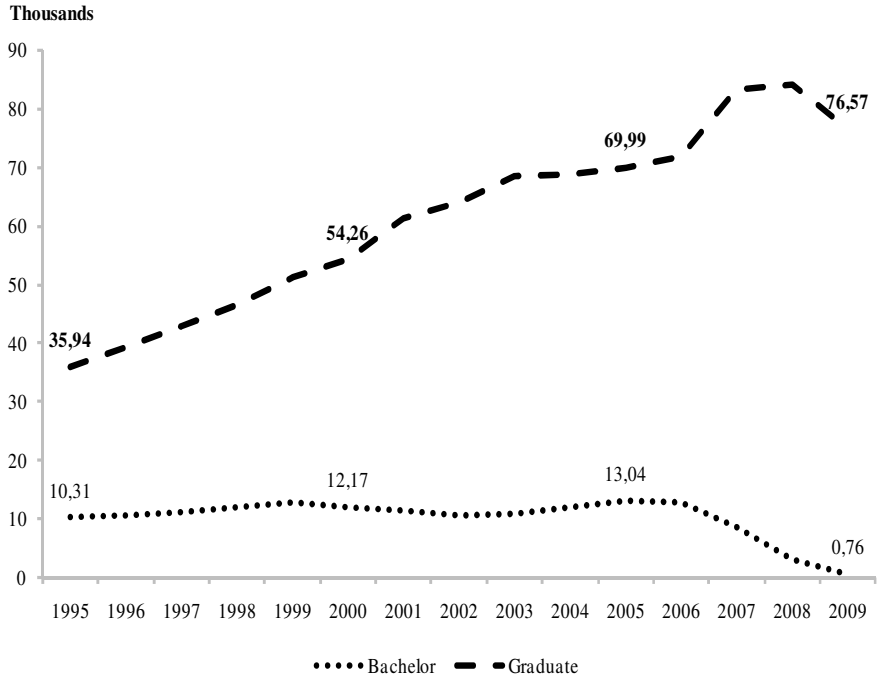
From 1990 to 2000 there was an increase of students' enrolments across the system. In last decade, the situation of the Portuguese higher education corresponds to a period of slightly declining or relative stagnation in the growth of students after a period of more than 60 years of consecutive growth (as shown in Figure 1 and Figure 2).

Initially the growth was due to the private sector. But after several measures, this expansion started to slow down after mid 1990s. The decline in student gross enrolment ratio (as shown in Figure 2) called for immediate policy attention.

In 2006 the government took two measures to redress declining enrolment and to promote access: Decree Law 64/2006, 21st March and Decree Law 88/2006, 23rd May. These measures reduced the age criteria of adults who wish to participate in higher education to 23 years and expanded post-secondary course offerings in higher education institutions.

But other effects took place at the same time: the number of graduates and bachelors from public and private universities and polytechnics has almost doubled between 1995 and 2005, but with a slightly decline in the two last years (see Figure 4).

Figure 4 – Evolution of the Number of Graduates and Bachelors in Higher Education in Portugal, 1995-2009.



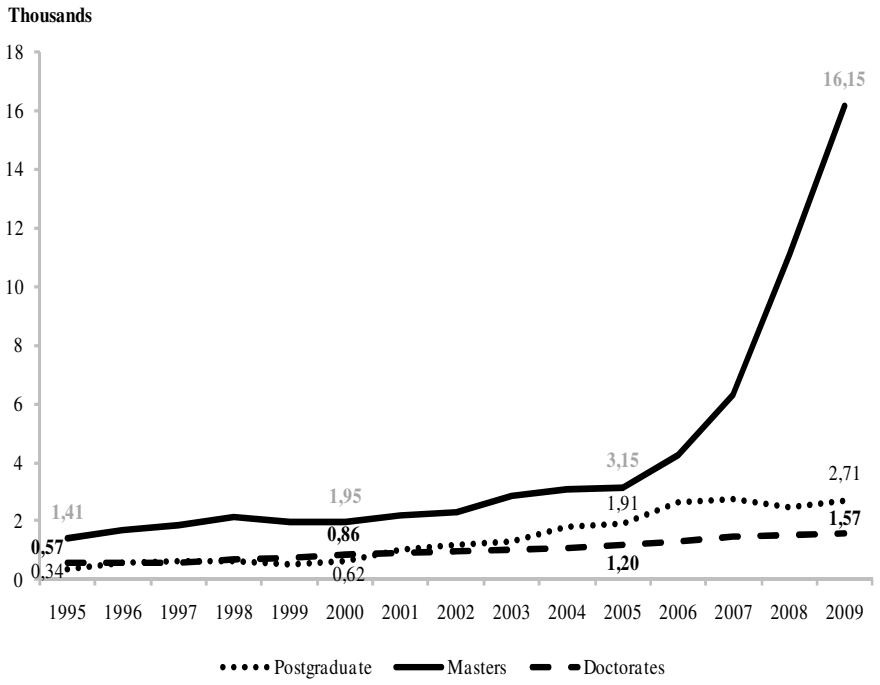
Source: Cabinet of Planning, Strategy, Evaluation and International Relations from Ministry of Science, Technology and Higher Education (GPEARI-MCTES) in link http://www.gpeari.mctes.pt/ - Statistics of Higher Education System: Candidates and Vacancies in Higher Education; Pordata in link http://www.pordata.pt – Theme: Education.

Besides a substantial increase at graduates level, comparing to the constant evolution of the bachelors, numbers indicate some declining in ending of this first decade of 21st century, with severe incidence in bachelors.

Alongside this situation is also highlighted a remarkable increase at complementary levels of higher education such as postgraduates, masters and doctorates. All levels considered in Figure 5 have increased since 1995.

As far as Master graduates are concerned, there was a huge and an important increase, mostly in the last 5 years, when number increased more than five times. The Postgraduates growth over the period increased nearly eight times and the Doctorates three times, one thousand more in 2009 comparing with 1995 (see Figure 5).

Figure 5 – Evolution of the Number of Postgraduates, Masters and Doctorates in Portugal, 1995-2009.



Source: Cabinet of Planning, Strategy, Evaluation and International Relations from Ministry of Science, Technology and Higher Education (GPEARI-MCTES) in link http://www.gpeari.mctes.pt/ - Statistics of Higher Education System: Candidates and Vacancies in Higher Education; Pordata in link http://www.pordata.pt – Theme: Education.

2. Recent Developments

By the end of the 1990s the participation rate in higher education was around 50% and demand was beginning to decrease. Government attention shifted from quantity to quality factors, not only because the education level of Portuguese population in general remains quite low, but also the lifelong education is still a relatively underdeveloped area of the Portuguese education system.

Until recently students over 25 years of age without formal qualifications could enter higher education by sitting in special entrance examinations. However, the number of students using this alternative entrance road was very limited, representing only about 1.1% of total first year enrolments in 2004. In 2006 the government reduced the age criteria to 23 years of age to encourage candidates to higher education.

The qualifications of teaching staff as well as their research and publication record, the quality of the higher education provision, including the need to raise admission standards to enter higher education, created a new *momentum* where competition for new students became evident between higher education institutions.

But access routes to higher education remain traditional with impediments for the enrolment of new publics. There is neither tradition nor accumulated knowledge in the area of recognition of informal training activities. Transfer between institutions was not facilitated and credit recognition can be a very uncertain business for students.

Thus, with the implementation of the Bologna Process (BP)[46] the Portuguese Government hoped to create conditions to the establishment of key measures to ensure the qualifications of Portuguese citizens in the European space, to promote equality of opportunity in access to higher education, to improve participation and completion levels in higher education programmes, and to attract new publics in a context of lifelong learning and improve educational welfare benefits.

2.1 The Importance of the Lisbon Agenda

In early 2000, Lisbon Agenda was approved and with it a new strategy was defined to Europe: a knowledge-based economy (KBE). At this time, EU was facing economic prosperity with, for example, high growth, net job creation and healthy balance of payments. Meanwhile, globalization and new knowledge economies were becoming an increasing threat and the EU was in need of a transformation in its economy and society. Towards this background the top priorities of Lisbon Agenda[47] was set to make Europe more dynamic and competitive.

Concerning the markets for higher education, EU considered important to analyze the role of higher education in promoting innovation and the effects of education on labour productivity.

[46] The Bologna Process is named after the Bologna Declaration, which was signed in the Italian city of Bologna on 19 June 1999 by ministers in charge of higher education from 29 European countries. The overarching aim of the Bologna Process is to create a European Higher Education Area (EHEA) based on international cooperation and academic exchange that is attractive to European students and staff as well as to students and staff from other parts of the world – in link http://www.ond.vlaanderen.be/hogeronderwijs/bologna/.

[47] For further details see http://ec.europa.eu/information_society/eeurope/i2010/ict_and_lisbon/index_en.htm.

Empirical research has shown that education raises labour productivity. However, the link between higher education and innovation is weak.

The typical pattern for the EU-15 countries seems to be rather high public expenditures and rather low private expenditures on higher education. High levels of public expenditure do not seem to encourage private investments in higher education.

An often used motivation for government intervention in higher education is that education generates positive external effects similar to the R&D case. In the presence of positive social effects, governments should subsidies education up to the point where the social and private returns are equalized.

However, in contrast to R&D, external effects of higher education are notoriously difficult to measure empirically and most reliable estimates that the social returns to higher education equal the private returns, that is, the individuals taking higher education are able to appropriate all the benefits of higher education.

Thus, there is clearly no argument for further increases in the public expenditures on higher education at the current level of education subsidies within most of the EU-15 States.

Furthermore, there are quite a number of arguments, which indicate government failure rather than market failure. It is also from an equity point of view difficult to motivate that the whole population should pay for a higher education which fruits can be enjoyed only by a limited share of the population. This relationship can be seen in the Figure 6.

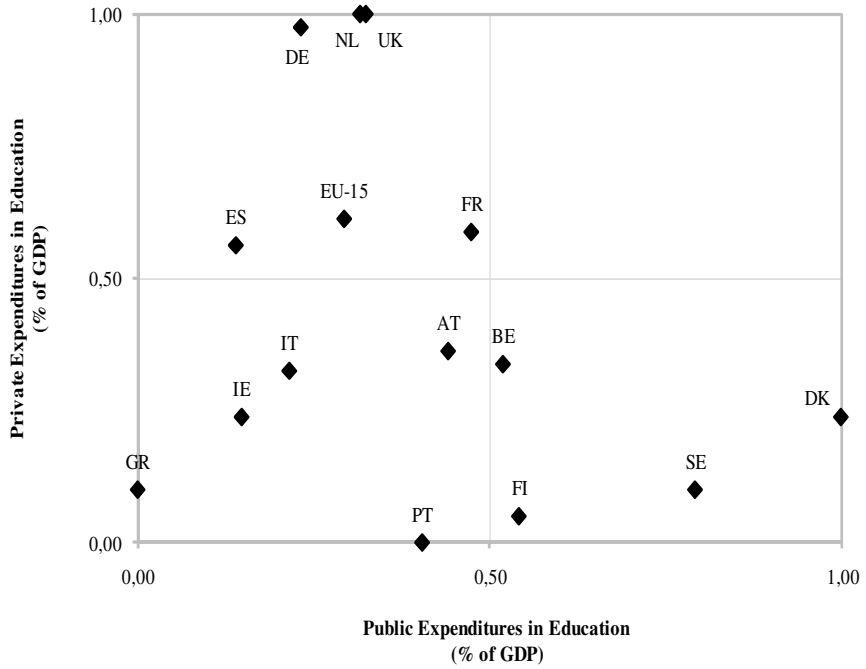
To allow this relationship, both indicators have been transformed with a formula[48] and with this formula all data collected were normalized.

The relativization is granted in order to compare the relationship between public and private expenditures. The formula's numerator is difference between the observed value in country and the minimum value of all data collected, and its denominator is the amplitude for all data, which means, the difference between the maximum and minimum value observed. As a result the obtained values are put in scale that ranging from 0 to 1.

In Figure 6 we looked at the levels of expenditures in the European education systems (EU-15) and we concluded that public expenditure on education as a percentage of GDP on average is about 5.36% in 2002 (5.54% to Portugal), while private expenditure is about 0.44% (0.09% to Portugal).

[48] To normalize all data the author used the formula: $DN_i = (D_i - D_{min}) / (D_{max} - D_{min})$, where DN_i – is the normalized value of study indicator in country i; D_i – is the value of study indicator in country i; D_{min} – is the minimum value of study indicator; and D_{max} – is the maximum value of study indicator.

Figure 6 – Relationship between Public and Private Expenditures in percentage of GDP[49] in EU-15[50], 2002.



Source: Eurostat in link http://epp.eurostat.ec.europa.eu/portal/page/portal/education/introduction - Statistics by Theme: Education and Training.

But the Lisbon Agenda launched in 2000, was a response to the lagging of Europe.

In March 2004, the EU Council invited Wim Kok (Former Prime Minister of Netherlands) to establish a High Level Group to help the Council in its mid-term review of the Lisbon Council's Strategy. The Group reported in November 2004. The report was clear about the importance of Europe's drive to become a KBE: "*the strength of its knowledge industries and Europe's capacity to diffuse knowledge across the totality of the economy are*

[49] Gross Domestic Product is the market value of all the final goods and services produced within a geographical entity within a given period of times. It is "Gross" because the depreciation of the value of capital used in the production of goods and services has not been deducted from the total value of GDP; "Domestic" because it relates only to activities within a domestic economy regardless of ownership; and "Product" because it refers to what is being produced, i.e., the goods and services, otherwise known as the output of the economy. This product/output is the end result of the economic activities within an economy. The GDP is the value of this output (Yanne Goossen *et al.*, 2007: p.10).

[50] Luxembourg is not included (Country abbreviations: AT – Austria; BE – Belgium; DE – Germany; DK – Denmark; ES – Spain; EU-15 – European Union-15; FI – Finland; FR – France; GR – Greece; IE – Ireland; IT – Italy; NL – Netherlands; PT – Portugal; SE – Sweden; and UK – United Kingdom).

fundamental to its success and are the key to lifting its growth of productivity to compensate for failing population growth and pay for its social model".

In 2005, the results that so far had been reached were evaluated in the mid-term reviews. The result found was not as hoped for. The EU was still lagging behind the other major regions, and in some cases had the gap even widened. It has become obvious by now that the Lisbon Agenda formulated in 2000 set too many goals.

According to a report by International Monetary Fund (IMF) it had over 100 goals; while Jacobs & Theeuwes (2005) claim that in total 405 different objectives have been set up within the Lisbon Agenda.

The Lisbon Agenda suggested a need for action on three broad fronts: macroeconomic and microeconomic policies and the third more institutional in nature, focused in particular on the labour market. However, the European summits have not been sufficiently explicit about the instruments to be made available, and several questions remain unaddressed. The Kok report highlighted in particular weakness on R&D: "*one of the most disappointing of the Lisbon process to date is that the importance of R&D remains so little understood and that so little progress has been made*".

The Lisbon Agenda had nothing to say about the optimal level of investment in, for example, higher education or R&D, that is, the social returns on such investments (Kok, *et al.*, 2004). There is no guarantee that increasing investments in either R&D or higher education will increase social welfare. This is critically dependent upon the rate of return on these investments. Naturally, higher investments will only increase social welfare if it is socially profitable.

On the second of February 2005, the European Council had a meeting concerning the process of the Lisbon Agenda. The Commission conclude that the expected results had not been fulfilled.

After the mid-term review there were some changes made but the main context was still intact. Only one goal was kept: the goal of devoting three percent to the national Gross Domestic Product (GDP) to the R&D. The main focus was put on the growth and jobs.

Other important aspect of this mid-term review was the time focus: the time point shifted from a long-term to a more medium-term view. One explanation behind the shift was the limited time left of the Lisbon Agenda. In order to reach any progress, the implementation strategy was also altered from relaying on the Open Method of Coordination (OMC) to using National Reform Programmes (NRP) in all Member States.

2.2 The National Action Programme for Growth and Employment – New Opportunities Initiative and Technological Plan

Thus, the Renewed Lisbon Strategy approved by the Spring European Council in 2005 envisaged that each Member State would develop and implement a NRP focussed on growth and employment, based on 24 guidelines that cover the Macro, Micro and Employment dimensions and to be applied between 2005-2008.

In this context, Portugal approved an ambitious reform programme entitled the National Action Programme for Growth and Employment[51], bearing in mind the strategic conformity with recommendations and warnings from the EU such as:

i) "*To reorientation of the public expenditure to the reinforcement of the economic growth potential*" (NPR Report, 2008: p.5);

ii) "*To pursue the efforts to modernise the labour protection mechanism, in order to reduce the segmentation of the labour market, within the framework of the Flexicurity*[52] *approach*" (NPR Report, 2008: p.13);

iii) "*To continue to take measures to significantly improve the efficiency of the education system*" (NPR Report, 2008: p.7).

Hence, and in compliance with the EU recommendations, the pledge in the quality of public finances and the allocation of the resources of the National Strategic Reference Framework[53] has been achieved by focusing on a mobilising agenda towards growth and competitiveness driven by the mobilisation of Portuguese society and concentration of public policies on resolving the factors blocking Portugal's the potential growth.

But the urgency in the recovery of the deficits in education and training, accumulated over several years and the significant reduction of early school leaving, led the Government to embark on a wide set of reforms that include the different levels of education and the vocational training system.

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[51] Also known as *Programa Nacional de Acção para o Crescimento e Emprego – PNACE 2005-2008*.

[52] *Flexicurity* is a comprehensive approach to labour market policy which combines sufficient flexibility in contractual arrangements – to allow firms and employees to cope with change – with the provision of security for workers to stay in their job, or be able to find a new one quickly with the assurance of an adequate income in between jobs. This process is possible through lifelong learning, active market policies and high levels of social protection – in link http://www.eurofound.europa.eu/pubdocs/2007/84/en/1/ef0784en.pdf.

[53] Also known as *Quadro de Referência Estratégico Nacional – QREN 2007-2013*.

In this context, due to its scope and impact, emphasis was given to the launch of the New Opportunities Initiative (NOI) in September 2005 that lies on two main pillars:

i) The improvement of the basic training of *youth*, namely by the diversification of the education and training supplies, through the strengthening of vocational courses, the fight against non-achievement and early drop-out rates in the educational and training system;

ii) The improvement of the base training of the *adult population*, recognising, validating and certifying the skills already acquired by means of education, training, professional experience or other, thereby structuring qualification paths that match the reality of each citizen, guided towards his/her personal development and towards the needs of the labour market.

In the framework of this reform, Decree Law 396/2007, dated December 31, was published, establishing the legal system of the National Qualifications System (NQS), which assumes the aims already stated in the NOI and promotes the required instruments for effective execution with the financial instruments.

On the one hand, the fundamental strategy of the Portuguese Government aims to assure the relevance of training and learning for personal development and for the modernisation of companies and the economy, whilst also assuring that all the national effort in training is actually valorised in terms of the school and professional progression of the citizens, both directly, through dual certification training within the scope of the National Qualifications Catalogue (NQC), and indirectly, by means of New Opportunity Centres (NOC) and the process of recognition, validation and certification of competences.

On the other hand, Portuguese Government promoted a sustained development in Portugal through the Technological Plan (TP)[54].

Concerning TP targets, the Portuguese Government assumed that the market has a crucial role as a mechanism to encourage economic activities. Most of the innovations arise from a complex exchange of ideas, products and experiences, from projects that have lasting results, from interactions between agents, within a competitive environment that induces each one to try an surpass itself. Innovation involves different agents, but it is important that it reaches the market and favours the administrative modernisation.

Still market malfunctions are a reality, namely at the level of investment in human capital, innovation, and R&D activities. These malfunctions are due to the fact that benefits

[54] To summarise Targets for the Impact Indicators of the Technological Plan, see Annex D.

associated to investment in education and R&D are not sufficient or are not totally appropriate to the agents who develop them.

In Portugal, those malfunctions are the more significant since it was recognised that the quality of human resources, the technological capacity and the permeability to innovation are precisely some of the greatest obstacles to economic growth.

However, it was recognised that there are malfunctions within the national innovation system. With the assistance of the previous Community Support Frameworks a large set of scientific, technological and support to innovation infrastructures has been set up. In global terms, a better linkage between all system components, and closer links and cooperation between the relevant agents are missing.

The TP recognises the need to qualify the Portuguese population and to stimulate innovation and technological modernisation, by putting into place policies designed to speed up the present adjustment process of the specialisation model of the Portuguese economy, with a view to differentiating between manufacturing and services based in research and development activities and increasingly directed to external markets.

In this context, due to its scope and impact, emphasis was given to the launch of the New Opportunities Initiative in September 2005. This step was a response to the qualification challenge of the population, through an integrated set of strategic measures in terms of education, training and certification, which aims at generalising the secondary level as a reference goal for the qualification of youths and adults.

Moreover, between 2005 and 2007, Portugal undertook another deep-seated step: the reform of higher education.

Introduced by the EU movement the modernisation of universities and polytechnics for the development of knowledge societies and economies, Portugal implemented legislative measures, namely: the new legal Regime of the Higher Education Institutions; the quality assurance system, including accreditation rules of the study cycles, the legal system for the quality evaluation of higher education and the creation of the Evaluation and Accreditation Agency for Higher Education; creation of conditions for national and international mobility of students and graduates; the establishment of new rules that facilitate adult admission in higher education and make it more flexible; the widening of the scope of non-refundable scholarships awarded to students enrolled in technological specialisation degrees and master degrees, promoting new conditions to enter and attend higher education by all students; and

the implementation of a grant system to higher education students with mutual guarantee, which complements the school social services system for higher education students.

