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Research Article

Measuring Human Capital: A Comparative Study with Emphasis on Malta

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Abstract. The main aim of this paper was to produce an estimate for human capital stock for Malta over the period 2005 to 2013 and to compare Malta's performance with that of other countries, wherever possible. The paper attempts to answer two main questions, the first, is how can one give a value to the amount of capital embodied in humans, and the second is what was the human capital dynamics in Malta over the years, particularly when compared with other countries. This research is primarily motivated by the fact that human resources are Malta's only resource, in the absence of any natural endowments. The conclusions of this paper are as follows: First, the lifetime income approach was found to be a more reliable monetary metric. Second, the human capital stock of Malta grew by 70% in nominal terms from 2005 to 2013 whereas the nominal average annual growth rate was approximately equal to 7%. The real human capital stock grew by 32% over the same period. The real change in human capital was attributed to a 2% increase in the labour force population and a 1% increase in real lifetime income per capita. Third, human capital stock were estimated to be on average twice the value of physical capital stock and four times the value of Malta's GDP. Fourth, the level of human capital stock estimates was found to be sensitive to the choice of the expected future income growth and the rate used to discount the future income.

Keywords: Human capital stock; lifetime income approach; physical capital stock; growth rate; education

1 Introduction

For over three centuries economists have been interested in valuing the productive capacity of the workers in an economy. A country's human capital endowment or the knowledge and skills embodied in individuals can reflect the economy's potential for economic growth, fuller employment and social cohesion. Growth economics literature suggests that other things being equal, countries with higher levels of human capital have greater potential output and income in the future. Optimising the use of a country's human capital endowment requires not only a focus on unemployment rates alone but a metric which takes stock of the skills and education of the labour market population.

The rapidly expanding literature has revealed the utility of the human capital concept in both the micro and macro spheres of economics. At the microeconomic level, the skills and level of education of individuals determine the risk of unemployment and social exclusion. The differences in human capital are generally believed to translate into inequality in earnings. Furthermore, a human capital measure can be used in the assessment of the impact of an ageing population, changes in retirement ages and in the evaluation of the economic benefits of different levels of education. In the macroeconomic theory, human capital is among the four factors of economic development together with natural resources, capital formation and technology. Human capital has become the most important among the factors, as the capital goods can be bought, but can be effectively used in the economic process only by well-educated and skilled workers.

This paper considers the lifetime income approach to measuring Malta's human capital stock. This approach was developed by Jorgenson and Fraumeni (1989, 1992b, 1992a). Lifetime income is measured as the discounted future labour income flows of a representative individual. An empirical variant of Jorgenson and Fraumeni's approach is used, resulting in a monetary measure which can be directly linked to Gross Domestic

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Product (GDP). This estimate is based on detailed data on labour remuneration across different groups of workers. The methodology behind the estimate is intended to track the progress Malta has made over the period under study. The paper first presents the lifetime income per capita for different age and education cohorts. It then deduces a figure for the aggregate human capital for Malta by summing the lifetime incomes for all cohorts. Further analysis is conducted to determine the human capital in real terms. The methodology adopted and the results