But, it should also be stressed that there were several effects resulting from measures taken by Portuguese Government concerning the NOI and the TP programmes.

One effect was recognized in National Plan of Reforms (NPR Report, 2008: p.11): "*As a result, in 2007, for the first time since 2002, the total number of students attending higher education increased in Portugal.*".

2.3 Challenges to the Future

Over the last decades, it is recognized that Portugal has made a significant effort to qualify the general population, and the adults in particular, in order to recover the separating us from other developed countries.

However, the pledge in the qualification of the Portuguese population continues to represent an essential strategic challenge for the promotion of the country's economic growth and social cohesion.

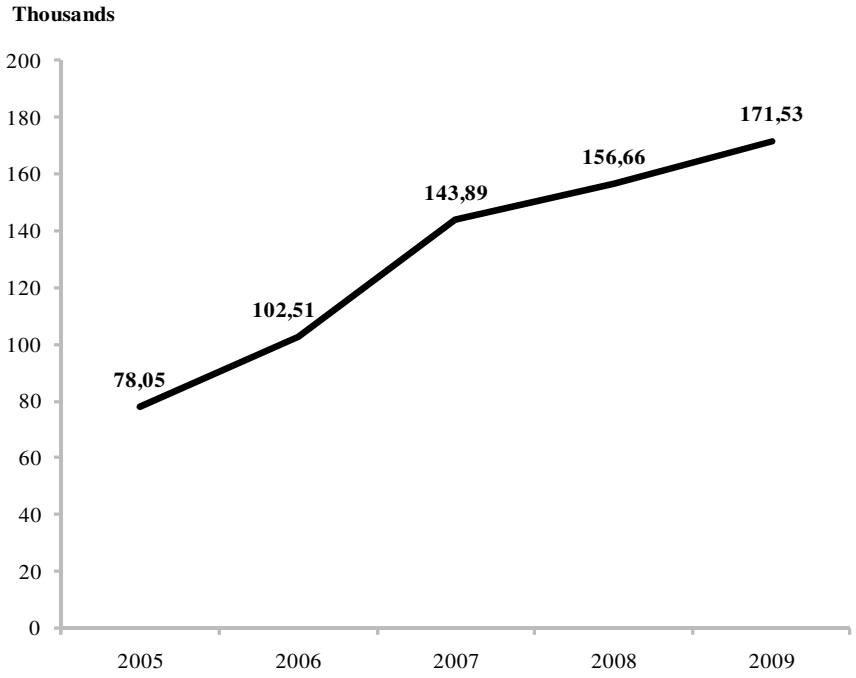
For example in 2005, only 20% of the adult population (age 25-64) completed upper secondary education, whilst the OECD average was 70%. Furthermore, of the 5 million active workers, more than 50% did not complete compulsory education (9 years of schooling[55]). But at the same time Portugal were among the more educated segments of the population with a "*respectable*" 5th place considering the 25 countries of European Union.

Being insufficient and slow the recovery, the Portuguese Government decided to do more to overcome the low levels of education and qualification of the Portuguese population and stated in 2005 the NOI as a national strategy within the scope of the National Employment Plan (NEP) and the TP.

The aim of the NOI was expand the qualification framework for completion of secondary education for both young people and adults, thus dealing with the country's problem with low skills level of its population (about 3.5 million active workers with qualifications below the complete secondary level). But, this kind of measures requires financial sustainability and instruments to support commitment from Governments (see Figure 7).

[55] The Law 85/2009, dated 27 August, review the compulsory education to 12 years.

Figure 7 – Number of Young People in Education and Training – New Opportunities Initiative, 2005-2009.



Source: Data for 2005-2008 comes from Statistics of Education (GEPE-ME) in link http://www.gepe.min-edu.pt/ and Tourism of Portugal (Vocational Courses in 2006) in link http://www.turismodeportugal.pt; Data for 2009 is provisional and comes from MISI-ME in link http://www.misi.min-edu.pt/, IEFP in link http://www.iefp.pt/ and by SIGO on-line platform in link http://www.novasoportunidades.gov.pt/.

On 15 September 2008, the collapse of an American investment bank triggered a paralysis in the global financial system that transitioned into a global economic and jobs crisis that plagued the world trough the last two years (ILO, 2010a: p.6).

The financial and economic crisis, and the recession that followed, dramatically increased uncertainty about job prospects, puts into question certain policy measures taken, including raising the skill levels of the Portuguese population.

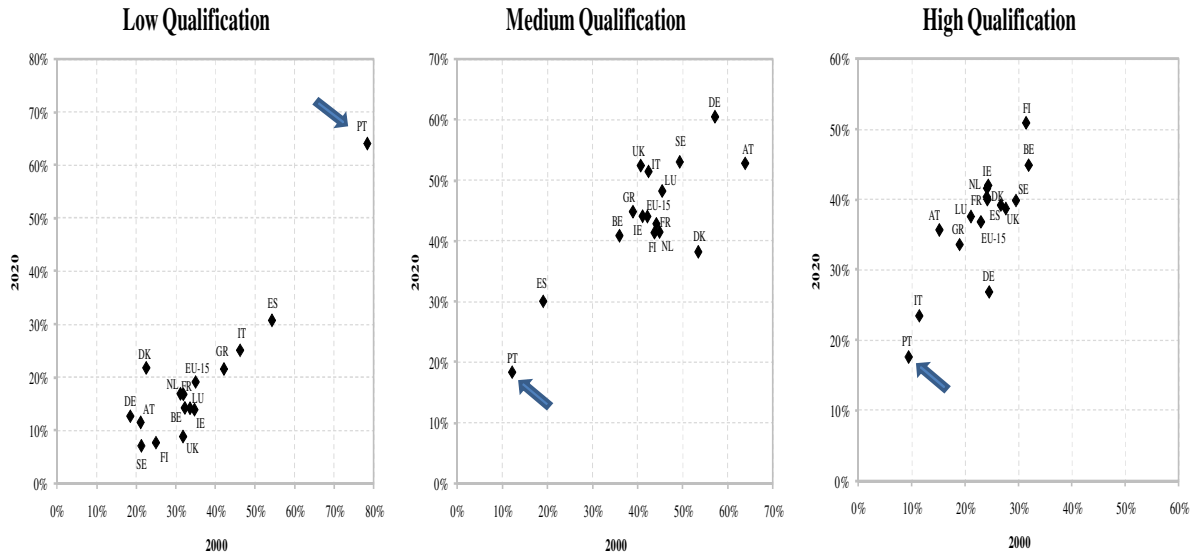
Beyond that, demographic developments and in particular, the aging population, are another challenge for Europe labour market and especially to Portugal. Indeed, demographic developments affect the skills available.

Skills become obsolete when they are not used or as people get older and technologies or working practices change (CEDEFOP, 2010: p.40).

In this context, Cedefop's medium-term skill supply forecast for Europe up to 2020 suggests that a substantial further increase in the proportion of the adult labour force with high and medium-level qualifications (CEDEFOP, 2009: p.2).

In contrast, the number of people with low-level qualifications (ISCED[56] 0 to 2) is projected to decline in most European countries, with an exception: Portugal does not converge with Cedefop's forecast (see Figure 8).

Figure 8 – Labour Force (age 15+) by Qualification, in EU-15, 2000-2020.



Source: European Centre for the Development of Vocational Training (CEDEFOP) in link http://www.cedefop.europa.eu/EN/ - *Skills Supply and Demand in Europe: medium-term forecast up to 2020 (IER estimates based on StockMOD).*

If we take into consideration the European force with medium-level qualifications (ISCED 3 and 4), conversely to low-level qualifications there are a projection to increase, continuing to constitute the biggest proportion of the labour force in 2020. However, is also a problem to Portugal because once again does not converge with other European countries.

Finally, we have the proportion of people with high levels of qualification (ISCED 5 and 6) that has risen steadily in recent years in most countries and Portugal was no exception. Moreover, Portugal is one of the European countries, together with Austria, Ireland, Italy and Luxembourg that notes a large growth between 2000 and 2020.

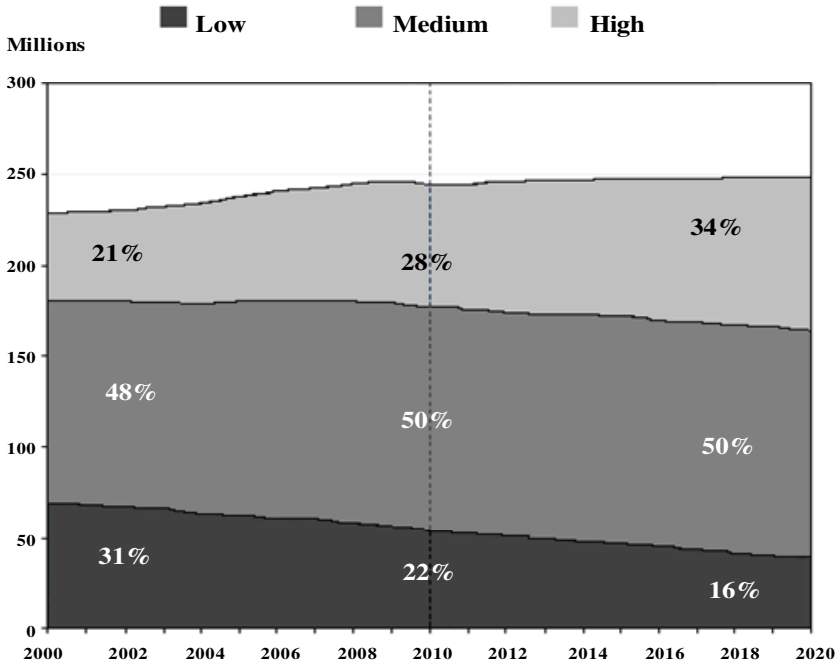
[56] International Standards Classification of Education (ISCED) was designed by UNESCO in the early 1970s to serve as an instrument suitable for assembling, compiling and presenting statistics of education both within individual countries and internationally. It was approved by International Conference on Education (Geneva, 1975) and was subsequently endorsed by UNESCO's General Conference.

Recent prospects of European Centre for the Development of Vocational Training (CEDEFOP) in last February says that "*(...) the effect of the recession on skill supply, about the future of employment patterns, will reflect not only demand, but also supply"*. The Cedefop's results show that the number of those with high-level qualifications will rise by almost 28 million and those with medium level qualifications by almost 20 million. This increase will be compensated by a decrease of about 33 million people holding low qualifications. Higher-qualified people tend to have higher rates of labour market participation. One explanation is because the higher-qualified people tend to have higher rates of labour market participation (CEDEFOP, 2010: p.41).

The supply trends show a considerable shift in labour demand towards skilled workers implying that future jobs will become more knowledge and skills-intensive.

In Figure 9, we can see that the biggest increase will be the proportion of the workforce with the highest levels of qualification and the biggest fall the share of the workforce with low formal qualifications.

Figure 9 – Supply Trends by Qualifications: labour force aged 15-64 years in EU-27, 2000-2020.



Source: European Centre for the Development of Vocational Training (CEDEFOP) in link http://www.cedefop.europa.eu/EN/ - Briefing Note, February 2011: *What next for skills on the European labour market?*

Despite this, as was already mentioned earlier, future labour supply projections depend on changes in demography, labour market participation and patterns of acquisition of qualifications.

The long-term sustainability of more young people staying on in further training and higher education depends on various things, such as the state of public finances and individual perceptions of how much their job prospects are improved by continuing in education and training (CEDEFOP, 2011: p.2-3). But, this consideration only could be accepted to understanding what happened in the last two decades.

On the other hand, the low educational level of the Portuguese older generations remains a heavy handicap in the labour market.

Curiously, a recent inquires made by Office of National Statistics (INE) show that the population is in general satisfied with its education level, which partly helps to explain the low number of people engaged in lifelong training activities.

However, in last decade the data collected from INE through annual Labour Force Survey[57] seems to indicate another reality concerning Portuguese younger generations.

The total of working population with a higher education degree has increased from 487,6 thousands in 2000, to about 854,7 thousand in 2009 (annual averages), that is, an increase of 75.3%, while in this same period the total of working population increased only 6.8%.

Furthermore, in the last decade the employed population holding a higher education degree has increased a lot, from 472 thousand in 2000, to about 800 thousand in 2009 (annual averages), that is, an increase of 69.3%. In this same period the total employed population increased only 0.7%.

The employed population holding a higher education degree represented 15.8% of the total employed population in 2009, more 6.4 percentage points (p.p.) than in 2000. Similar conclusion had been found by CEDEFOP in *Future Skill Supply in Europe: key findings*.

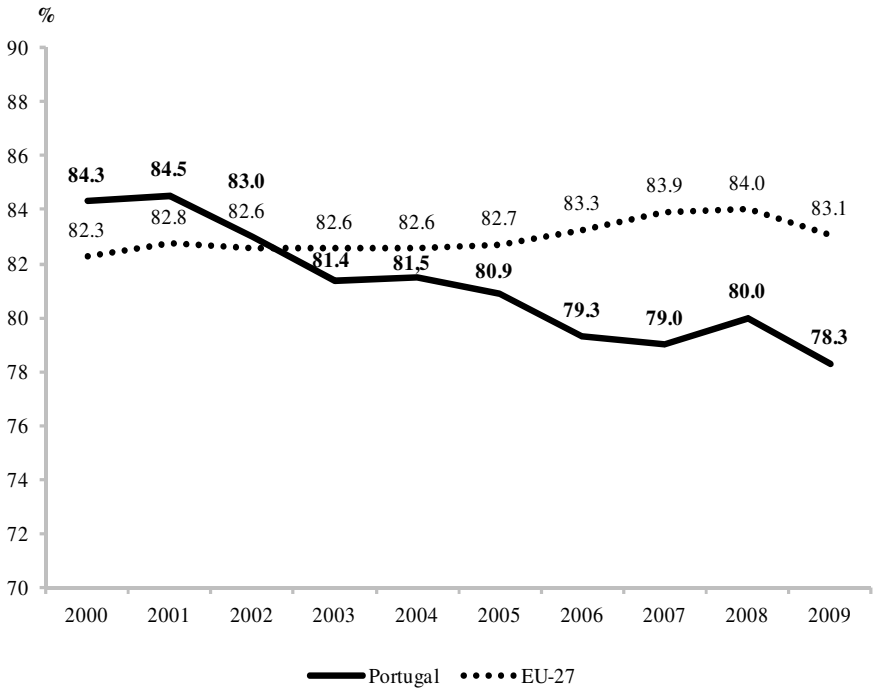
Another important aspect is the analysis of patterns of job creation shows that the Portuguese labour market is characterised by high job rotation, with high job creation and destruction occurring for all groups of workers regardless of their level of schooling (Cardoso and Ferreira, 2001).

[57] To summarise the data collected from Annual Labour Force Survey, about Population, Employment and Unemployment Indicators in Portugal: evolution of higher education, see Annex E.

However, both the raw and net rates of job creation were persistently higher for workers with higher education degrees than for those with lower schooling, between the mid-1980s and late 1990s, precisely as shown before, the period of greatest higher education expansion.

But, if we consider the same period of analysis, the employment rate of Portuguese population with higher education has decreased 6 p.p., that is, a contrary behaviour to that which occurred in the EU-27 that increased 0.8 p.p.. Figure 10 shows this evidence.

Figure 10 – Evolution of Employment Rate of Population with Higher Education in Portugal and EU-27, 2000-2009.

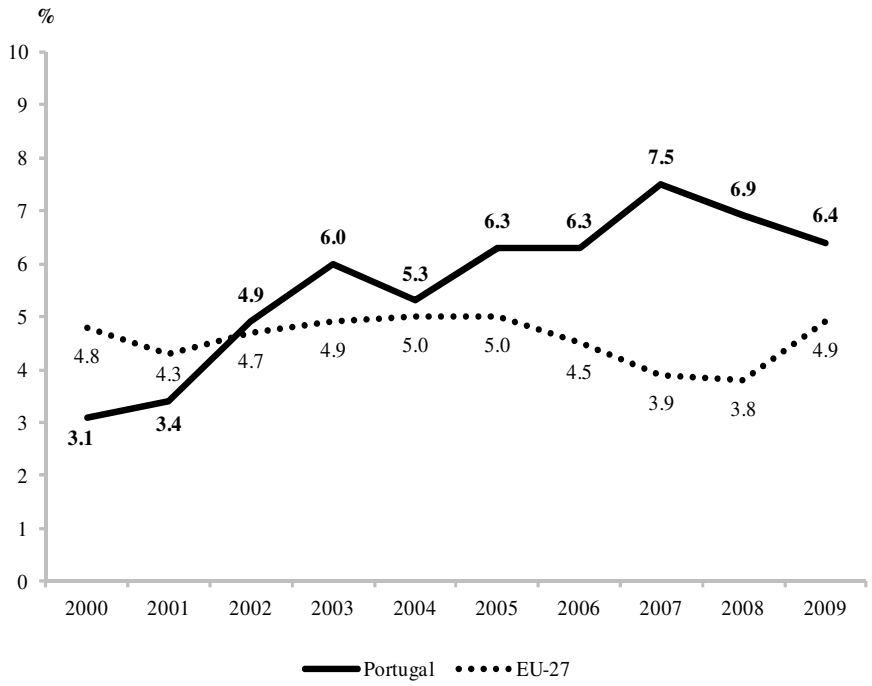


Source: INE in link http://www.ine.pt – Labour Force Survey; Eurostat in link http://epp.europa.eu/portal/employment_unemployment_lfs/data/main_tables - Statistics by Theme: Employment and Unemployment (Labour Force Survey).

Recently one can observe a gradual unemployment increase of the Portuguese population with higher education. In Figure 11, the same period, Portugal increased its unemployment rate in 3.3 p.p. more 1.5 p.p. than EU-27.

Hence, the slight increase of the number in graduate unemployment did not result from a decline in the willingness of companies to recruit higher education graduates, but rather from the labour market's incapacity to absorb the massive flow of graduates from last two decades.

Figure 11 – Evolution of Unemployment Rate of Population with Higher Education in Portugal and EU-27, 2000-2009.



Source: INE in link http://www.ine.pt – Labour Force Survey; Eurostat in link http://epp.europa.eu/portal/employment_unemployment_lfs/data/main_tables - Statistics by Theme: Employment and Unemployment (Labour Force Survey).

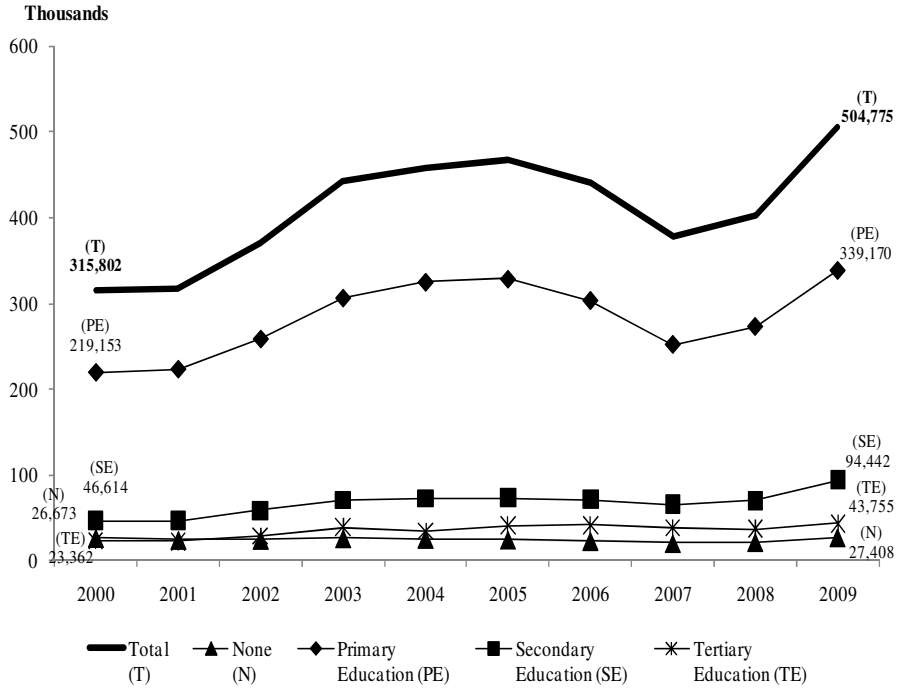
More, it's probably a generalized economy phenomena within, that it seems associated with the present slow-down of the economy and the saturation of some labour market areas such as social sciences.

There are now new challenges for Portuguese economy.

Until quite recently, Portuguese industry was able to compete with low-qualified work force, as demonstrated by the low number of people with a PhD working in industry, the low qualification level of many entrepreneurs and the low dimension of lifelong education and training activities – more evident on older generations.

Under these circumstances it is almost inevitable that there will be a mismatch between the figures of higher education sector and the demands of the labour market. The problem can emerge at the level of graduate higher education sector in times of economic slow-down or even stagnation.

Figure 12 – Evolution of Unemployment in Portugal by Education Level, 2000-2009.



Source: Portuguese Ministry of Labour and Social Solidarity (MTSS) in link http://www.mtss.gov.pt/ - Theme: Statistics from Labour Market – Unemployment.

But notwithstanding several facts, people with higher education remain the least affected by unemployment, as we can see in Figure 12.

Simultaneously, the present study aims to understand whether this situation of lower unemployment to people with higher education compared to other levels of education, doesn't hide, for example, overeducated people in the labour market.

The next chapter investigates the incidence of overeducation in Portugal.

Chapter 3

Empirical Strategy and Findings

In the first section of the chapter one, overeducation was presented from a general perspective using several possible definitions. This chapter investigates the incidence of overeducation based on the third definition: *Underutilization of Educational Skills* (the discrepancy between educational attainments of workers and the educational requirements of their jobs).

Although overeducation can be measured in several ways, this definition is perhaps the most straightforward for measuring the phenomena, because it measures directly the utilization of skills in the labour market (Rumberger, 1981a: p.45).

Constructing this measure of overeducation requires information on both the skill requirements of jobs and the educational attainments of workers. It is also necessary to convert the skill requirements of jobs into equivalent years of schooling in order to compare them with educational attainments. However, constructing this index presents a number of challenges.

The first concerns the definition of job skill requirements. In this study they are defined as set of several *key-concepts* such as *job*, *task*, *occupation*, *level of skills* and *expertise*.

A second challenge is determining the skills that workers have. This study focuses on general skills, not specific ones. The former are acquired in school while the latter can be acquired from a number of sources, including vocational education, experience and on-the-job training. Information about educational attainments of workers is commonly available according to the Educational System by complete education level.

The third challenge concerns the problem of converting the skill requirements of jobs into equivalent years of schooling. To solve this problem the present study uses a link between the International Standard Classification of Education and the International Standard Classification of Occupation through *levels of competence* as defined on Portuguese Classification of Occupations of 2010.

The aim of this chapter is to measure and quantify how many individuals are overeducated following the methodology of objective and empirical approach. The first section describes the data used in this study and the second section outlines how data were constructed. Following that, it is a presentation on the empirical procedures used to evaluate the incidence of overeducation. Finally, the results of both approaches are compared and discussed.

1. Source and Data

The measure of overeducation used in this study requires information on the characteristics of jobs (the educational requirements) and the characteristics of workers holding those jobs (the educational attainments). In order to achieve the purpose of this study we selected the Labour Force Survey (LFS)[58] from Office of National Statistics (INE) that contains information on both.

In general, the LFS aims to obtain information on the labour market and its related issues by means of personal or telephone interviews. It gives a set national and regional statistics for employment, unemployment, underemployment, discouraged workers, occasional workers, second jobs, occupations and education, which can be compared with those of other EU countries[59].

There are advantages in using the LFS for the purposes of this study. In the first place, it affords the opportunity to obtain information on relevant labour market aspect across all sectors of the economy in a consistent and representative manner. Additionally, the LFS gives an overview of other socio-demographic variables, including marital status, household composition and living arrangements.

The Portuguese LFS started in 1983 as a quarterly survey. Since 1998, the survey is a continuous one yielding quarterly results. The current series[60] was recalibrated to incorporate the results from the Census of Population in 2001 and to complete the process of harmonisation with those of other EU countries. Through LFS all geographical territory of Portugal is covered, i.e., mainland, Madeira and Azores.

To assess the contemporary situation of Portuguese labour market, the years 1998, 2004 and 2009 were chosen (for this study based on availability data from Office of National Statistics).

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[58] The INE periodically collects information on resident population which consists of individuals residing in a private dwelling during the reference week. However, individuals who are absent for short periods of time and not occupying another dwelling permanently are also included. The participation in the survey is compulsory in accordance with de Law 6/89, *Sistema Estatístico Nacional*, of April 1989.

[59] For further details see Eurostat, 2003 and 2011.

[60] There are currently four series of LFS: series of 74 (1974-1982), series of 83 (1983-1991), series of 92 (1992-1997) and series of 98 (from 1998). All four series reflect several adjustments (Community Regulations and some National needs for further information on labour market) in order to improve the quality of LFS and to monitoring some new statistical and labour market realities.

1.1 Information on Jobs

The aim of this section is to establish the relationship between LFS, skill requirements of jobs through several *key-concepts* and how they can be related to educational levels.

In the LFS jobs are classified according to the National Classification of Occupations of 1994 (NCO/94). The NCO/94 has been produced from a revision of the National Classification of Occupations. From 1980, this review was conducted on the basis of the International Standard Classification of Occupations (ISCO-88), published by the International Labour Office (ILO), and was motivated the need for national labour statistics to use ISCO definitions.

The NCO/94 was drawn up using two central concepts: the concept of *the nature of the work performed* and *the concept of skills*. The first is directly related to the tasks normally executed by the occupant of the job and its respective requirements. Occupations are defined broadly, to cover a number of jobs and work stations with similar tasks and requirements.

The concept of skills is defined as the capacity to perform the tasks required by a given job. For the purposes of NCO/94, two parameters are used for this definition:

i) *Level of skill*, which is determined by the complexity and diversity of the tasks required;

ii) *Type of skill*, which is related to the breadth of education required, the tools and machinery used, the materials worked on and with, and the nature of the goods produced and the services rendered.

These two concepts were used to aggregate and define occupations for the NCO/94. The result was a pyramidal and hierarchical structure of ten Major Groups which subdivide into Major Sub-Groups and Base Groups.

For all chosen years, the LFS data was collected for jobs classified according to the NCO/94. This classification was done at two levels: major group and major sub-group. However, NCO/94 has some limitations:

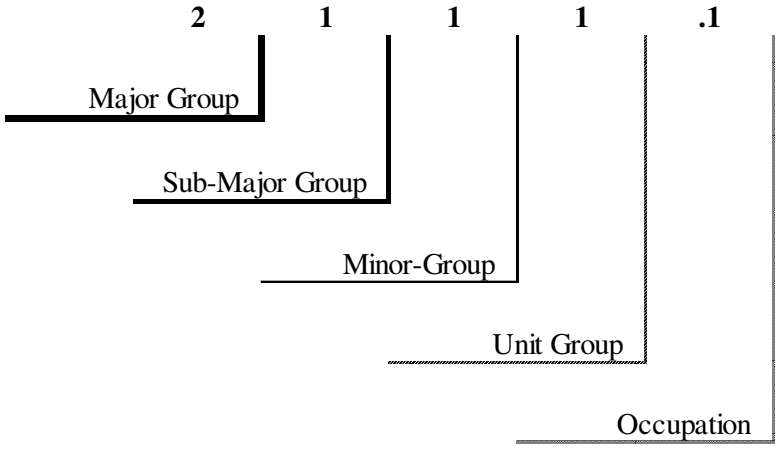
i) It does not present a complete definition for levels and types of skills and its relations;

ii) And it does not present a link between types of skills, the Portuguese Education System and the International Standards Classification of Education (ISCED).

With the new Portuguese Classification of Occupations of 2010 (PCO/2010)[61] the pointed limitations were solved. The shift from NCO/94 to PCO/2010 was possible because major groups in PCO/2010 were kept in the same structure of the NCO/94.

Moreover, the structure of PCO/2010 integrates all levels of ISCO/2008, and it is an essential tool for statistics on occupations and the statistical comparability at European and international level (see Figure 13).

Figure 13 – Structure Levels of Portuguese Classification of Occupations of 2010.



Source: INE in link http://www.ine.pt - Portuguese Classification of Occupations of 2010 (PCO, 2011: p.14).

At this point we can observe some similarities with other studies. For example, Rumberger (1981) also had to face some difficulties, mainly derived from new editions of the DOT, particularly with 1977 DOT which codes were changed and information on job characteristics was updated. To overcame these methodological problems, Rumberger used similar specifications from the 1960 and 1976 United States Census Public Use Sample (CPS) with some transformations constructed by Robert Lucas (1972) and a matrix that crosses occupation codes with DOT codes made by Ann Miller (1971). With this process, given a person's census occupation code it was possible to assign to that individual the probability of holding a job with each level GED scale (Rumberger, 1981a: p.53-55).

[61] Also known as *Classificação Portuguesa das Profissões 2010 (CPP/2010)*. The PCO/2010 substitutes the NCO/94.

At 1-digit level from Figure 15 we can found the ten major groups as defined by PCO/2010 (see Table 1).

Table 1 – Major Groups of Portuguese Classification of Occupations of 2010.

Code	Major Group
1	**Managers**
2	**Professionals**
3	**Technicians and Associate Professionals**
4	**Clerical Support Workers**
5	**Service and Sales Workers**
6	**Skilled Agricultural, Forestry and Fishery Woorkers**
7	**Craft and related Trades Workers**
8	**Plant and Machine Operators and Assemblers**
9	**Elementary Occupations**
0	**Armed Forces Occupations**

Source: INE in link http://www.ine.pt - Portuguese Classification of Occupations of 2010 (PCO, 2011: p.19).

To understanding the design of PCO/2010 it is also important to define fundamental *key-concepts*, such as: *job*, *task*, *occupation*, *level of skills* and *expertise* (PCO, 2011: p.20). These *key-concepts* are used to classify occupations according to educational requirements of jobs. The PCO/2010 defines each concept as follow:

i) *Job* means the duties and functions carried out by an individual employed by others or by themselves.

ii) *Task* refers to a physical or intellectual activity performed by an individual who holds a job.

iii) *Occupation* corresponds to the set of jobs whose main tasks and functions possess a high degree of affinity and requires a similar knowledge.

iv) *Competence* is defined as the ability to perform the tasks and functions of a given job and it has two dimensions: *skill level and expertise*.

iv.1) *Skill level* is determined by the complexity of the tasks and functions performing within a job. This level is measured considering one or more than one of the following aspects:

- The nature of work in a job related with characteristics of tasks and functions defined for each level by ISCO/2008;

- The formal education set by ISCED/97; and the training and experience obtained in carrying out tasks and functions of a job.

iv.2) *Expertise* is characterized by four base concepts: the knowledge required, the tools and machines used, the materials worked, and the products and services produced.

Within each major group, the jobs are organized at various levels that comprise, primarily, on the basis of expertise. The four *levels of competence* in PCO/2010, adopted from ISCO/2008, are defined as follows:

i) *Skill level 1* – includes the execution of simple and routine physical or manual tasks. It involves tasks such as: cleaning, transport and storage manual of goods and materials, operating motorized vehicles, and pick fruit and vegetables.

ii) *Skill level 2* – involves performing tasks related to operation of machinery and electrical equipment, driving vehicles, maintenance and repair of equipment, treatment and storage of information. This skill level requires the ability to interpret safety instructions, perform arithmetic and registration of information.

iii) *Skill level 3* – involves performing technical tasks and complex practices, including the preparation of estimates of quantities, materials and workmanship costs for a specific project, coordination and supervision activities of other employees performing technical functions, and support to the experts.

iv) *Skill level 4* – involves performing tasks that require complex problem solving and research in specific fields, diagnosis and treatment of diseases, machinery and construction design.

Considering the four levels of competence in PCO/2010, adopted from ISCO/2008, we can also observe some similarities and compare them, for example, with Components of the GED Scale[62] that was used by Rumberger (1981), which adopted a matrix defined with six levels for three main components[63] (Rumberger, 1981a: p.50).

Now it is possible to establish a relationship between LFS and the skill requirements of jobs through several *key-concepts* as defined by PCO/2010. The four *levels of competence* of ISCO/2008 can be linked to the ten major groups of PCO/2010 as described in the next Table.

[62] There are also some similarities with Dutch Job Qualification Scales (Hartog and Oosterbeek, 1988).

[63] The components of the GED Scale embraced aspects of formal and informal education which contribute to the worker's *reasoning development* and *ability to follow instructions*, as also acquisition of "*tool*" knowledge's, such as *language and mathematical skills*. Each job may require different levels for each of three components.

Table 2 – Major Groups of PCO/2010 and Levels of Competence.

Code	Major Group	Level of Competence
1	**Managers**	**3 + 4**
2	**Professionals**	**4**
3	**Technicians and Associate Professionals**	**3**
4	**Clerical Support Workers**	**2**
5	**Service and Sales Workers**	**2**
6	**Skilled Agricultural, Forestry and Fishery Woorkers**	**2**
7	**Craft and related Trades Workers**	**2**
8	**Plant and Machine Operators and Assemblers**	**2**
9	**Elementary Occupations**	**1**
0	**Armed Forces Occupations**	**1, 2 + 4**

Source: INE in link http://www.ine.pt - Portuguese Classification of Occupations of 2010 (PCO, 2011: p.21).

However, regarding the four *levels of competence* of ISCO/2008, when levels of education and training are required to measure the level of competence of a job, in PCO/2010 they are correlated with the ISCED/97. Thus, it is possible to complete the relationship between LFS, skill requirements of jobs and educational levels.

The Table below shows the levels of competence and its correspondents ISCED groups.

Table 3 – Levels of Competence and ISCED/97 Groups.

Level of Competence	ISCED/97 Groups	
4	**6**	Second stage of tertiary education
	5a	First stage of tertiary education
3	**5b**	First stage of tertiary education
2	**4**	Post-secondary non-tertiary education
	3	(Upper) secondary education
	2	Lower secondary or second stage of basic education
1	**1**	Primary education or first stage of basic education

Source: INE in link http://www.ine.pt - Portuguese Classification of Occupations of 2010 (PCO, 2011: p.21).

These definitions and concepts play an important role in PCO/2010, facilitating the grouping of workers by the content and nature of their work, providing the necessary information about the characteristics of jobs.

1.2 Information on Education

In addition to information on the characteristics of jobs, this study requires information on characteristics of workers, in particular, their educational attainments.

The aim of this section is to link the Portuguese Education System with ISCED groups and establish the relationship between levels of competence and the major groups of PCO/2010 by years of schooling.

In the LFS, the educational attainment of workers is classified according to the Portuguese Education System[64] and the Law on the Education System[65] which establish the general legal framework of the Portuguese Education System.

The Educational System[66] comprises three levels: primary, secondary, and tertiary education. The first level has three cycles: the first cycle of basic education (4 years); the second cycle of basic education (2 years); and the third cycle of basic education (3 years). The basic education was compulsory up to 2009. However, since this year, the Government headed by former Prime Minister José Sócrates approved the extension of the compulsory education to the 12th grade. The second level is comprised by three years, corresponding to 10th, 11th and 12th year of schooling. And the third level comprises the higher education cycle that is taught at university and polytechnic institutions, which can be public, private or cooperative.

The Portuguese Education System has some similarities and differences with other European countries. On the one hand, there are differences in terms of compulsory education[67] (e.g., full-time, part-time, and duration of full-time compulsory education) and secondly in terms of centralization or decentralization of the education systems themselves (Eurydice). On Table 4 we can see the organisation of Portuguese Education System by year of schooling and education level as was defined here.

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[64] The main principles governing the framework of the Portuguese Education System reflect the constitutional right to education and the State's duty to promote democracy in education (Art 73º from Constitution of the Portuguese Republic).

[65] Law 46/86, dated 14th October 1986, further amended by Laws 115/97, dated 19th September 1997 and 49/2005, dated 30th August 2005.

[66] Educational System refers to a structure of operation for the provision of education, i.e., educational system is influenced by philosophies of policy makers. The educational systems are normally classified around countries (e.g., the Portuguese Education System) or levels of education (e.g., Primary Education, Secondary Education and Tertiary Education) or regions (e.g., European Educational System).

[67] For more information see Eurybase in link: http://eacea.ec.europa.eu/education/eurydice/eurybase_en.php.

Table 4 – Organisation of the Portuguese Education System by Years of Schooling and Education Level.

Organisation of the Portuguese Education System	Years of Schooling	Education Level
Doctorate	**23**	**Tertiary Education**
Master	**18**	
Postgraduate	**17**	
Graduate	**16**	
Bachelor	**15**	
Secondary	**12**	**Secondary Education**
Third cycle of basic education	**9**	**Primary Education**
Second cycle of basic education	**6**	
First cycle of basic education	**4**	
None	**0**	**None**

Source: INE in link http://www.ine.pt - Portuguese Education System in 50 Years of Education Statistics: vol. I – (INE, 2009: p.14).

Now, it is possible to relate the education levels with years of schooling. But to complete the harmonisation process it is needed to relate all years of schooling within its correspondents ISCED groups (see Table 5).

Table 5 – Harmonisation between Portuguese Education System by Years of Schooling and ISCED/97 Groups.

Organisation of the Portuguese Education System	Years of Schooling	ISCED/97 Groups
Doctorate	**23**	**6**
Master	**18**	
Postgraduate	**17**	**5a**
Graduate	**16**	
Bachelor	**15**	**5b**
Secondary	**12**	**3 and 4**
Third cycle of basic education	**9**	**2**
Second cycle of basic education	**6**	**1**
First cycle of basic education	**4**	
None	**0**	**-**

Source: Cabinet of Planning, Strategy, Evaluation and International Relations from Ministry of Science, Technology and Higher Education (GPEARI-MCTES) in link http://www.gpeari.mctes.pt/.

Finally, the link between skill requirements of jobs and educational levels with educational attainments of workers it is now complete. Furthermore, it is now possible to convert the skill requirements of jobs into equivalent years of schooling, i.e., overeducation can be measured through the link between the ISCED groups and ISCO as defined in PCO/2010 and Portuguese Education System (see Table 6).

Table 6 – Relationship between Major Groups of PCO/2010 by Level of Competence, ISCED/97 Groups, Portuguese Education System and Years of Schooling.

1-Digit-Level	Major Group of PCO/2010	Level of Competence	ISCED/97 Groups	Portuguese Education System (Law 46/86)	Years of Schooling
1	Managers	4	6	Master and Doctorate	18 - 23
			5a	Graduate and Postgraduate	16 - 17
		3	5b	Bachelor	15
2	Professionals	4	6	Master and Doctorate	18 - 23
			5a	Graduate and Postgraduate	16 - 17
3	Technicians and Associate Professionals	3	5b	Bachelor	15
4	Clerical Support Workers	2	4 3	Secondary	12
			2	Third cycle of basic education	9
5	Service and Sales Workers	2	4 3	Secondary	12
			2	Third cycle of basic education	9
6	Skilled Agricultural, Forestry and Fishery Woorkers	2	4 3	Secondary	12
			2	Third cycle of basic education	9
7	Craft and related Trades Workers	2	4 3	Secondary	12
			2	Third cycle of basic education	9
8	Plant and Machine Operators and Assemblers	2	4 3	Secondary	12
			2	Third cycle of basic education	9
9	Elementary Occupations	1	1	First and Second cycles of basic education	4 - 6
0	Armed Forces Occupations	4	6	Master and Doctorate	18 - 23
			5a	Graduate and Postgraduate	16 - 17
		2	4 3	Secondary	12
			2	Third cycle of basic education	9
		1	1	First and Second cycles of basic education	4 - 6

Source: Relationship established by the author from the base concepts of PCO/2010 and Portuguese Education System.

Similar approach has been introduced by Kiker *et al.* (1997). In this study, the authors measured overeducation and undereducation through the observed distribution of workers by qualification levels and an exogenous definition of schooling requirements for each level based on the opinion of job analysts (Kiker *et al*., 1997: p.115).

The qualification levels were defined by the Portuguese Ministry of Labor and involved a broad classification of workers in eight distinct categories. These categories were adopted from Coelho *et al.* (1982), and were designed by job analysts, taking into account the training required for adequate job performance.

They have followed similar steps to translate the skill requirements of jobs into equivalent years of schooling and to define the qualifications' level by content of job. Using equivalent criteria, qualification levels were assigned to workers by each employer with its correspondent years of schooling. The final result was a very similar Table as the one which is defined by this study.

2. Constructing the Data Set

In this section, we resume the methodological options that were made to define the data set required to measure the discrepancy between educational attainments of workers and the educational requirements of their jobs. The aim of this section is to establish the Criteria for Empirical Analysis (CEA) to control and validate the records within LFS and to explain the methodology on both approaches used in this study.

The first procedure was to establish the CEA concerning the skill requirements of jobs and the educational attainments of workers (see Table 7).

Table 7 – Criteria of Empirical Analysis.

LFS Field Code	Meaning of the Field	Criteria of Empirical Analysis
Age	Age	>= 15 and <= 64 years
IEQ3	Sex	1 for male and 2 for female
IEQ28cod	Current Occupation	PCO/2010 at major groups
CPT	Employment Status	1 for civilian worker and 2 for armed forces occupations
IEQ85	Education	Portuguese Education System (*Law 46/86*)

Source: Criteria of Empirical Analysis (CEA) established by the author.

Then to comprise the demographic distribution of the LFS respondents, we used four variables: sex, age, marital status and resident area (NUTS II). The majority of LFS respondents are married women, aged over 35, and live in Northern Portugal (see Table 8).

Table 8 – Demographic Distribution of LFS Respondents.

Variable	1998			2004			2009		
	F	**M**	**F + M**	**F**	**M**	**F + M**	**F**	**M**	**F + M**
Sex	52.1%	47.9%	**100.0%**	51.9%	48.1%	**100.0%**	52.7%	47.3%	**100.0%**
Age									
< 15	14.9%	16.8%	**15.8%**	13.8%	16.0%	**14.8%**	12.0%	14.0%	**12.9%**
15 - 34	25.8%	29.3%	**27.5%**	24.1%	27.1%	**25.5%**	20.3%	23.8%	**22.0%**
35 - 64	38.3%	37.3%	**37.8%**	40.4%	39.6%	**40.1%**	42.7%	41.8%	**42.3%**
> 64	21.0%	16.6%	**18.9%**	21.7%	17.3%	**19.6%**	25.1%	20.3%	**22.8%**
Marital Status									
Married	50.9%	54.8%	**52.8%**	52.0%	55.5%	**53.7%**	51.8%	57.2%	**54.3%**
Divorced	2.5%	1.3%	**1.9%**	3.2%	1.7%	**2.5%**	4.3%	2.3%	**3.3%**
Single	34.5%	41.3%	**37.8%**	33.3%	40.2%	**36.6%**	30.9%	37.8%	**34.1%**
Widower	12.1%	2.6%	**7.5%**	11.5%	2.5%	**7.2%**	13.0%	2.8%	**8.2%**
Residential Area (NUTS II)									
Norte	30.1%	30.4%	**30.3%**	29.5%	29.1%	**29.3%**	28.3%	28.4%	**28.4%**
Centro	15.2%	15.2%	**15.2%**	15.2%	15.4%	**15.3%**	14.9%	14.8%	**14.9%**
Lisboa	15.6%	15.2%	**15.4%**	16.3%	16.1%	**16.2%**	15.4%	15.1%	**15.3%**
Alentejo	10.6%	10.6%	**10.6%**	11.8%	12.0%	**11.9%**	12.8%	12.9%	**12.8%**
Algarve	10.3%	10.4%	**10.3%**	9.5%	9.7%	**9.6%**	10.2%	10.1%	**10.1%**
R. A. Madeira	9.0%	8.4%	**8.7%**	9.0%	8.5%	**8.8%**	9.2%	8.9%	**9.1%**
R. A. Azores	9.2%	9.8%	**9.5%**	8.7%	9.1%	**8.9%**	9.1%	9.8%	**9.4%**

Source: Calculations made by the author.

Each LFS quarter contains on average of 46.800 records. After CEA a considerable number of individuals denoted some missing information and others do not correspond to the establish criteria. The first ones were considered an invalid record and the seconds are not part of this study. Thus, the number of valid records was less than the original ones. The records validation process resulted in a decrease of 58%.

The second procedure involved estimating the discrepancy degree between educational attainments of workers and the skill requirements of their jobs and also analyzing trends in these discrepancies over chosen years. To materialize this procedure it is necessary a methodology to measure.

2.1 Objective Approach

This first approach has a basic principle of measurement strategy: it measures the discrepancy between educational attainments of workers and the educational requirements of their jobs. The information about the request education to perform a specific occupation (variable SR) is compared with the acquired education (variable SA) of job-holders. The number of surplus or deficit of individuals overeducated can easily be established by comparing both variables.

Although it is common to find in the literature overeducation measured in years, the present study aim is to quantify how many individuals are overeducated. To that end, we use the following typology:

i) An individual is overeducated if SA > SR;

ii) An individual is adequately educated if SA = SR;

iii) And, an individual is undereducated if SA < SR.

2.2 Empirical Approach

The second approach used to measure overeducation has a different methodology of measurement: it measures the discrepancy between educational attainments of workers and the educational requirements of their jobs, through some statistical measures within each occupation, disaggregated as low as possible.

However, as was mentioned in previous section, the PCO/2010 definitions are aggregated and to the present study were only considered the workers' occupations at major groups' level.

So, within each major group of PCO/2010, the mean, mode (variable M) and standard deviation (variable SD) of acquired education of job-holders were calculated. Then, information about variable M (mean and mode) and SD were compared with the acquired education (variable SA) of job-holders.

This way, like in the previous approach, we can measure three types of results:

i) An individual is overeducated if SA > (M+SD);

ii) An individual is adequately educated if SA = (M+SD);

iii) And, an individual is undereducated if SA < (M+SD).

3. Results

In the first section we described the data used to measure overeducation and in the second we outlined the constructing of the data set and the empirical procedures used to evaluate the incidence of overeducation. This section will proceed with the examination of the incidence of the phenomena by revealing the results arising from methodology described in previous section.

We start by using the so-called *Objective Approach*, which depends on systematic evaluation by professional job analyst who attempts to specify the required level and type of education in particular occupation. In Table 9 are highlighted the empirical findings.

Table 9 – Results of the Objective Approach.

Year and Quarter	Number of Records	Overeducated			Adequately Educated			Undereducated		
		F	M	F + M	F	M	F + M	F	M	F + M
1998_1Q	**21.093**	1.5%	1.2%	**2.6%**	16.8%	13.9%	**30.7%**	25.3%	41.4%	**66.7%**
1998_2Q	**21.198**	1.4%	1.1%	**2.5%**	17.1%	13.8%	**30.9%**	25.3%	41.2%	**66.6%**
1998_3Q	**20.225**	1.5%	1.1%	**2.6%**	16.9%	14.2%	**31.0%**	25.0%	41.4%	**66.4%**
1998_4Q	**20.319**	1.6%	1.3%	**2.9%**	17.1%	14.3%	**31.4%**	24.9%	40.8%	**65.8%**
2004_1Q	**21.619**	3.4%	2.2%	**5.6%**	20.6%	16.2%	**36.8%**	21.5%	36.1%	**57.6%**
2004_2Q	**21.927**	3.4%	2.3%	**5.7%**	20.7%	16.9%	**37.6%**	21.3%	35.4%	**56.6%**
2004_3Q	**21.249**	3.4%	2.3%	**5.8%**	20.9%	16.8%	**37.6%**	21.3%	35.3%	**56.6%**
2004_4Q	**21.269**	3.8%	2.4%	**6.2%**	21.0%	17.2%	**38.1%**	21.0%	34.6%	**55.7%**
2009_1Q	**17.220**	5.1%	2.8%	**7.9%**	23.4%	18.7%	**42.1%**	18.7%	31.3%	**50.0%**
2009_2Q	**16.873**	5.3%	2.7%	**8.0%**	23.7%	18.8%	**42.5%**	18.5%	30.9%	**49.4%**
2009_3Q	**16.530**	5.4%	2.6%	**8.0%**	23.8%	19.2%	**43.0%**	18.2%	30.8%	**49.0%**
2009_4Q	**16.430**	5.6%	2.7%	**8.3%**	24.1%	19.1%	**43.2%**	18.0%	30.4%	**48.5%**

Source: Calculations made by the author.

The analysis of this table as well as the following will be developed on annual terms (i.e., regarding the calculated average distribution for all quarters per year).

In general terms we can observe, over the period, an increase of the incidence of overeducation increase (+5.7 p.p.) as well a rise in the proportion of individuals adequately

educated (+12.5 p.p.), which are compensated by a decrease on undereducated workers (-18.2 p.p.). The main conclusions that can be drawn from this table are:

First, the incidence of overeducation increased in the period between 1998 and 2009 about 5.4 p.p. of calculated average distribution. Considering this empirical finding, we have noted that the Portuguese Education System experienced a phenomenal growth between 1998 and 2009, especially at the secondary and tertiary education level. The empirical evidence presented in section 1 of chapter 2 already denoted some elevation on Portuguese workforce qualifications, especially in higher education (e.g., postgraduates, masters, and doctorates)[68].

Second, overeducation increased with greater magnitude on women over the period, about 3.9 p.p. of calculated average distribution. Evidence to this empirical finding it is suggested by one of the most striking phenomena of recent decades has been the extent to which women have increased their share of the labour force.

In this twenty years period, the education level of workers in Portuguese companies increased and the progression of educational attainment was more pronounced among women, especially in the percentage of women with higher education (ISCED 5 and 6)[69]. This change in workers education follows the sexual recomposition of university students. From mid 80s onwards women became the majority of university students in Portugal.

The Observatory of Inequalities (OI)[70] found the same evidence concerning the growing number of workers that was especially pronounced among women between 1988 and 2008 (OI, 2011).

Third, the incidence of undereducation decreased over the period about 17.2 p.p. of calculated average distribution, with highest prevalence on men (-10.4 p.p.). This finding is in agreement with evidence of other studies. Moniz (2008) pointed out that younger generations have already much higher levels of schooling on both sexes.

Fourth, individuals with adequately education also increased over the period about 11.7 p.p. of calculated average distribution (women: 6.8 p.p.; men: 4.9 p.p.).

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[68] The same evidence was found by Moniz (2008).

[69] See Annex F.

[70] The Observatory of Inequalities (OI) is an independent structure formed by the Centre for Research and Studies at Lisbon University Institute (CIES, ISCTE-IUL), which is responsible for its daily running and scientific coordination Its partner institutions are the Sociology Institute at the Faculty of Arts of University of Porto (ISFLUP) and the Social Studies Centre at the University of Azores (CES-UA). For further information see link: http://observatorio-das-desigualdades.cies.iscte.pt/index.jsp.

Overall, these findings are in line with Kiker *et al.* (1997) that with data for the Portuguese economy for the year of 1991 concluded that the incidence of overeducation increased, overeducation for women was larger, and there was a decline in the percentage of undereducated workers (Kiker *et al.*, 1997: p.116-117).

As an alternative to the previous approach, we used the *Empirical Approach* developed on the distribution of educational attainments within a given occupation, defined as a level of education more than on standard deviation below the mean. Table 10 presents the empirical findings by using the *Mean (Me)* as *variable M*.

Table 10 – Results of the Empirical Approach using the Mean (variable M).

Year and Quarter	Number of Records	Overeducated			Adequately Educated			Undereducated		
		F	M	F + M	F	M	F + M	F	M	F + M
1998_1Q	**21.093**	3.7%	6.4%	**10.1%**	5.1%	3.6%	**8.7%**	34.7%	46.5%	**81.2%**
1998_2Q	**21.198**	4.3%	7.2%	**11.4%**	4.6%	2.6%	**7.2%**	35.0%	46.4%	**81.4%**
1998_3Q	**20.225**	3.7%	6.4%	**10.1%**	5.1%	3.7%	**8.8%**	34.5%	46.6%	**81.0%**
1998_4Q	**20.319**	3.9%	6.8%	**10.7%**	5.0%	3.4%	**8.4%**	34.7%	46.2%	**80.9%**
2004_1Q	**21.619**	6.4%	8.7%	**15.1%**	1.3%	1.2%	**2.5%**	37.7%	44.7%	**82.5%**
2004_2Q	**21.927**	4.4%	4.9%	**9.4%**	2.5%	5.1%	**7.6%**	38.5%	44.5%	**83.0%**
2004_3Q	**21.249**	5.6%	5.5%	**11.1%**	1.9%	5.0%	**6.9%**	38.0%	44.0%	**82.0%**
2004_4Q	**21.269**	4.6%	5.2%	**9.8%**	2.6%	5.0%	**7.6%**	38.6%	44.0%	**82.6%**
2009_1Q	**17.220**	7.1%	6.1%	**13.1%**	2.9%	5.9%	**8.8%**	37.3%	40.8%	**78.1%**
2009_2Q	**16.873**	7.3%	6.1%	**13.4%**	3.0%	5.7%	**8.7%**	37.2%	40.6%	**77.9%**
2009_3Q	**16.530**	7.2%	6.3%	**13.6%**	3.3%	5.8%	**9.1%**	36.9%	40.5%	**77.4%**
2009_4Q	**16.430**	7.7%	6.5%	**14.2%**	3.2%	5.8%	**9.0%**	36.8%	40.0%	**76.9%**

Source: Calculations made by the author.

Regarding to this approach, similar studies used this methodology to measure over and undereducation. For example, Kiker *et al.* (1997) developed a study based on the Verdugo and Verdugo (1989) definition, but instead of using the Verdugo and Verdugo's mean-centred bracket they chose a different measure of central location, the distribution mode (Kiker *et al.*, 1997: p.114-115).

From Table 10 we can start by highlighting that results are very different from previous approach. In terms of other conclusions, several aspects should be stressed. First, the incidence of overeducation between 1998 and 2009 about 2.9 p.p. of calculated average distribution, but less then observed with the *Objective Approach*. As well as observed with the *Objective Approach*, there is an increase of overeducation with greater magnitude on women (about 3.4 p.p. of calculated average distribution). And if we compare the results, it is possible to note a slightly change in men's case, because there was a decrease in incidence of overeducation about 0.5 p.p. of calculated average distribution. In addition, it is possible to observe the incidence of overeducation within each occupational group as defined in previous section, using statistical measures calculated within each occupational group (which correspond to the major groups of PCO/2010)[71].

Secondly, the incidence of undereducation decreased over the period about 3.6 p.p. of calculated average distribution with some different results among genders: men decreased 5.9 p.p. and women increased 2.3 p.p.. One explanation that could be proposed for this fact is the increasing participation of women in paid work which has been driving employment trends and reducing the gender gaps in labour force participation rates (ILO, 2010b: p.3-6).

Similar results were found to individuals with adequately education. This group of workers increased over the period about 0.6 p.p. of calculated average distribution, but differently among men and women (women: -1.8 p.p.; men: 2.4 p.p.).

The previous findings suggest another important thing that competes directly with these results: *the changes in skill requirements of jobs*[72]. According to Lopes (1996), the entry of Portugal into the ECC was a turning point for the Portuguese economy, initiating the rise of a new economic cycle, which benefited from new investment opportunities, and from professional reconversion. It is also recognized that the recovery was greatly motivated by the integration of Portugal into European Community, and in particular by policies improving and providing financial support for professional reconversion and training of Portuguese workforce (Hespanha, 1999: p.24).

Alongside with the previous procedure, we applied the same methodology but instead of using mean as variable M, we tested the results with *Mode (Mo) as variable M*. Through this

[71] See Annex G.

[72] In fact, if a technological change takes place, that has the effect of making higher education the required level thereafter, firms will retrain the existing workforce, adjust standards upwards and replace each vacant or newly created position with better-educated employee (Santos and de Oliveira, 2002: p.4).

empirical procedure, the job requirements are based on actual educational attainments of workers within occupations disaggregated as low as possible. Table 11 resumes the empirical findings.

Table 11 – Results of the Empirical Approach using the Mode (variable M).

Year and Quarter	Number of Records	Overeducated			Adequately Educated			Undereducated		
		F	M	F + M	F	M	F + M	F	M	F + M
1998_1Q	**21.093**	4.9%	8.2%	**13.1%**	3.1%	7.3%	**10.5%**	35.4%	41.0%	**76.4%**
1998_2Q	**21.198**	5.1%	8.1%	**13.1%**	3.7%	8.4%	**12.0%**	35.1%	39.7%	**74.8%**
1998_3Q	**20.225**	5.2%	8.2%	**13.4%**	3.0%	7.5%	**10.5%**	35.2%	41.0%	**76.1%**
1998_4Q	**20.319**	5.1%	8.5%	**13.6%**	3.1%	7.6%	**10.7%**	35.4%	40.3%	**75.7%**
2004_1Q	**21.619**	8.3%	11.4%	**19.7%**	3.3%	7.5%	**10.8%**	33.9%	35.6%	**69.5%**
2004_2Q	**21.927**	8.4%	12.0%	**20.3%**	1.5%	0.8%	**2.3%**	35.5%	41.8%	**77.3%**
2004_3Q	**21.249**	8.4%	12.1%	**20.6%**	1.5%	0.8%	**2.3%**	35.6%	41.5%	**77.1%**
2004_4Q	**21.269**	8.5%	12.1%	**20.7%**	1.7%	0.8%	**2.5%**	35.6%	41.3%	**76.9%**
2009_1Q	**17.220**	7.3%	11.1%	**18.4%**	3.6%	2.6%	**6.1%**	36.4%	39.1%	**75.5%**
2009_2Q	**16.873**	8.2%	11.8%	**20.0%**	3.1%	1.8%	**4.9%**	36.3%	38.8%	**75.1%**
2009_3Q	**16.530**	8.3%	11.9%	**20.2%**	3.2%	1.9%	**5.0%**	35.9%	38.9%	**74.8%**
2009_4Q	**16.430**	8.1%	11.0%	**19.1%**	3.7%	2.8%	**6.5%**	36.0%	38.4%	**74.3%**

Source: Calculations made by the author.

Overall, the incidence of over and undereducation converged with the results obtained in previous approaches. However, overeducation incidence is now higher (about 6.1 p.p. of calculated average distribution in period 1998-2009) and less significant at the undereducation level (about -0.8 p.p. of calculated average distribution over the same period). The results are in agreement with other studies. As some authors suggest, the mode is less sensitive to the presence of outliers in the data and provides a more accurate measure of the extent of surplus or deficit schooling than can be garnered from the mean procedure (Santos and de Oliveira, 2002).

From table above, and concerning educational attainments of job-holders adequately educated, the results diverged from previous approaches (about -5.2 p.p. of calculated average distribution over the period). Different results were observed according to gender: first, a clear divergence in the men's adequately educated (a decrease about 5.4 p.p. of calculated average

distribution over the period) and second, women results fluctuations with adequately educated and undereducated.

Next, we analyze the incidence of overeducation within major groups and compare the results with ISCED groups. When using the *Mode as variable M*, results are different than found previously. First, the incidence of overeducation by major groups has no direct relation with number of records. Second, it is found to be more concentrated around major groups 5 (1998 and 2004) and 7 (2009)[73].

The findings presented above regarding the incidence of undereducation and overeducation might be explained by one important process that characterized the last three decades: *the tertiarization*[74] *of the Portuguese economy*. Some developments are associated with the changes in shares of sectors as well as with the movement of labour between sectors that induces new challenges for the development of human capital and education system. Many authors state that the general trends in sectoral evolution could be summarised by the so-called "*three sector hypothesis*"[75].

In this regard, some other effects took place. One remarkable change is associated with the tertiarization of Portuguese workforce particularly significant among women. Between 1988 and 2008 the employment feminization and tertiarization in Portugal resulted in a profound occupational rearrangement of the Portuguese population.

According to a recent study of the Observatory of Inequalities, in 1988 about 50% of women were employed in a tertiary sector, while in 2008 this number rose to 70%. At the same time, there is an increase in the specialization of women in routine work, i.e., in tasks related to the tertiary sector. In 1988 already 48% of women worked in such jobs, in 2008 they rose to 57% (OI, 2011).

Somehow, the empirical evidence in this study suggests that there is an interconnection between *the changes in skill requirements of jobs* and *the tertiarization of Portuguese economy*. As pointed out by the Observatory of Inequalities, the intense tertiarization of employment must be seen as a cause and an effect of the transformation processes: on the one

[73] See Annex H.

[74] Tertiarization is a term used to the development of the tertiary sector (service) and the growing proportion of employment (both of men, and particularly, of women) represented by this sector compared with the primary and secondary sectors in link: http://www.eurofound.europa.eu.

[75] The "*three sector hypothesis*" describes the long-run evolution of economies from agricultural to industrial and then to service-based economic structure defined as the process of tertiarization (Bachman and Burda, 2008).

hand, it relates to the rising percentage of working women; on the other hand, with the increasing school attainment of Portuguese workers (OI, 2011). And it could be possible refer another fact which is correlated: *the educational transition of Portuguese economy*.

Using the LFS data set disaggregated by ISCED groups it is possible to note: (i) a decrease on educational attainments of job-holders with ISCED 1 and 2 (-12.5 p.p.), (ii) an increase on ISCED 3 and 4 (+6.2 p.p.), and (iii) an increase on ISCED 5 and 6 (+6.3 p.p.). The Table 12 shows the empirical findings over ISCED groups.

Table 12 – Educational Attainments of Job-Holders by ISCED/97 Groups.

Year and Quarter	Number of Records	ISCED 1 and 2			ISCED 3 and 4			ISCED 5 and 6		
		F	M	F + M	F	M	F + M	F	M	F + M
1998_1T	**21.093**	33.7%	48.3%	**82.1%**	4.9%	4.9%	**9.9%**	4.8%	3.2%	**8.0%**
1998_2T	**21.198**	34.1%	48.0%	**82.0%**	4.9%	5.0%	**10.0%**	4.9%	3.2%	**8.0%**
1998_3T	**20.225**	33.8%	48.6%	**82.3%**	5.0%	5.1%	**10.1%**	4.6%	3.0%	**7.6%**
1998_4T	**20.319**	33.8%	48.0%	**81.7%**	5.1%	5.2%	**10.3%**	4.8%	3.2%	**8.0%**
2004_1T	**21.619**	31.4%	43.7%	**75.0%**	6.7%	6.5%	**13.2%**	7.3%	4.4%	**11.7%**
2004_2T	**21.927**	31.3%	43.1%	**74.4%**	6.7%	6.6%	**13.4%**	7.4%	4.8%	**12.2%**
2004_3T	**21.249**	31.5%	43.1%	**74.6%**	6.8%	6.7%	**13.5%**	7.3%	4.6%	**11.9%**
2004_4T	**21.269**	31.2%	42.5%	**73.7%**	6.8%	6.8%	**13.7%**	7.7%	4.9%	**12.7%**
2009_1T	**17.220**	30.6%	39.6%	**70.2%**	8.0%	7.6%	**15.6%**	8.7%	5.6%	**14.3%**
2009_2T	**16.873**	30.5%	39.2%	**69.6%**	8.2%	7.8%	**16.0%**	8.9%	5.5%	**14.4%**
2009_3T	**16.530**	30.2%	39.1%	**69.4%**	8.5%	8.3%	**16.8%**	8.7%	5.2%	**13.9%**
2009_4T	**16.430**	29.9%	38.9%	**68.8%**	8.7%	8.1%	**16.8%**	9.1%	5.3%	**14.4%**

Source: Calculations made by the author.

In this sense, according to Centeno *et al.* (2010), the authors recognize that there was a significant educational transition in Portugal in last two decades, with a marked rise in the average schooling level and an increase in the dispersion on the educational distribution[76]. However, the educational transition has not been fully materialised yet (Centeno *et al.*, 2010: p.14), because the convergence process towards the present educational structure in developed

[76] See Annex I.

countries still calls for a significant improvement in the education performance, especially with older aged groups, that in Portuguese economy will tend to be a particularly protracted.

To summarise the results presented in this section, Table 13 provides an overview of the similarities and discrepancies in the findings between the approaches used to measure the incidence of overeducation, allowing a comparison between the two, in order to know whether there are common points of convergence.

Table 13 – Overview of Similarities and Discrepancies in Results between Objective Approach and Empirical Approach.

	F						M						F+M					
	Δ 98/04			Δ 98/09			Δ 98/04			Δ 98/09			Δ 98/04			Δ 98/09		
ES	OA	EA		OA	EA		OA	EA		OA	EA		OA	EA		OA	EA	
		Me	Mo		Me	Mo		Me	Mo		Me	Mo		Me	Mo		Me	Mo
OE	↗	↗	↗	↗	↗	↗	↗	↙	↗	↗	↙	↗	↗	↗	↗	↗	↗	↗
AE	↗	↙	↙	↗	↙	↗	↗	↗	↙	↗	↗	↙	↗	↙	↙	↗	↗	↙
UE	↙	↗	↙	↙	↗	↗	↙	↙	↙	↙	↙	↙	↙	↗	↙	↙	↙	↙

Source: Construction made by the author.

Legend: **Gender**: F – Female, M – Male; **Educational Status (ES)**: AE – Adequately Educated, UE – Undereducated, OE – Overeducated; **Overeducation Approach**: OA – Objective Approach, EA – Empirical Approach; **Empirical Approach Measures**: Me – Mean, Mo – Mode.

The Table above allows an overview about the incidence of overeducation over the period. Considering the approaches together, we can see that the incidence of overeducation increased on women. Conversely, the incidence of undereducation decreased on men. But overall the incidence of overeducation increased on both sexes.

Moreover, with regard to the measured results it is clear that demand for better qualifications does not followed the rhythm of supply growth, mainly considering *the tertiarization* and *the educational transition* process of the Portuguese economy, at least, in terms of what was discussed in present study.

Conclusions

In the last three decades there was an important process of educational transition in Portugal. Between the 1981 Census and the 2001 Census, the share of the workforce with a maximum of 6 years of schooling decreased by 30 percentage points and the share of the workforce with 12 years of schooling or more increased by 20 percentage points (Centeno *et al*., 2010: p.11-12).

Despite these positive developments, the current average level of schooling of Portuguese population remains particularly low compared with other EU countries. However, education remains at the top of individual decisions and has a very strong impact on labour market. Education is generally regarded as an important determinant for the labor market position of workers, because individuals with more education tend to get better jobs (Borghans *et al.*, 2000: p.191).

Moreover, investment in education also generates significant social benefits through the positive external effects generated. An economy with a better-trained workforce is more productive. According to a recent survey carried out by the OECD, the academic qualification deficit in Portugal probably accounts for an annual shortfall amounting to 1.2% of GDP (Portugal, 2004: p.75).

In many OECD countries, there is a tendency for highly skilled individuals to be employed in jobs that used to be occupied by people with lower level of education. This phenomenon is often directly interpreted as overeducation.

This study focuses overeducation as a form of *underutilization of educational skills* defined as a level of educational attainment greater than the educational requirement of an occupation. Rumberger (1981) defined this measure as the most straightforward for measuring the phenomena because it measures directly the utilization of skills in the labour market (Rumberger, 1981a: p.45).

There are in literature three main alternatives in the measurement of the *underutilization of educational skills*. However, just two of them were addressed here. First we used the so--called *Objective Approach*, which depends on systematic evaluation by professional job analyst who attempts to specify the required level and type of education in particular occupation (Rumberger 1981a; Hartog and Oosterbeek, 1988; and Kiker *et al*., 1997).

The second approach focuses on the distribution of educational attainments within a given occupation. Most commonly, *underutilization of educational skills* is defined as a level of education more than on standard deviation below the mean (Verdugo and Verdugo, 1989). This so-called *Empirical Approach* clearly differs from the above-mentioned measure in

defining underutilization as being substantially underutilized. It also implies symmetry and will clearly give biased estimates where the tendency to underutilization or overutilization of educational skills is skewed. The latter was generally the case, as in almost all studies of the US and British labour markets. However, the reverse seems to hold in Netherlands and Spain. Therefore it seems more appropriate to consider this measurement of overeducation in relation to the mode rather than the mean, as Kiker *et al.* (1997) have done for Portugal and Alpin *et al.* (1997) have done to Britain.

Constructing these measurements was the major challenge of this study, because it requires information on both the skill requirements of jobs and the educational attainments of workers. First, to achieve the purpose of this study we selected the Labour Force Survey (LFS) from Office of National Statistics (INE) that contains information on both. Second, we used the Portuguese Classification of Occupations 2010 (PCO/2010) and the Portuguese Educational System to link both and convert them into equivalent years of schooling.

Over the period the measurement of the incidence of overeducation using alternative methodologies revealed different results. On the one hand, with the *Objective Approach* the findings denoted an increase on the incidence of overeducation. One reason that can justify the discrepancy between the results is the fact that heterogeneity of jobs within an occupation is not considered in the analysis (Büchel, 2001). Another reason could be the method of measurement that rest upon administrative sources, i.e., the inability to accommodate changes on skill requirements or educational attainments of workers over the period (Santos and de Oliveira, 2002).

On the other hand, with the *Empirical Approach* the statistical measures calculated within each major groups of PCO/2010 denoted the incidence of overeducation, but we can't say the same about a possible growth, since some results were skewed. In this case, there are two limitations that can justify the discrepancy observed between the values of mean and mode.

The first problem results from aggregated definitions of PCO/2010 at 1-digit-level. The level of aggregation involves neglecting the heterogeneity of jobs within an occupation. Such information should be studied disaggregated as low as possible, usually on a 3-digit-level (Verdugo and Verdugo, 1989; Büchel, 2001). Besides, the mode is less sensitive and provides a more accurate measure of the extent of surplus or deficit schooling than the mean (Santos and de Oliveira, 2002).

Notwithstanding such limitations, similar results between both approaches, particularly trends on empirical findings, were flagged to understand the most relevant facts and to fulfilling the central aim of the present study.

First, they indicate that overeducation, as defined in this study, existed between 1998 and 2009 in Portuguese labour market. The second finding was an increase on the incidence of overeducation. The third, is that incidence of overeducation varies among gender. This point was noted with clear evidence on women. And finally that incidence of overeducation varies with the measurement strategy that is used. Thus, it is hard to escape the conclusion that a condition of overeducation exists in the Portuguese labour market, with more incidences on women, at least, according to the definition used here.

The evidences of this study are in general agreement with those that were found by Kiker *et al.* (1997). The estimates of these authors revealed that overeducation and undereducation exist in the Portuguese labour market, with the extent varying across the measures used (Kiker *et al.*, 1997: p.116).

Nevertheless, the results should not be viewed as definitive. Educational attainments signify more than simply formal education and skills. Recent studies have pointed out that in the most recent period of Portuguese economy, there was an important polarisation of the demand for labour, and less qualified jobs increased their share in the employment structure, while more qualified jobs continued to gain weight in total employment (Centeno *et al.*, 2010). This could be an important reason to explore the incidence of overeducation in a different way.

It is also important that future research explores the link between the incidence of overeducation and crowding out effects of low-skilled workers in Portuguese labour market during last two decades (Battu and Sloane, 2000). A study of this nature would be important to establish whether the increase in qualifications is reflected in a rise in overeducation. Another trail to be studied would be to find a causal effect between some policies, as the ones referred in the present study, and changes in jobs requirements (*the demand side*) and educational attainments of job-holders (*the supply side*). Another extension to this study would be the estimation of an econometric model in order to identify the determinants of undereducation and overeducation.

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Annexes

Annex A

Summary of Literature Review and Mismatch Estimates about Overeducation

Annex A.
Summary of Literature Review and Mismatch Estimates about Overeducation

Author(s)	Country	Subject	Time period	Dataset	Measure(s)	Estimates and comments
Duncan and Hoffman (1981)	United States	*The Incidence and Wage Effects of Overeducation*	1976	Panel Study of Income Dynamics (*PSID*)	Subjective	46.1% AE 11.9% UE 42.0% OE
Burris (1983)	United States	*The Social and Political Consequences of Overeducation*	1977 - 1978	National Sample Survey	Objective	21.7% OE 22.7% Males 20.1% Females
Rumberger (1987)	United States	*The Impact of Surplus Schooling on Producitivity and Earnings*	1969, 1973 and 1977	Quality of Employment Surveys	Objective	1969: 35% OE 1973: 27% OE 1977: 32% OE
Hartog and Oosterbeek (1988)	Netherlands	*Education, Allocation and Earnings in the Netherlands: Overschooling?*	1960, 1971 and 1974	Dutch Census and Labour Force Surveys	Objective - job analysts (ARB1 code) and Subjective	**Objective:** 1960: 57.5% AE, 35.6% UE and 7% OE 1971: 59.3% AE, 27.1% UE and 13.6% OE **Subjective:** 1974: 53% AE, 30% UE and 17% OE
Verdugo and Verdugo (1989)	United States	*The Impact of Surplus Schooling on Earnings: Some Additional Findings*	1980	United States Census	Standard Deviation	79.2% AE 9.9% UE 10.9% OE
Sicherman (1991)	United States	*Overeducation in the Labour Market*	1976 - 1978	Panel Study of Income Dynamics (*PSID*)	Subjective	44% AE 16% UE 40% OE
Alba-Ramirez (1993)	Spain	*Mismatch in the Spanish Labour Market: Overeducation?*	1985	The Living and Working Conditions Survey	Subjective	60% AE 23% UE 17% OE
Groot (1993)	Netherlands	*Overeducation and the Returns to Enterprise-related Schooling*	1983	*Brabant* Survey	Standard Deviation	67.5% AE 16.3% UE 16.1% OE
Robst (1995)	United States	*Career Mobility, Job Match, and Overeducation*	1976, 1978 and 1985	Panel Study of Income Dynamics (*PSID*)	Subjective	**Pooled estimates for 3 years:** 44% AE 20% UE 36% OE

Source: Overeducation in Europe: Current Issues in Theory and Policy (Büchel *et al*., 2003: p.41-45).
Legend: AE - Adequately Educated ; **UE** - Undereducated and **OE** - Overeducated.

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Hersch (1995)	United States	*Optimal Mismatch and Promotions*	1991	Survey of private firm in *Wyoming*	Self-Assessment and Subjective	**Self-Assessment and Subjective:** 58% AE 13% UE 29% OE
Cohn and Kahn (1995)	United States	*The Wage Effects of Overschooling Revisited*	1984	Panel Study of Income Dynamics (*PSID*)	Subjective and Standard Deviation	**Subjective:** 47% AE 20% UE 33% OE **Standard Deviation:** 75% AE 12% UE 13% OE
Garcia-Serrano and Malo-Ocana (1996)	Spain	*Educational Mismatch and Internal Labour Markets: is there any relantionship?*	1991	Survey of Class Structure (*ECBC*)	Subjective	40.1% AE 33.0% UE 26.9% OE
Groot (1996)	United Kingdom	*The Incidence of, and Returns to Overeducation in the UK*	1991	British Household Panel Survey (*BHPS*)	Standard Deviation	80% AE 9% UE 11% OE **Males:** 77% AE 10% UE 13% OE **Females:** 82% AE 8% UE 10% OE
Kiker et al. (1997)	Portugal	*Overeducation and undereducation: evidence for Portugal*	1991	Personnel Records collected by Ministry of Labour	Standard Deviation (1), Modal (2) and Objective (3)	**Combined (1):** 85.6% AE 5.0% UE 9.4% OE **Combined (2):** 57.5% AE 17.0% UE 25.5% OE **Combined (3):** 29.4% AE 37.5% UE 33.1% OE

Source: Overeducation in Europe: Current Issues in Theory and Policy (Büchel *et al*., 2003: p.41-45).
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Author(s)	Country	Subject	Time period	Dataset	Measure(s)	Estimates and comments
Kiker et al. (1997) (**cont.**)	Portugal	*Overeducation and undereducation: evidence for Portugal*	1991	Personnel Records collected by Ministry of Labour	Standard Deviation (1), Modal (2) and Objective (3)	**Males:** (1): 83.8% AE, 5.3% UE and 10.9% OE (2): 58.4% AE, 16.0% UE and 25.5% OE (3): 27.0% AE, 44.2% UE and 28.8% OE **Females:** (1): 88.4% AE, 4.7% UE and 6.9% OE (2): 56.0% AE, 18.7% UE and 25.3% OE (3): 33.7% AE, 25.9% UE and 40% OE
Dolton and Vignoles (1997 and 2000)	United Kingdom	*The Incidence and Effects of Overeducation in the UK Graduate Labour Market*	1980 and 1986	1980 National Survey of Graduates and Diplomates	Subjective	**Graduates in first job:** 38% OE **Graduates in final job:** 30% OE
Forgeout and Gautié (1997)	France	*Overeducation in the Youth Labour Market in France*	1995	French Employment Survey	Objective	**OE in French youth (18-29 anos):** 18% OE - Males 24% OE - Females
Beneito et al. (1997)	Spain	*Overeducation/Undereducation and Specific Training in Spain: complementary or substitute components of Human Capital?*	1985 and 1990	Survey of Class Structure (*ECBC*)	Self-Classification (1985), Standard Deviation and Subjective (both 1990)	**Standard Deviation:** 69.4% AE 15.3% UE 15.2% OE **Subjective:** 58.0% AE 16.5% UE 25.6% OE **Self-Classification:** 61.3% AE 10.9% UE 27.9% OE
Alpin, Shackleton and Walsh (1998)	United Kingdom	*Over and Undereducation in the UK Graduate Labour Market*	1995	Labour Force Survey (Graduates only)	2 Objective measures: - Degree required (yes/no) - Modal	**Degree required:** 55.2% AE 17.8% UE 27.0% OE **Modal:** 53.9% AE 8.4% UE 37.7% OE

Source: Overeducation in Europe: Current Issues in Theory and Policy (Büchel *et al*., 2003: p.41-45).
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Author(s)	Country	Subject	Time period	Dataset	Measure(s)	Estimates and comments
Battu et al. (1999)	United Kingdom	*Overeducation Among Graduates: a cohort view*	1986, 1991 and 1996	Careers of Highly Qualified Workers Survey (Graduates)	Degree required (yes/no)	**1985 Graduates** 37.6% OE in 1986 - Males 46.4% OE in 1986 - Females 39.6% OE in 1991 - Males 39.0% OE in 1991 - Females 41.5% OE in 1996 - Males 40.1% OE in 1996 - Females **1990 Graduates** 41.6% OE in 1991 - Males 45.3% OE in 1991 - Females 41.3% OE in 1996 - Males 39.3% OE in 1996 - Females
Sloane, Battu and Seaman (1999)	United Kingdom	*Overeducation, Undereducation and the British Labour Market*	1986	Social Change and Economic Life Initiative (*SCELI*)	Subjective	52% AE 31% UE 17% OE
Green, McIntosh and Vignoles (1999)	United Kingdom	*Overeducation and Skills - Clarifying the Concepts*	1995	National Child Development Survey	Subjective	35.1% AE 1.9% UE 47.4% OE
Chevalier (2000)	United Kingdom	*Graduate Over-Education in the UK*	1986, 1991 and 1996	Careers of Highly Qualified Workers Survey	Objective (1) and Subjective (2): - Degree required (yes/no) Subjective (3): - Based on satisfaction	OE **Males** **(1)** **(2)** **(3)** 1985 cohort 13.0% 33.8% 13.0% 1990 cohort 18.9% 33.8% 20.0% **Females** **(1)** **(2)** **(3)** 1985 cohort 14.7% 30.9% 14.4% 1990 cohort 21.6% 30.9% 17.4%
Groot and Maassen van den Brink (2000)	Netherlands	*Overeducation in the Labour Market: a meta analysis*	1994	Sixth Wave of the Dutch - OSA Labour Market Survey	Standard Deviation (1), Objective (2) and Subjective (3)	**Males** **(1)** **(2)** **(3)** AE 71.8% 74.4% 87.5% UE 16.7% 13.3% 3.8% OE 11.5% 12.3% 8.7% **Females** **(1)** **(2)** **(3)** AE 73.5% 74.8% 84.3% UE 14.3% 5.7% 2.1% OE 12.2% 19.5% 13.6%

Source: Overeducation in Europe: Current Issues in Theory and Policy (Büchel *et al*., 2003: p.41-45).

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Author(s)	Country	Subject	Time period	Dataset	Measure(s)	Estimates and comments
Daly, Büchel and Duncan (2000)	United States Germany	*Premiums and Penalties for Surplus and Deficit Education: evidence from the U.S. and Germany*	1976 and 1985 1984	Panel Study of Income Dynamics (*PSID*) German Socio-Economic Panel	Subjective	**1976 (US)** **1985 (US)** 45.2% AE - Males 47.0% AE - Males 52.0% AE - Females 49.7% AE - Females 16.3% UE - Males 21.2% UE - Males 11.3% UE - Females 16.8% UE - Females 38.5% OE - Males 31.8% OE - Males 36.8% OE - Females 33.5% OE - Females **1984 (Germany)** 78.8% AE - Males 71.9% AE - Females 6.9% UE - Males 7.4% UE - Females 14.3% OE - Males 20.7% OE - Females
Mendes de Oliveira, Santos and Kiker (2000)	Portugal	*The Role of Human Capital and Technological Change in Overeducation*	1991	Ministry of Employment Survey of Business Firms	Adequate equals level shared by at least 60% of workers in that occupation (modal value)	Mean years of adequate schooling: AE = 4.040 Mean years of adequate schooling: UE = 0.132 Mean years of adequate schooling: OE = 1.106
Van der Velden and Van Smoorenburg (2000)	Netherlands	*The Training of School Leavers, Complementarity and Substitution*	1996	Combination of two former Surveys RUBS and HBO-Monitor (*STOA*)	Subjective	72% AE 2% UE 26% OE
Vahey (2000)	Canada	*The Great Canadian Training Robbery: evidence on the returns to education mismatch*	1982	National Survey of Class Structure and Labour Process	Subjective	**Males** 57% AE 24% UE 30% OE **Females** 33% AE 17% UE 32% OE
Cohn and NG (2000)	Hong Kong	*Incidence and Wage Effects of Overschooling and Underschooling in Hong Kong*	1986 and 1991	Hong Kong by Census 1986 and Census 1991	Standard Deviation (modal value)	**1986** **Men** **Women** 35% AE 44% AE 28% UE 24% UE 38% OE 32% OE

Source: Overeducation in Europe: Current Issues in Theory and Policy (Büchel *et al*., 2003: p.41-45).

Legend: AE - Adequately Educated ; **UE**- Undereducated and **OE** - Overeducated.

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Summary of Literature Review and Mismatch Estimates about Overeducation

Author(s)	Country	Subject	Time period	Dataset	Measure(s)	Estimates and comments
Cohn and NG (2000) **(cont.)**	Hong Kong	*Incidence and Wage Effects of Overschooling and Underschooling in Hong Kong*	1986 and 1991	Hong Kong by Census 1986 and Census 1991	Standard Deviation (modal value)	**1991** **Men** **Women** 35% AE 44% AE 28% UE 23% UE 37% OE 31% OE
Dolton and Silles (2001)	United Kingdom	*Over-Education in the Graduate Labour Market: some evidence from alumni data*	1998 (variable dates)	University of Newcastle Alumni Survey	Subjective	**First job in terms of degree being:** 42% OE **Current job necessary to do the work:** 22% OE **Did not require a degree to get job:** 33%
Allen and van der Velden (2001)	Netherlands	*Educational Mismatches Versus Skill Mismatches: effects on wages, jobs satisfaction and on-the-job search*	1998	High Education and Graduates Employment in Europe Survey	Subjective	**Total sample:** 33% OE **Higher vocational education graduates:** 14% UE **University graduates:** 8% UE
Bauer (2002)	Germany	*Educational Mismatch and Wages: a panel analysis*	1984 - 1998	German Socio-Economic Panel	Standard Deviation using both mean and modal values	**Mean Index** **Males** 10.4% UE 12.3% OE **Females** 15.6% UE 10.7% OE **Mode Index** **Males** 20.6% UE 30.8% OE **Females** 37.0% UE 29.9% OE
McGuinness (2002)	Northern Ireland	*Private Sector Post Graduate Training and Graduate Under-Employment: evidence from Northern Ireland*	1997 - 2000	Telephone Survey of Graduates	Subjective	**First job:** 29% OE **Current job:** 24% OE

Source: Overeducation in Europe: Current Issues in Theory and Policy (Büchel *et al*., 2003: p.41-45).

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Author(s)	Country	Subject	Time period	Dataset	Measure(s)	Estimates and comments
Dekker, de Grip and Heijke (2002)	Netherlands	*The Effects of Training and Over-Education on Career Mobility in a Sequential Labour Market*	1992	Labour Supply Survey (*OSA*)	Subjective	**Overall:** 30.6% OE **Age group: 15-19 anos** 41.7% OE **Age group: 30-44 anos** 27.0% OE **Age group: 49-64 anos** 18.0% OE

Source: Overeducation in Europe: Current Issues in Theory and Policy (Büchel *et al*., 2003: p.41-45).

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Annex B

Summary of Theoretical Reflections on Overeducation

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Summary of Theoretical Reflections on Overeducation

Theory	Main proponent(s)	Overeducation gap	Main determinants of wage	Predictions of overeducation
1. Human Capital Theory **(HCT)**	Becker (1964) Mincer (1974)	Transitory and short-term phenomenon	Supply (personal characteristics)	Return on years of overeducation = Return on years of required education
2. Job Competition Theory **(JCT)**	Thurow (1975)	Permanent phenomenon	Demand (job queues)	Return on overeducation is zero
3. Career Mobility Theory **(CMT)**	Sicherman and Galor (1990)	Temporary phenomenon	Training costs are general and paid for by the individual	**i. In the short-run** Return on years of overeducation < Return on required education **ii. In the long-run** Return on years of overeducation < Return on years of required education
4. Assignment Theory **(AT)**	Sattinger (1993)	Permanent phenomenon	Supply and Demand	Return on years of overeducation < Return on required education

Source: The Skill Matching Challange: analysing skill mismatch and policy implications (CEDEFOP, 2010: p.30) and own interpretation based on each theory presented.
CEDEFOP - European Centre for the Development of Vocational Training in link http://www.cedefop.europa.eu/EN/.

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Summary of Theoretical Reflections on Overeducation

Theory	Main proponent(s)	Overeducation gap	Main determinants of wage	Predictions of overeducation
5. Alternatives Theories:				
a) Job Signalling Theory **(JST)**	Spence (1973)	Transitory and short-term phenomenon	Supply (personal characteristics)	Return on years of overeducation = Return on years of required education
b) Spatial Mobility Theory **(SMT)**	Hey and Mckenna (1979) Jarvis (1999)	*In* Migration: Temporary phenomenon	Supply (combination of spatial flexibility with spatial distribution of job opportunities)	**i. In the short-term** Return on years of overeducation < Return on required education
				ii. In the long-run Return on years of overeducation < Return on years of required education
	Van Ommeren (1996) Rouwendal (1999)	*In* Commuting: Permanent phenomenon	Gender and family status (regional labour market characteristics)	Return on years of overeducation < Return on required education
c) Theory of Differential Overqualification **(TDO)**	Frank (1978)	Permanent phenomenon	Gender and family status	Return on years of overeducation < Return on required education

Source: The Skill Matching Challange: analysing skill mismatch and policy implications (CEDEFOP, 2010: p.30) and own interpretation based on each theory presented.

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Annex C

Summary of Measuring Overeducation

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Summary of Measuring Overeducation

Approach (short description)	Developers of approach	Advantages of approach	Disadvantages of approach
Objective *For each occupation listed in Dictionary of Occupational Titles (DOT), information about the level of ocupation requirements is available in an ordered scale - General Educational Development (GED).* *The GED scale has to be made a compatible to the scale on which individuals report their acquired education (e.g. transformation into request years of schooling).* *The information about the request education to perform a specific occupation (SR) is compared with the acquired education (SA) of job-holders.* ***Overeducation of an individual is stated if SA > SR.***	. Eckaus (1964) . Scoville (1966) . Fine (1968) . Berg (1970 . Kalleberg and Sørensen (1973) . Hartog (1980) . Burris (1983c) . Rumberger (1987) . Patrinos (1997) . Battenburg and de Witte (1998)	. No negative influences in the measurement process which are caused by subjective assessments of job-holders.	. Heterogeneity of jobs within an occupation is neglected. . New occupations, such as IT industry, cannot be considered. (*until a new DOT is realised*) . Change in job requirements is neglected. (*until a new GED scale is realised*) . Defining required skill levels is methodologically problematic. (*construction of GED scale*) . Making the GED scale compatible to the scale of acquired education is methodologically problematic. . Usually high numbers of missing values in occupational information. (*caused by coding problems*)
Subjective *Each worker is asked about the educational requirements of his specific job (e.g. what kind of education is usually required to perform/get a job like your's) - Required Education (RE).* *The scale of the RE variable has to be made compatible with the scale of the respondents information of acquired education (e.g. by asking for years of schooling required).* ***Overeducation of an individual is stated if SA > RE.***	. Quinn and Mandilovitch (1975) . Duncan and Hoffmann (1978, 1981) . Sicherman (1981) . Tsang et al. (1991) . Alba-Ramirez (1993) . Hersch (1995) . Sloane et al. (1996) . Borghans and Smits (1997) . Battu et al. (1998) . van der Velden and van Smoorenburg (1999)	. Severe disadvantages of objective approach become obsolete. . Individuals know the specific requirements of their scpecific job best (specifically: better than labour market experts generating the GED scale)	. Subjective influence in measurement approach (e.g. risk of getting answers influenced by a cognitive dissonance behaviour; answers may be biased towards pompousness or exaggerated modesty).
Empirical *Within each occupation, disaggregated as low as possible, (usually on a 3-digit-level), the mean, median or mode (M) and the standard deviation (SD) of acquired education of job-holders is calculated.* *Information about M and SD of a specific occupation is compared with the acquired education (SA) of job-holders.* ***Overeducation of an individual is stated if SA > (M + SD).***	. Sullivan (1978) . Clogg (1979) . Clogg and Schockey (1984) . Schockey (1989) . Verdugo (1989) . Kiker et al. (1997) . Alpin et al. (1998) . Cohn and Ng (1999)	. Higher validity when categorising overeducation.	. Genuine problem of neglecting heterogeneity of jobs within an occupation remains. . Metodological problems in measuring means, medians or modes, and especially measuring standard deviations in occupations with few employed. . Problems with causal relations: the higher the share of "effectively" overeducated workers within a specific occupation, the lower the measured share "detected" overeducated workers (and vice versa).

Source: Training in Europe - Second Report on Vocational Training Research in Europe 2000: Background Report (Büchel, 2001: p.484-487) and own interpretation based on each approach presented.
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Annex C.
Summary of Measuring Overeducation

Approach (short description)	Developers of approach	Advantages of approach	Disadvantages of approach
Innovative *Using a 3 third variable (occupational status) for validation.* *Validation check is done using a standardised categorisation system. This produces the output categories "clearly plausible combination of the three variables"; "clearly implausible combination" (in German GSOEP: about 1% of cases); and "doubtful plausibility of combination" (in German GSOEP: about 5% of cases).* ***Overeducation of an individual is stated if SA > RE.*** *(if the validity check leads to a clearly plausible result - otherwise: generating a missing value)*	. Büchel and Weißhuhn (1997)	. Tests showed a much higher validity when categorising overeducation, compared to the standard subjective two-variable approach.	. Approach produces a so-called "mixed" or "grey" area of work with doubtful plausibility of combination of required education, acquired education and occupational status. In general individuals working in such a situation have to be excluded from overeducation analyses. This leads to information loss in general and reduced number of cases in special. . Number of missing values in the produced overeducation variable is slighty higher than in standard subjective two-variable approach, because three source variable are involved.

Source: Training in Europe - Second Report on Vocational Training Research in Europe 2000: Background Report (Büchel, 2001: p.484-487) and own interpretation based on each approach presented.
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Annex D

Summary of Targets for the Impact Indicators of the Technological Plan

Annex D.

Summary of Targets for the Impact Indicators of the Technological Plan

Strategy level	Indicators	Proposed target to 2010	Portugal		European Union	
			Initial value/Year	Last value/Year	Initial value/Year	Last value/Year
1. Qualification and Knowledge *qualifying the portuguese people for the knowledge society*	1.1 population having a higher education degree (% of the age group 25-64 years)	**15%**	10.5% (2003)	13.7% (2007)	21.3% (2003) - EU25	23.5% (2007) - EU27
	1.2 population having a secondary education degree (% of the age group 20-24 years)	**65%**	49.6% (2004)	54.3% (2008)	77.1% (2004) - EU27	78.5% (2008) - EU27
	1.3 population having a diploma in science and technology per 1.000 inhabitants (between 20-29 years)	**12**	8.2 (2003)	18.1 (2007)	12.3 (2003) - EU27	13.4 (2007) - EU27
	1.4 lifelong training per 100 inhabitants (between 25-64 years)	**12.5%**	4.3% (2004)	5.3% (2008)	9.3% (2004) - EU27	9.6% (2008) - EU27
2. Science and Technology *to overcome the scientific and technological backwardness*	2.1 researchers per 1.000 employees	**5.3**	4.0 (2004)	5.5 (2007)	5.8 (2004) - EU27	6.1 (2006) - EU27
	2.2 population having a recent PhD in S&T per 1.000 inhabitants (between 25-34 years)	**0.45**	0.33 (2003)	0.43 (2007)	0.49 (2003) - EU25	0.49 (2003) - EU25
	2.3 public expenditure in R&D as % of GDP	**1.00%**	0.48% (2003)	0.57% (2007)	0.67% (2003) - EU25	0.67% (2007) - EU27
	2.4 company expenditure in R&D as % of GDP	**0.80%**	0.24% (2003)	0.61% (2007)	1.19% (2003) - EU27	1.17% (2007) - EU27

Source: The Technological Plan - A Growth Strategy based on Knowledge, Technology and Innovation: presentation document in link http://www.planotecnologico.pt/.

Annex D.

Summary of Targets for the Impact Indicators of the Technological Plan

Strategy level	Indicators	Proposed target to 2010	Portugal		European Union	
			Initial value/Year	Last value/Year	Initial value/Year	Last value/Year
3. Competitiveness and Innovation *giving a new mometum to innovation*	3.1 employment in medium and high-tech industries as % of total employment	**4.70%**	3.33% (2002)	3.45% (2007)	7.23% (2002) - EU27	6.69% (2007) - EU27
	3.2 employment in high-tech services as % of total employment	**1.80%**	1.43% (2001)	1.85% (2006)	3.40% (2001) - EU25	3.26% (2006) - EU27
	3.3 EPO patents per million inhabitants	**12**	3.94 (2002)	12.90 (2006)	103.70 (2002) - EU27	106.72 (2006) - EU27
	3.4 Community trademarks registered per million inhabitants	**50**	36.50 (2002)	118.50 (2007)	87.20 (2004) - EU25	124.60 (2007) - EU27

Source: The Technological Plan - A Growth Strategy based on Knowledge, Technology and Innovation: presentation document in link http://www.planotecnologico.pt/.

Annex E

Population, Employment and Unemployment

Indicators in Portugal: Evolution of Higher Education

Annex E.

Population, Employment and Unemployment Indicators in Portugal: evolution of Higher Education

Unit: Thousands

Indicators	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Total Population (15 years and over)	8.576,7	8.654,0	8.723,5	8.800,1	8.862,5	8.912,2	8.945,5	8.969,6	8.998,1	9.023,3
Total Population with Higher Education	**558,6**	**590,3**	**610,8**	**713,7**	**829,9**	**848,7**	**901,0**	**927,6**	**970,4**	**1.008,2**
Working Population (15 years and over)	5.226,4	5.325,2	5.407,8	5.460,3	5.487,8	5.544,9	5.587,3	5.618,3	5.624,9	5.582,7
Working Population with Higher Education	**487,6**	**516,3**	**533,1**	**617,6**	**714,2**	**733,1**	**762,5**	**792,3**	**834,2**	**854,7**
Employed Population (15 years and over)	5.020,9	5.111,7	5.137,3	5.118,0	5.122,8	5.122,6	5.159,5	5.169,7	5.197,8	5.054,1
Employed Population with Higher Education	**472,3**	**498,6**	**507,1**	**580,6**	**676,3**	**686,9**	**714,1**	**733,0**	**776,6**	**799,7**
Unemployed Population (15 years and over)	205,5	213,5	270,5	342,3	365,0	422,3	427,8	448,6	427,1	528,6
Unemployed Population with Higher Education	**15,3**	**17,8**	**26,0**	**37,0**	**37,9**	**46,2**	**48,4**	**59,3**	**57,6**	**55,0**

Source: INE in link http://www.ine.pt - Labour Force Survey.

Annex F

Auxiliary Tables of the Objective Approach

by ISCED/97 Groups

Annex F.

Auxiliary Tables of Objective Approach by ISCED/97 Groups

		ISCED 1 and 2											
Year	Number	F				M				F + M			
and Quarter	of Records	OE	AE	UE	F	OE	AE	UE	M	OE	AE	UE	F + M
1998_1T	**21.093**	0.5%	10.1%	23.2%	33.7%	0.5%	8.9%	38.9%	48.3%	1.1%	19.0%	62.0%	82.1%
1998_2T	**21.198**	0.5%	10.3%	23.2%	34.1%	0.5%	8.8%	38.6%	48.0%	1.0%	19.2%	61.8%	82.0%
1998_3T	**20.225**	0.6%	10.4%	22.9%	33.8%	0.6%	9.2%	38.8%	48.6%	1.1%	19.5%	61.7%	82.3%
1998_4T	**20.319**	0.6%	10.5%	22.8%	33.8%	0.7%	9.1%	38.2%	48.0%	1.2%	19.6%	60.9%	81.7%
2004_1T	**21.619**	0.9%	11.4%	19.1%	31.4%	0.9%	10.0%	32.8%	43.7%	1.8%	21.4%	51.8%	75.0%
2004_2T	**21.927**	0.9%	11.6%	18.8%	31.3%	1.0%	10.2%	32.0%	43.1%	1.9%	21.8%	50.7%	74.4%
2004_3T	**21.249**	0.8%	11.8%	18.8%	31.5%	1.0%	10.1%	31.9%	43.1%	1.9%	22.0%	50.8%	74.6%
2004_4T	**21.269**	0.9%	11.7%	18.6%	31.2%	1.1%	10.2%	31.2%	42.5%	2.0%	21.9%	49.8%	73.7%
2009_1T	**17.220**	1.4%	12.9%	16.3%	30.6%	1.0%	10.8%	27.8%	39.6%	2.5%	23.7%	44.1%	70.2%
2009_2T	**16.873**	1.5%	12.9%	16.1%	30.5%	1.0%	10.8%	27.4%	39.2%	2.5%	23.7%	43.5%	69.6%
2009_3T	**16.530**	1.6%	12.8%	15.9%	30.2%	1.0%	10.9%	27.2%	39.1%	2.6%	23.7%	43.1%	69.4%
2009_4T	**16.430**	1.6%	12.7%	15.6%	29.9%	1.1%	10.7%	27.1%	38.9%	2.7%	23.4%	42.7%	68.8%

		ISCED 3 and 4											
Year	Number	F				M				F + M			
and Quarter	of Records	OE	AE	UE	F	OE	AE	UE	M	OE	AE	UE	F + M
1998_1T	**21.093**	0.2%	3.2%	1.6%	4.9%	0.2%	2.6%	2.2%	4.9%	0.4%	5.8%	3.8%	9.9%
1998_2T	**21.198**	0.2%	3.2%	1.6%	4.9%	0.2%	2.6%	2.3%	5.0%	0.3%	5.7%	3.9%	10.0%
1998_3T	**20.225**	0.2%	3.1%	1.6%	5.0%	0.1%	2.7%	2.3%	5.1%	0.4%	5.8%	3.9%	10.1%
1998_4T	**20.319**	0.2%	3.2%	1.7%	5.1%	0.2%	2.7%	2.3%	5.2%	0.4%	5.9%	4.0%	10.3%
2004_1T	**21.619**	0.5%	4.3%	2.0%	6.7%	0.4%	3.1%	3.0%	6.5%	0.8%	7.4%	5.0%	13.2%
2004_2T	**21.927**	0.5%	4.2%	2.0%	6.7%	0.4%	3.2%	3.1%	6.6%	0.8%	7.4%	5.1%	13.4%
2004_3T	**21.249**	0.5%	4.3%	2.0%	6.8%	0.4%	3.3%	3.0%	6.7%	0.9%	7.6%	5.0%	13.5%
2004_4T	**21.269**	0.5%	4.3%	2.0%	6.8%	0.4%	3.4%	3.1%	6.8%	0.9%	7.7%	5.0%	13.7%
2009_1T	**17.220**	0.7%	5.1%	2.2%	8.0%	0.4%	4.0%	3.2%	7.6%	1.1%	9.1%	5.4%	15.6%
2009_2T	**16.873**	0.7%	5.3%	2.2%	8.2%	0.4%	4.2%	3.2%	7.8%	1.1%	9.5%	5.4%	16.0%
2009_3T	**16.530**	0.8%	5.5%	2.2%	8.5%	0.4%	4.6%	3.2%	8.3%	1.2%	10.2%	5.4%	16.8%
2009_4T	**16.430**	0.8%	5.7%	2.2%	8.7%	0.5%	4.6%	3.0%	8.1%	1.3%	10.3%	5.3%	16.8%

		ISCED 5 and 6											
Year	Number	F				M				F + M			
and Quarter	of Records	OE	AE	UE	F	OE	AE	UE	M	OE	AE	UE	F + M
1998_1T	**21.093**	0.7%	3.5%	0.6%	4.8%	0.5%	2.4%	0.3%	3.2%	1.2%	5.9%	0.9%	8.0%
1998_2T	**21.198**	0.8%	3.5%	0.6%	4.9%	0.4%	2.4%	0.3%	3.2%	1.2%	6.0%	0.9%	8.0%
1998_3T	**20.225**	0.7%	3.4%	0.5%	4.6%	0.4%	2.3%	0.3%	3.0%	1.2%	5.7%	0.8%	7.6%
1998_4T	**20.319**	0.8%	3.4%	0.5%	4.8%	0.4%	2.5%	0.3%	3.2%	1.3%	5.9%	0.8%	8.0%
2004_1T	**21.619**	2.0%	4.8%	0.4%	7.3%	1.0%	3.1%	0.3%	4.4%	3.0%	8.0%	0.8%	11.7%
2004_2T	**21.927**	2.1%	4.9%	0.5%	7.4%	0.9%	3.5%	0.4%	4.8%	3.0%	8.4%	0.8%	12.2%
2004_3T	**21.249**	2.1%	4.7%	0.5%	7.3%	0.9%	3.4%	0.4%	4.6%	3.0%	8.1%	0.8%	11.9%
2004_4T	**21.269**	2.4%	4.9%	0.5%	7.7%	0.9%	3.6%	0.4%	4.9%	3.3%	8.5%	0.8%	12.7%
2009_1T	**17.220**	3.1%	5.4%	0.2%	8.7%	1.3%	3.9%	0.3%	5.6%	4.4%	9.3%	0.5%	14.3%
2009_2T	**16.873**	3.1%	5.6%	0.2%	8.9%	1.3%	3.8%	0.4%	5.5%	4.4%	9.4%	0.6%	14.4%
2009_3T	**16.530**	3.0%	5.5%	0.2%	8.7%	1.2%	3.7%	0.3%	5.2%	4.2%	9.2%	0.5%	13.9%
2009_4T	**16.430**	3.2%	5.7%	0.2%	9.1%	1.2%	3.8%	0.3%	5.3%	4.4%	9.5%	0.5%	14.4%

Source: Calculations made by the author.

Annex G

Auxiliary Tables of the Empirical Approach

Using the Mean (variable M)

Annex G.

Auxiliary Tables of Empirical Approach using the Mean (variable M)

Major Group of PCO/2010 with higher incidence of overeducation

1998_1Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.552**	97	224	**321**	0	0	**0**	425	806	**1.231**	**522**	**1.030**	**1.552**
2	**1.197**	6	18	**24**	22	25	**47**	644	482	**1.126**	**672**	**525**	**1.197**
3	**1.530**	85	50	**135**	220	39	**259**	452	684	**1.136**	**757**	**773**	**1.530**
4	**1.938**	48	26	**74**	444	226	**670**	621	573	**1.194**	**1.113**	**825**	**1.938**
5	**2.708**	198	145	**343**	298	264	**562**	1.115	688	**1.803**	**1.611**	**1.097**	**2.708**
6	**2.233**	16	63	**79**	88	182	**270**	887	997	**1.884**	**991**	**1.242**	**2.233**
7	**5.026**	124	448	**572**	0	0	**0**	1.184	3.270	**4.454**	**1.308**	**3.718**	**5.026**
8	**1.780**	45	212	**257**	0	0	**0**	330	1.193	**1.523**	**375**	**1.405**	**1.780**
9	**2.998**	153	153	**306**	0	0	**0**	1.667	1.025	**2.692**	**1.820**	**1.178**	**2.998**
0	**131**	0	11	**11**	3	27	**30**	2	88	**90**	**5**	**126**	**131**
Total	**21.093**	**772**	**1.350**	**2.122**	**1.075**	**763**	**1.838**	**7.327**	**9.806**	**17.133**	**9.174**	**11.919**	**21.093**
%	**100.0%**	**3.7%**	**6.4%**	**10.1%**	**5.1%**	**3.6%**	**8.7%**	**34.7%**	**46.5%**	**81.2%**	**43.5%**	**56.5%**	**100.0%**

1998_2Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.547**	94	221	**315**	0	0	**0**	429	803	**1.232**	**523**	**1.024**	**1.547**
2	**1.205**	27	45	**72**	0	0	**0**	649	484	**1.133**	**676**	**529**	**1.205**
3	**1.565**	85	40	**125**	219	32	**251**	469	720	**1.189**	**773**	**792**	**1.565**
4	**1.910**	53	30	**83**	424	224	**648**	617	562	**1.179**	**1.094**	**816**	**1.910**
5	**2.810**	210	159	**369**	323	270	**593**	1.154	694	**1.848**	**1.687**	**1.123**	**2.810**
6	**2.237**	109	234	**343**	0	0	**0**	912	982	**1.894**	**1.021**	**1.216**	**2.237**
7	**5.045**	119	438	**557**	0	0	**0**	1.196	3.292	**4.488**	**1.315**	**3.730**	**5.045**
8	**1.751**	54	206	**260**	0	0	**0**	297	1.194	**1.491**	**351**	**1.400**	**1.751**
9	**3.002**	150	141	**291**	0	0	**0**	1.697	1.014	**2.711**	**1.847**	**1.155**	**3.002**
0	**126**	0	8	**8**	3	31	**34**	3	81	**84**	**6**	**120**	**126**
Total	**21.198**	**901**	**1.522**	**2.423**	**969**	**557**	**1.526**	**7.423**	**9.826**	**17.249**	**9.293**	**11.905**	**21.198**
%	**100.0%**	**4.3%**	**7.2%**	**11.4%**	**4.6%**	**2.6%**	**7.2%**	**35.0%**	**46.4%**	**81.4%**	**43.8%**	**56.2%**	**100.5%**

1998_3Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.437**	96	200	**296**	0	0	**0**	398	743	**1.141**	**494**	**943**	**1.437**
2	**1.070**	7	15	**22**	20	25	**45**	576	427	**1.003**	**603**	**467**	**1.070**
3	**1.488**	76	39	**115**	205	37	**242**	453	678	**1.131**	**734**	**754**	**1.488**
4	**1.845**	56	30	**86**	406	226	**632**	582	545	**1.127**	**1.044**	**801**	**1.845**
5	**2.735**	193	161	**354**	319	264	**583**	1.124	674	**1.798**	**1.636**	**1.099**	**2.735**
6	**2.126**	18	62	**80**	82	166	**248**	840	958	**1.798**	**940**	**1.186**	**2.126**
7	**4.809**	107	427	**534**	0	0	**0**	1.119	3.156	**4.275**	**1.226**	**3.583**	**4.809**
8	**1.676**	46	207	**253**	0	0	**0**	263	1.160	**1.423**	**309**	**1.367**	**1.676**
9	**2.907**	154	143	**297**	0	0	**0**	1.618	992	**2.610**	**1.772**	**1.135**	**2.907**
0	**132**	0	8	**8**	5	34	**39**	3	82	**85**	**8**	**124**	**132**
Total	**20.225**	**753**	**1.292**	**2.045**	**1.037**	**752**	**1.789**	**6.976**	**9.415**	**16.391**	**8.766**	**11.459**	**20.225**
%	**100.0%**	**3.7%**	**6.4%**	**10.1%**	**5.1%**	**3.7%**	**8.8%**	**34.5%**	**46.6%**	**81.0%**	**43.3%**	**56.7%**	**100.0%**

1998_4Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.495**	96	226	**322**	0	0	**0**	400	773	**1.173**	**496**	**999**	**1.495**
2	**1.145**	25	46	**71**	0	0	**0**	622	452	**1.074**	**647**	**498**	**1.145**
3	**1.504**	91	43	**134**	198	32	**230**	450	690	**1.140**	**739**	**765**	**1.504**
4	**1.829**	58	28	**86**	431	222	**653**	581	509	**1.090**	**1.070**	**759**	**1.829**
5	**2.744**	193	163	**356**	309	261	**570**	1.157	661	**1.818**	**1.659**	**1.085**	**2.744**
6	**2.020**	15	69	**84**	76	138	**214**	809	913	**1.722**	**900**	**1.120**	**2.020**
7	**4.828**	120	418	**538**	0	0	**0**	1.119	3.171	**4.290**	**1.239**	**3.589**	**4.828**
8	**1.636**	42	208	**250**	0	0	**0**	262	1.124	**1.386**	**304**	**1.332**	**1.636**
9	**2.991**	155	172	**327**	0	0	**0**	1.642	1.022	**2.664**	**1.797**	**1.194**	**2.991**
0	**127**	0	12	**12**	7	29	**36**	5	74	**79**	**12**	**115**	**127**
Total	**20.319**	**795**	**1.385**	**2.180**	**1.021**	**682**	**1.703**	**7.047**	**9.389**	**16.436**	**8.863**	**11.456**	**20.319**
%	**100.0%**	**3.9%**	**6.8%**	**10.7%**	**5.0%**	**3.4%**	**8.4%**	**34.7%**	**46.2%**	**80.9%**	**43.6%**	**56.4%**	**100.0%**

Source: Calculations made by the author.

Annex G.

Auxiliary Tables of Empirical Approach using the Mean (variable M)

Major Group of PCO/2010 with higher incidence of overeducation

2004_1Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.897**	108	153	**261**	99	184	**283**	454	899	**1.353**	**661**	**1.236**	**1.897**
2	**1.634**	29	30	**59**	24	13	**37**	945	593	**1.538**	**998**	**636**	**1.634**
3	**1.812**	242	108	**350**	145	36	**181**	447	834	**1.281**	**834**	**978**	**1.812**
4	**2.136**	128	42	**170**	0	0	**0**	1.205	761	**1.966**	**1.333**	**803**	**2.136**
5	**3.055**	354	199	**553**	0	0	**0**	1.664	838	**2.502**	**2.018**	**1.037**	**3.055**
6	**1.833**	23	94	**117**	0	0	**0**	807	909	**1.716**	**830**	**1.003**	**1.833**
7	**4.247**	132	666	**798**	0	0	**0**	753	2.696	**3.449**	**885**	**3.362**	**4.247**
8	**1.698**	69	291	**360**	0	0	**0**	254	1.084	**1.338**	**323**	**1.375**	**1.698**
9	**3.166**	300	278	**578**	0	0	**0**	1.626	962	**2.588**	**1.926**	**1.240**	**3.166**
0	**141**	2	12	**14**	6	26	**32**	4	91	**95**	**12**	**129**	**141**
Total	**21.619**	**1.387**	**1.873**	**3.260**	**274**	**259**	**533**	**8.159**	**9.667**	**17.826**	**9.820**	**11.799**	**21.619**
%	**100.0%**	**6.4%**	**8.7%**	**15.1%**	**1.3%**	**1.2%**	**2.5%**	**37.7%**	**44.7%**	**82.5%**	**45.4%**	**54.6%**	**100.0%**

2004_2Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.916**	114	162	**276**	110	190	**300**	466	874	**1.340**	**690**	**1.226**	**1.916**
2	**1.751**	17	21	**38**	27	36	**63**	989	661	**1.650**	**1.033**	**718**	**1.751**
3	**1.860**	8	7	**15**	260	104	**364**	582	899	**1.481**	**850**	**1.010**	**1.860**
4	**2.132**	117	42	**159**	0	0	**0**	1.248	725	**1.973**	**1.365**	**767**	**2.132**
5	**3.103**	339	208	**547**	0	0	**0**	1.719	837	**2.556**	**2.058**	**1.045**	**3.103**
6	**1.823**	24	94	**118**	0	0	**0**	803	902	**1.705**	**827**	**996**	**1.823**
7	**4.220**	31	141	**172**	99	548	**647**	732	2.669	**3.401**	**862**	**3.358**	**4.220**
8	**1.781**	21	89	**110**	49	251	**300**	250	1.121	**1.371**	**320**	**1.461**	**1.781**
9	**3.198**	303	305	**608**	0	0	**0**	1.642	948	**2.590**	**1.945**	**1.253**	**3.198**
0	**143**	0	16	**16**	0	0	**0**	10	117	**127**	**10**	**133**	**143**
Total	**21.927**	**974**	**1.085**	**2.059**	**545**	**1.129**	**1.674**	**8.441**	**9.753**	**18.194**	**9.960**	**11.967**	**21.927**
%	**100.0%**	**4.4%**	**4.9%**	**9.4%**	**2.5%**	**5.1%**	**7.6%**	**38.5%**	**44.5%**	**83.0%**	**45.4%**	**54.6%**	**100.0%**

2004_3Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.825**	97	144	**241**	106	167	**273**	445	866	**1.311**	**648**	**1.177**	**1.825**
2	**1.668**	16	19	**35**	30	40	**70**	939	624	**1.563**	**985**	**683**	**1.668**
3	**1.776**	262	97	**359**	124	37	**161**	419	837	**1.256**	**805**	**971**	**1.776**
4	**2.101**	119	45	**164**	0	0	**0**	1.232	705	**1.937**	**1.351**	**750**	**2.101**
5	**3.074**	328	203	**531**	0	0	**0**	1.708	835	**2.543**	**2.036**	**1.038**	**3.074**
6	**1.761**	29	85	**114**	0	0	**0**	780	867	**1.647**	**809**	**952**	**1.761**
7	**4.074**	28	153	**181**	93	524	**617**	704	2.572	**3.276**	**825**	**3.249**	**4.074**
8	**1.717**	23	90	**113**	48	252	**300**	236	1.068	**1.304**	**307**	**1.410**	**1.717**
9	**3.099**	297	310	**607**	0	0	**0**	1.613	879	**2.492**	**1.910**	**1.189**	**3.099**
0	**154**	1	14	**15**	4	35	**39**	3	97	**100**	**8**	**146**	**154**
Total	**21.249**	**1.200**	**1.160**	**2.360**	**405**	**1.055**	**1.460**	**8.079**	**9.350**	**17.429**	**9.684**	**11.565**	**21.249**
%	**100.0%**	**5.6%**	**5.5%**	**11.1%**	**1.9%**	**5.0%**	**6.9%**	**38.0%**	**44.0%**	**82.0%**	**45.6%**	**54.4%**	**100.0%**

2004_4Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.828**	95	155	**250**	102	162	**264**	449	865	**1.314**	**646**	**1.182**	**1.828**
2	**1.742**	16	19	**35**	31	36	**67**	974	666	**1.640**	**1.021**	**721**	**1.742**
3	**1.820**	12	11	**23**	280	89	**369**	533	895	**1.428**	**825**	**995**	**1.820**
4	**2.179**	131	42	**173**	0	0	**0**	1.271	735	**2.006**	**1.402**	**777**	**2.179**
5	**2.980**	324	192	**516**	0	0	**0**	1.684	780	**2.464**	**2.008**	**972**	**2.980**
6	**1.757**	33	86	**119**	0	0	**0**	782	856	**1.638**	**815**	**942**	**1.757**
7	**4.036**	31	155	**186**	86	547	**633**	713	2.504	**3.217**	**830**	**3.206**	**4.036**
8	**1.682**	17	101	**118**	49	236	**285**	226	1.053	**1.279**	**292**	**1.390**	**1.682**
9	**3.092**	322	322	**644**	0	0	**0**	1.564	884	**2.448**	**1.886**	**1.206**	**3.092**
0	**153**	1	16	**17**	0	0	**0**	11	125	**136**	**12**	**141**	**153**
Total	**21.269**	**982**	**1.099**	**2.081**	**548**	**1.070**	**1.618**	**8.207**	**9.363**	**17.570**	**9.737**	**11.532**	**21.269**
%	**100.0%**	**4.6%**	**5.2%**	**9.8%**	**2.6%**	**5.0%**	**7.6%**	**38.6%**	**44.0%**	**82.6%**	**45.8%**	**54.2%**	**100.0%**

Source: Calculations made by the author.

Annex G.

Auxiliary Tables of Empirical Approach using the Mean (variable M)

Major Group of PCO/2010 with higher incidence of overeducation

2009_1Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.191**	86	136	**222**	0	0	**0**	309	660	**969**	**395**	**796**	**1.191**
2	**1.493**	21	34	**55**	62	41	**103**	790	545	**1.335**	**873**	**620**	**1.493**
3	**1.605**	314	118	**432**	62	36	**98**	437	638	**1.075**	**813**	**792**	**1.605**
4	**1.604**	127	45	**172**	0	0	**0**	875	557	**1.432**	**1.002**	**602**	**1.604**
5	**2.828**	441	211	**652**	0	0	**0**	1.519	657	**2.176**	**1.960**	**868**	**2.828**
6	**1.466**	46	134	**180**	0	0	**0**	603	683	**1.286**	**649**	**817**	**1.466**
7	**3.213**	28	185	**213**	88	530	**618**	472	1.910	**2.382**	**588**	**2.625**	**3.213**
8	**1.269**	16	88	**104**	50	221	**271**	131	763	**894**	**197**	**1.072**	**1.269**
9	**2.464**	134	79	**213**	242	180	**422**	1.276	553	**1.829**	**1.652**	**812**	**2.464**
0	**87**	2	14	**16**	0	0	**0**	6	65	**71**	**8**	**79**	**87**
Total	**17.220**	**1.215**	**1.044**	**2.259**	**504**	**1.008**	**1.512**	**6.418**	**7.031**	**13.449**	**8.137**	**9.083**	**17.220**
%	**100.0%**	**7.1%**	**6.1%**	**13.1%**	**2.9%**	**5.9%**	**8.8%**	**37.3%**	**40.8%**	**78.1%**	**47.3%**	**52.7%**	**100.0%**

2009_2Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.148**	92	122	**214**	0	0	**0**	308	626	**934**	**400**	**748**	**1.148**
2	**1.495**	20	31	**51**	62	44	**106**	796	542	**1.338**	**878**	**617**	**1.495**
3	**1.553**	306	111	**417**	51	35	**86**	415	635	**1.050**	**772**	**781**	**1.553**
4	**1.588**	121	49	**170**	0	0	**0**	880	538	**1.418**	**1.001**	**587**	**1.588**
5	**2.805**	450	210	**660**	0	0	**0**	1.491	654	**2.145**	**1.941**	**864**	**2.805**
6	**1.448**	49	133	**182**	0	0	**0**	573	693	**1.266**	**622**	**826**	**1.448**
7	**3.087**	31	192	**223**	93	512	**605**	446	1.813	**2.259**	**570**	**2.517**	**3.087**
8	**1.237**	18	94	**112**	56	203	**259**	133	733	**866**	**207**	**1.030**	**1.237**
9	**2.418**	144	73	**217**	246	172	**418**	1.232	551	**1.783**	**1.622**	**796**	**2.418**
0	**94**	3	14	**17**	0	0	**0**	10	67	**77**	**13**	**81**	**94**
Total	**16.873**	**1.234**	**1.029**	**2.263**	**508**	**966**	**1.474**	**6.284**	**6.852**	**13.136**	**8.026**	**8.847**	**16.873**
%	**100.0%**	**7.3%**	**6.1%**	**13.4%**	**3.0%**	**5.7%**	**8.7%**	**37.2%**	**40.6%**	**77.9%**	**47.6%**	**52.4%**	**100.0%**

2009_3Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.073**	88	117	**205**	0	0	**0**	292	576	**868**	**380**	**693**	**1.073**
2	**1.419**	20	26	**46**	68	42	**110**	765	498	**1.263**	**853**	**566**	**1.419**
3	**1.493**	275	97	**372**	54	34	**88**	411	622	**1.033**	**740**	**753**	**1.493**
4	**1.577**	124	38	**162**	0	0	**0**	882	533	**1.415**	**1.006**	**571**	**1.577**
5	**2.810**	439	234	**673**	0	0	**0**	1.467	670	**2.137**	**1.906**	**904**	**2.810**
6	**1.464**	52	140	**192**	0	0	**0**	550	722	**1.272**	**602**	**862**	**1.464**
7	**3.021**	33	204	**237**	100	503	**603**	415	1.766	**2.181**	**548**	**2.473**	**3.021**
8	**1.224**	21	100	**121**	57	207	**264**	139	700	**839**	**217**	**1.007**	**1.224**
9	**2.358**	144	77	**221**	266	167	**433**	1.163	541	**1.704**	**1.573**	**785**	**2.358**
0	**91**	2	12	**14**	0	0	**0**	10	67	**77**	**12**	**79**	**91**
Total	**16.530**	**1.198**	**1.045**	**2.243**	**545**	**953**	**1.498**	**6.094**	**6.695**	**12.789**	**7.837**	**8.693**	**16.530**
%	**100.0%**	**7.2%**	**6.3%**	**13.6%**	**3.3%**	**5.8%**	**9.1%**	**36.9%**	**40.5%**	**77.4%**	**47.4%**	**52.6%**	**100.0%**

2009_4Q

Unit: individuals — Empirical Approach - with **M = Mean**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**988**	91	119	**210**	0	0	**0**	256	522	**778**	**347**	**641**	**988**
2	**1.451**	18	24	**42**	60	40	**100**	800	509	**1.309**	**878**	**573**	**1.451**
3	**1.516**	292	105	**397**	49	34	**83**	420	616	**1.036**	**761**	**755**	**1.516**
4	**1.560**	124	33	**157**	0	0	**0**	892	511	**1.403**	**1.016**	**544**	**1.560**
5	**2.795**	468	232	**700**	0	0	**0**	1.441	654	**2.095**	**1.909**	**886**	**2.795**
6	**1.482**	53	152	**205**	0	0	**0**	552	725	**1.277**	**605**	**877**	**1.482**
7	**2.968**	28	212	**240**	95	494	**589**	397	1.742	**2.139**	**520**	**2.448**	**2.968**
8	**1.212**	28	93	**121**	62	203	**265**	128	698	**826**	**218**	**994**	**1.212**
9	**2.363**	157	81	**238**	263	174	**437**	1.154	534	**1.688**	**1.574**	**789**	**2.363**
0	**95**	3	13	**16**	0	0	**0**	12	67	**79**	**15**	**80**	**95**
Total	**16.430**	**1.262**	**1.064**	**2.326**	**529**	**945**	**1.474**	**6.052**	**6.578**	**12.630**	**7.843**	**8.587**	**16.430**
%	**100.0%**	**7.7%**	**6.5%**	**14.2%**	**3.2%**	**5.8%**	**9.0%**	**36.8%**	**40.0%**	**76.9%**	**47.7%**	**52.3%**	**100.0%**

Source: Calculations made by the author.

Annex H

Auxiliary Tables of the Empirical Approach

Using the Mode (variable M)

Annex H.

Auxiliary Tables of Empirical Approach using the Mode (variable M)

Major Group of PCO/2010 with higher incidence of overeducation

1998_1Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.552**	169	393	**562**	0	0	**0**	353	637	**990**	**522**	**1.030**	**1.552**
2	**1.197**	6	18	**24**	0	0	**0**	666	507	**1.173**	**672**	**525**	**1.197**
3	**1.530**	2	2	**4**	83	48	**131**	672	723	**1.395**	**757**	**773**	**1.530**
4	**1.938**	26	18	**44**	22	8	**30**	1.065	799	**1.864**	**1.113**	**825**	**1.938**
5	**2.708**	496	409	**905**	0	0	**0**	1.115	688	**1.803**	**1.611**	**1.097**	**2.708**
6	**2.233**	16	63	**79**	0	0	**0**	975	1.179	**2.154**	**991**	**1.242**	**2.233**
7	**5.026**	124	448	**572**	425	1.100	**1.525**	759	2.170	**2.929**	**1.308**	**3.718**	**5.026**
8	**1.780**	45	212	**257**	128	366	**494**	202	827	**1.029**	**375**	**1.405**	**1.780**
9	**2.998**	153	153	**306**	0	0	**0**	1.667	1.025	**2.692**	**1.820**	**1.178**	**2.998**
0	**131**	0	11	**11**	3	27	**30**	2	88	**90**	**5**	**126**	**131**
Total	**21.093**	**1.037**	**1.727**	**2.764**	**661**	**1.549**	**2.210**	**7.476**	**8.643**	**16.119**	**9.174**	**11.919**	**21.093**
%	**100%**	**5%**	**8%**	**13%**	**3%**	**7%**	**10%**	**35%**	**41%**	**76%**	**43%**	**57%**	**100%**

1998_2Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.547**	163	395	**558**	0	0	**0**	360	629	**989**	**523**	**1.024**	**1.547**
2	**1.205**	7	19	**26**	20	26	**46**	649	484	**1.133**	**676**	**529**	**1.205**
3	**1.565**	3	2	**5**	82	38	**120**	688	752	**1.440**	**773**	**792**	**1.565**
4	**1.910**	32	20	**52**	21	10	**31**	1.041	786	**1.827**	**1.094**	**816**	**1.910**
5	**2.810**	533	429	**962**	0	0	**0**	1.154	694	**1.848**	**1.687**	**1.123**	**2.810**
6	**2.237**	16	51	**67**	93	183	**276**	912	982	**1.894**	**1.021**	**1.216**	**2.237**
7	**5.045**	119	438	**557**	440	1.119	**1.559**	756	2.173	**2.929**	**1.315**	**3.730**	**5.045**
8	**1.751**	54	206	**260**	115	373	**488**	182	821	**1.003**	**351**	**1.400**	**1.751**
9	**3.002**	150	141	**291**	0	0	**0**	1.697	1.014	**2.711**	**1.847**	**1.155**	**3.002**
0	**126**	0	8	**8**	3	31	**34**	3	81	**84**	**6**	**120**	**126**
Total	**21.198**	**1.077**	**1.709**	**2.786**	**774**	**1.780**	**2.554**	**7.442**	**8.416**	**15.858**	**9.293**	**11.905**	**21.198**
%	**100%**	**5%**	**8%**	**13%**	**4%**	**8%**	**12%**	**35%**	**40%**	**75%**	**44%**	**56%**	**100%**

1998_3Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.437**	167	356	**523**	0	0	**0**	327	587	**914**	**494**	**943**	**1.437**
2	**1.070**	7	15	**22**	0	0	**0**	596	452	**1.048**	**603**	**467**	**1.070**
3	**1.488**	2	2	**4**	74	37	**111**	658	715	**1.373**	**734**	**754**	**1.488**
4	**1.845**	32	19	**51**	24	11	**35**	988	771	**1.759**	**1.044**	**801**	**1.845**
5	**2.735**	512	425	**937**	0	0	**0**	1.124	674	**1.798**	**1.636**	**1.099**	**2.735**
6	**2.126**	18	62	**80**	0	0	**0**	922	1.124	**2.046**	**940**	**1.186**	**2.126**
7	**4.809**	107	427	**534**	395	1.076	**1.471**	724	2.080	**2.804**	**1.226**	**3.583**	**4.809**
8	**1.676**	46	207	**253**	109	352	**461**	154	808	**962**	**309**	**1.367**	**1.676**
9	**2.907**	154	143	**297**	0	0	**0**	1.618	992	**2.610**	**1.772**	**1.135**	**2.907**
0	**132**	0	8	**8**	5	34	**39**	3	82	**85**	**8**	**124**	**132**
Total	**20.225**	**1.045**	**1.664**	**2.709**	**607**	**1.510**	**2.117**	**7.114**	**8.285**	**15.399**	**8.766**	**11.459**	**20.225**
%	**100%**	**5%**	**8%**	**13%**	**3%**	**7%**	**10%**	**35%**	**41%**	**76%**	**43%**	**57%**	**100%**

1998_4Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.495**	167	384	**551**	0	0	**0**	329	615	**944**	**496**	**999**	**1.495**
2	**1.145**	8	18	**26**	17	28	**45**	622	452	**1.074**	**647**	**498**	**1.145**
3	**1.504**	2	1	**3**	89	42	**131**	648	722	**1.370**	**739**	**765**	**1.504**
4	**1.829**	33	19	**52**	25	9	**34**	1.012	731	**1.743**	**1.070**	**759**	**1.829**
5	**2.744**	502	424	**926**	0	0	**0**	1.157	661	**1.818**	**1.659**	**1.085**	**2.744**
6	**2.020**	15	69	**84**	0	0	**0**	885	1.051	**1.936**	**900**	**1.120**	**2.020**
7	**4.828**	120	418	**538**	384	1.083	**1.467**	735	2.088	**2.823**	**1.239**	**3.589**	**4.828**
8	**1.636**	42	208	**250**	104	352	**456**	158	772	**930**	**304**	**1.332**	**1.636**
9	**2.991**	155	172	**327**	0	0	**0**	1.642	1.022	**2.664**	**1.797**	**1.194**	**2.991**
0	**127**	0	12	**12**	7	29	**36**	5	74	**79**	**12**	**115**	**127**
Total	**20.319**	**1.044**	**1.725**	**2.769**	**626**	**1.543**	**2.169**	**7.193**	**8.188**	**15.381**	**8.863**	**11.456**	**20.319**
%	**100%**	**5%**	**8%**	**14%**	**3%**	**8%**	**11%**	**35%**	**40%**	**76%**	**44%**	**56%**	**100%**

Source: Calculations made by the author.

Annex H.

Auxiliary Tables of Empirical Approach using the Mode (variable M)

Major Group of PCO/2010 with higher incidence of overeducation

2004_1Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.897**	308	563	**871**	0	0	**0**	353	673	**1.026**	**661**	**1.236**	**1.897**
2	**1.634**	29	30	**59**	24	13	**37**	945	593	**1.538**	**998**	**636**	**1.634**
3	**1.812**	7	8	**15**	235	100	**335**	592	870	**1.462**	**834**	**978**	**1.812**
4	**2.136**	95	36	**131**	33	6	**39**	1.205	761	**1.966**	**1.333**	**803**	**2.136**
5	**3.055**	828	496	**1.324**	0	0	**0**	1.190	541	**1.731**	**2.018**	**1.037**	**3.055**
6	**1.833**	23	94	**117**	0	0	**0**	807	909	**1.716**	**830**	**1.003**	**1.833**
7	**4.247**	132	666	**798**	304	1.065	**1.369**	449	1.631	**2.080**	**885**	**3.362**	**4.247**
8	**1.698**	69	291	**360**	102	420	**522**	152	664	**816**	**323**	**1.375**	**1.698**
9	**3.166**	300	278	**578**	0	0	**0**	1.626	962	**2.588**	**1.926**	**1.240**	**3.166**
0	**141**	2	12	**14**	6	26	**32**	4	91	**95**	**12**	**129**	**141**
Total	**21.619**	**1.793**	**2.474**	**4.267**	**704**	**1.630**	**2.334**	**7.323**	**7.695**	**15.018**	**9.820**	**11.799**	**21.619**
%	**100%**	**8%**	**11%**	**20%**	**3%**	**8%**	**11%**	**34%**	**36%**	**69%**	**45%**	**55%**	**100%**

2004_2Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.916**	339	581	**920**	0	0	**0**	351	645	**996**	**690**	**1.226**	**1.916**
2	**1.751**	17	21	**38**	27	36	**63**	989	661	**1.650**	**1.033**	**718**	**1.751**
3	**1.860**	8	7	**15**	260	104	**364**	582	899	**1.481**	**850**	**1.010**	**1.860**
4	**2.132**	82	33	**115**	35	9	**44**	1.248	725	**1.973**	**1.365**	**767**	**2.132**
5	**3.103**	863	536	**1.399**	0	0	**0**	1.195	509	**1.704**	**2.058**	**1.045**	**3.103**
6	**1.823**	24	94	**118**	0	0	**0**	803	902	**1.705**	**827**	**996**	**1.823**
7	**4.220**	130	689	**819**	0	0	**0**	732	2.669	**3.401**	**862**	**3.358**	**4.220**
8	**1.781**	70	340	**410**	0	0	**0**	250	1.121	**1.371**	**320**	**1.461**	**1.781**
9	**3.198**	303	305	**608**	0	0	**0**	1.642	948	**2.590**	**1.945**	**1.253**	**3.198**
0	**143**	0	16	**16**	7	31	**38**	3	86	**89**	**10**	**133**	**143**
Total	**21.927**	**1.836**	**2.622**	**4.458**	**329**	**180**	**509**	**7.795**	**9.165**	**16.960**	**9.960**	**11.967**	**21.927**
%	**100%**	**8%**	**12%**	**20%**	**2%**	**1%**	**2%**	**36%**	**42%**	**77%**	**45%**	**55%**	**100%**

2004_3Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.825**	315	538	**853**	0	0	**0**	333	639	**972**	**648**	**1.177**	**1.825**
2	**1.668**	16	19	**35**	30	40	**70**	939	624	**1.563**	**985**	**683**	**1.668**
3	**1.776**	9	10	**19**	253	87	**340**	543	874	**1.417**	**805**	**971**	**1.776**
4	**2.101**	85	34	**119**	34	11	**45**	1.232	705	**1.937**	**1.351**	**750**	**2.101**
5	**3.074**	849	545	**1.394**	0	0	**0**	1.187	493	**1.680**	**2.036**	**1.038**	**3.074**
6	**1.761**	29	85	**114**	0	0	**0**	780	867	**1.647**	**809**	**952**	**1.761**
7	**4.074**	121	677	**798**	0	0	**0**	704	2.572	**3.276**	**825**	**3.249**	**4.074**
8	**1.717**	71	342	**413**	0	0	**0**	236	1.068	**1.304**	**307**	**1.410**	**1.717**
9	**3.099**	297	310	**607**	0	0	**0**	1.613	879	**2.492**	**1.910**	**1.189**	**3.099**
0	**154**	1	14	**15**	4	35	**39**	3	97	**100**	**8**	**146**	**154**
Total	**21.249**	**1.793**	**2.574**	**4.367**	**321**	**173**	**494**	**7.570**	**8.818**	**16.388**	**9.684**	**11.565**	**21.249**
%	**100%**	**8%**	**12%**	**21%**	**2%**	**1%**	**2%**	**36%**	**41%**	**77%**	**46%**	**54%**	**100%**

2004_4Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.828**	306	547	**853**	0	0	**0**	340	635	**975**	**646**	**1.182**	**1.828**
2	**1.742**	16	19	**35**	31	36	**67**	974	666	**1.640**	**1.021**	**721**	**1.742**
3	**1.820**	12	11	**23**	280	89	**369**	533	895	**1.428**	**825**	**995**	**1.820**
4	**2.179**	93	30	**123**	38	12	**50**	1.271	735	**2.006**	**1.402**	**777**	**2.179**
5	**2.980**	847	511	**1.358**	0	0	**0**	1.161	461	**1.622**	**2.008**	**972**	**2.980**
6	**1.757**	33	86	**119**	0	0	**0**	782	856	**1.638**	**815**	**942**	**1.757**
7	**4.036**	117	702	**819**	0	0	**0**	713	2.504	**3.217**	**830**	**3.206**	**4.036**
8	**1.682**	66	337	**403**	0	0	**0**	226	1.053	**1.279**	**292**	**1.390**	**1.682**
9	**3.092**	322	322	**644**	0	0	**0**	1.564	884	**2.448**	**1.886**	**1.206**	**3.092**
0	**153**	1	16	**17**	7	35	**42**	4	90	**94**	**12**	**141**	**153**
Total	**21.269**	**1.813**	**2.581**	**4.394**	**356**	**172**	**528**	**7.568**	**8.779**	**16.347**	**9.737**	**11.532**	**21.269**
%	**100%**	**9%**	**12%**	**21%**	**2%**	**1%**	**2%**	**36%**	**41%**	**77%**	**46%**	**54%**	**100%**

Source: Calculations made by the author.

Annex H.

Auxiliary Tables of Empirical Approach using the Mode (variable M)

Major Group of PCO/2010 with higher incidence of overeducation

2009_1Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.191**	154	273	**427**	85	160	**245**	156	363	**519**	**395**	**796**	**1.191**
2	**1.493**	21	34	**55**	62	41	**103**	790	545	**1.335**	**873**	**620**	**1.493**
3	**1.605**	314	118	**432**	62	36	**98**	437	638	**1.075**	**813**	**792**	**1.605**
4	**1.604**	98	36	**134**	29	9	**38**	875	557	**1.432**	**1.002**	**602**	**1.604**
5	**2.828**	61	18	**79**	380	193	**573**	1.519	657	**2.176**	**1.960**	**868**	**2.828**
6	**1.466**	46	134	**180**	0	0	**0**	603	683	**1.286**	**649**	**817**	**1.466**
7	**3.213**	116	715	**831**	0	0	**0**	472	1.910	**2.382**	**588**	**2.625**	**3.213**
8	**1.269**	66	309	**375**	0	0	**0**	131	763	**894**	**197**	**1.072**	**1.269**
9	**2.464**	376	259	**635**	0	0	**0**	1.276	553	**1.829**	**1.652**	**812**	**2.464**
0	**87**	2	12	**14**	0	2	**2**	6	65	**71**	**8**	**79**	**87**
Total	**17.220**	**1.254**	**1.908**	**3.162**	**618**	**441**	**1.059**	**6.265**	**6.734**	**12.999**	**8.137**	**9.083**	**17.220**
%	**100%**	**7%**	**11%**	**18%**	**4%**	**3%**	**6%**	**36%**	**39%**	**75%**	**47%**	**53%**	**100%**

2009_2Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.148**	254	400	**654**	0	0	**0**	146	348	**494**	**400**	**748**	**1.148**
2	**1.495**	20	31	**51**	62	44	**106**	796	542	**1.338**	**878**	**617**	**1.495**
3	**1.553**	306	111	**417**	51	35	**86**	415	635	**1.050**	**772**	**781**	**1.553**
4	**1.588**	95	36	**131**	26	13	**39**	880	538	**1.418**	**1.001**	**587**	**1.588**
5	**2.805**	71	19	**90**	379	191	**570**	1.491	654	**2.145**	**1.941**	**864**	**2.805**
6	**1.448**	49	133	**182**	0	0	**0**	573	693	**1.266**	**622**	**826**	**1.448**
7	**3.087**	124	704	**828**	0	0	**0**	446	1.813	**2.259**	**570**	**2.517**	**3.087**
8	**1.237**	74	297	**371**	0	0	**0**	133	733	**866**	**207**	**1.030**	**1.237**
9	**2.418**	390	245	**635**	0	0	**0**	1.232	551	**1.783**	**1.622**	**796**	**2.418**
0	**94**	3	14	**17**	4	27	**31**	6	40	**46**	**13**	**81**	**94**
Total	**16.873**	**1.386**	**1.990**	**3.376**	**522**	**310**	**832**	**6.118**	**6.547**	**12.665**	**8.026**	**8.847**	**16.873**
%	**100%**	**8%**	**12%**	**20%**	**3%**	**2%**	**5%**	**36%**	**39%**	**75%**	**48%**	**52%**	**100%**

2009_3Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**1.073**	243	390	**633**	0	0	**0**	137	303	**440**	**380**	**693**	**1.073**
2	**1.419**	20	26	**46**	68	42	**110**	765	498	**1.263**	**853**	**566**	**1.419**
3	**1.493**	275	97	**372**	54	34	**88**	411	622	**1.033**	**740**	**753**	**1.493**
4	**1.577**	96	29	**125**	28	9	**37**	882	533	**1.415**	**1.006**	**571**	**1.577**
5	**2.810**	66	18	**84**	373	216	**589**	1.467	670	**2.137**	**1.906**	**904**	**2.810**
6	**1.464**	52	140	**192**	0	0	**0**	550	722	**1.272**	**602**	**862**	**1.464**
7	**3.021**	133	707	**840**	0	0	**0**	415	1.766	**2.181**	**548**	**2.473**	**3.021**
8	**1.224**	78	307	**385**	0	0	**0**	139	700	**839**	**217**	**1.007**	**1.224**
9	**2.358**	410	244	**654**	0	0	**0**	1.163	541	**1.704**	**1.573**	**785**	**2.358**
0	**91**	2	6	**8**	0	6	**6**	10	67	**77**	**12**	**79**	**91**
Total	**16.530**	**1.375**	**1.964**	**3.339**	**523**	**307**	**830**	**5.939**	**6.422**	**12.361**	**7.837**	**8.693**	**16.530**
%	**100%**	**8%**	**12%**	**20%**	**3%**	**2%**	**5%**	**36%**	**39%**	**75%**	**47%**	**53%**	**100%**

2009_4Q

Unit: individuals — Empirical Approach - with **M = Mode**

Major Group of PCO/2010	Number of Records	Overeducated			Adequately Educated			Undereducated			Total		
		F	M	F + M	F	M	F + M	F	M	F + M	F	M	F + M
1	**988**	152	220	**372**	76	143	**219**	119	278	**397**	**347**	**641**	**988**
2	**1.451**	18	24	**42**	60	40	**100**	800	509	**1.309**	**878**	**573**	**1.451**
3	**1.516**	292	105	**397**	49	34	**83**	420	616	**1.036**	**761**	**755**	**1.516**
4	**1.560**	101	28	**129**	23	5	**28**	892	511	**1.403**	**1.016**	**544**	**1.560**
5	**2.795**	77	16	**93**	391	216	**607**	1.441	654	**2.095**	**1.909**	**886**	**2.795**
6	**1.482**	53	152	**205**	0	0	**0**	552	725	**1.277**	**605**	**877**	**1.482**
7	**2.968**	123	706	**829**	0	0	**0**	397	1.742	**2.139**	**520**	**2.448**	**2.968**
8	**1.212**	90	296	**386**	0	0	**0**	128	698	**826**	**218**	**994**	**1.212**
9	**2.363**	420	255	**675**	0	0	**0**	1.154	534	**1.688**	**1.574**	**789**	**2.363**
0	**95**	3	13	**16**	5	30	**35**	7	37	**44**	**15**	**80**	**95**
Total	**16.430**	**1.329**	**1.815**	**3.144**	**604**	**468**	**1.072**	**5.910**	**6.304**	**12.214**	**7.843**	**8.587**	**16.430**
%	**100%**	**8%**	**11%**	**19%**	**4%**	**3%**	**7%**	**36%**	**38%**	**74%**	**48%**	**52%**	**100%**

Source: Calculations made by the author.

Annex I

Auxiliary Tables to Calculations of Mean (Me), Mode (Mo)
and Standard Deviation (SD)

Annex I.

Auxiliary Tables to Calculations of Mean (Me), Mode (Mo) and Standard Deviation (SD)

Major Group of PCO/2010:

1 - Managers

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	1.552	7	4	4
1998_2Q	1.547	7	4	4
1998_3Q	1.437	7	4	4
1998_4Q	1.495	7	4	4
2004_1Q	1.897	8	4	4
2004_2Q	1.916	8	4	4
2004_3Q	1.825	8	4	4
2004_4Q	1.828	8	4	4
2009_1Q	1.191	9	4	5
2009_2Q	1.148	9	4	4
2009_3Q	1.073	9	4	4
2009_4Q	988	9	4	5

Major Group of PCO/2010:

2 - Professionals

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	1.197	15	16	3
1998_2Q	1.205	15	16	2
1998_3Q	1.070	15	16	3
1998_4Q	1.145	15	16	2
2004_1Q	1.634	16	16	2
2004_2Q	1.751	16	16	2
2004_3Q	1.668	16	16	2
2004_4Q	1.742	16	16	2
2009_1Q	1.493	16	16	2
2009_2Q	1.495	16	16	2
2009_3Q	1.419	16	16	2
2009_4Q	1.451	16	16	2

Major Group of PCO/2010:

3 - Technicians and Associate Professionals

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	1.530	11	12	4
1998_2Q	1.565	11	12	4
1998_3Q	1.488	11	12	4
1998_4Q	1.504	11	12	4
2004_1Q	1.812	11	12	4
2004_2Q	1.860	12	12	4
2004_3Q	1.776	11	12	4
2004_4Q	1.820	12	12	4
2009_1Q	1.605	12	12	3
2009_2Q	1.553	12	12	3
2009_3Q	1.493	12	12	3
2009_4Q	1.516	12	12	3

Major Group of PCO/2010:

4 - Clerical Support Workers

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	1.938	9	12	3
1998_2Q	1.910	9	12	3
1998_3Q	1.845	9	12	3
1998_4Q	1.829	9	12	3
2004_1Q	2.136	10	12	3
2004_2Q	2.132	10	12	3
2004_3Q	2.101	10	12	3
2004_4Q	2.179	10	12	3
2009_1Q	1.604	10	12	3
2009_2Q	1.588	10	12	3
2009_3Q	1.577	11	12	3
2009_4Q	1.560	10	12	3

Major Group of PCO/2010:

5 - Service and Sales Workers

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	2.708	6	4	3
1998_2Q	2.810	6	4	3
1998_3Q	2.735	6	4	3
1998_4Q	2.744	6	4	3
2004_1Q	3.055	7	4	3
2004_2Q	3.103	7	4	3
2004_3Q	3.074	7	4	3
2004_4Q	2.980	7	4	3
2009_1Q	2.828	8	9	3
2009_2Q	2.805	8	9	3
2009_3Q	2.810	8	9	3
2009_4Q	2.795	8	9	3

Major Group of PCO/2010:

6 - Skilled Agricultural, Forestry and Fishery Workers

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	2.233	3	4	3
1998_2Q	2.237	3	4	2
1998_3Q	2.126	3	4	3
1998_4Q	2.020	3	4	3
2004_1Q	1.833	4	4	3
2004_2Q	1.823	4	4	3
2004_3Q	1.761	4	4	3
2004_4Q	1.757	4	4	3
2009_1Q	1.466	4	4	3
2009_2Q	1.448	5	4	3
2009_3Q	1.464	5	4	3
2009_4Q	1.482	5	4	3

Source: Calculations made by the author (all values are expressed in years of schooling).

Annex I.

Auxiliary Tables to Calculations of Mean (Me), Mode (Mo) and Standard Deviation (SD)

Major Group of PCO/2010:
7 - Craft and related Trades Workers

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	5.026	5	4	2
1998_2Q	5.045	5	4	2
1998_3Q	4.809	5	4	2
1998_4Q	4.828	5	4	2
2004_1Q	4.247	6	4	2
2004_2Q	4.220	6	4	3
2004_3Q	4.074	6	4	3
2004_4Q	4.036	6	4	3
2009_1Q	3.213	6	4	3
2009_2Q	3.087	6	4	3
2009_3Q	3.021	6	4	3
2009_4Q	2.968	6	4	3

Major Group of PCO/2010:
8 - Plant and Machine Operators and Assemblers

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	1.780	5	4	2
1998_2Q	1.751	5	4	2
1998_3Q	1.676	5	4	2
1998_4Q	1.636	5	4	2
2004_1Q	1.698	6	4	2
2004_2Q	1.781	6	4	3
2004_3Q	1.717	6	4	3
2004_4Q	1.682	6	4	3
2009_1Q	1.269	6	4	3
2009_2Q	1.237	6	4	3
2009_3Q	1.224	6	4	3
2009_4Q	1.212	6	4	3

Major Group of PCO/2010:
9 - Elemtary Occupations

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	2.998	4	4	3
1998_2Q	3.002	4	4	3
1998_3Q	2.907	4	4	3
1998_4Q	2.991	4	4	3
2004_1Q	3.166	5	4	3
2004_2Q	3.198	5	4	3
2004_3Q	3.099	5	4	3
2004_4Q	3.092	5	4	3
2009_1Q	2.464	6	4	3
2009_2Q	2.418	6	4	3
2009_3Q	2.358	6	4	3
2009_4Q	2.363	6	4	3

Major Group of PCO/2010:
0 - Armed Forces Occupations

Year and Quarter	Number of Records	Me = M	Mo = M	SD
1998_1Q	131	9	9	3
1998_2Q	126	9	9	3
1998_3Q	132	9	9	3
1998_4Q	127	9	9	3
2004_1Q	141	9	9	3
2004_2Q	143	10	9	3
2004_3Q	154	9	9	3
2004_4Q	153	10	9	3
2009_1Q	87	11	12	3
2009_2Q	94	11	9	3
2009_3Q	91	11	12	3
2009_4Q	95	11	9	3

Source: Calculations made by the author (all values are expressed in years of schooling).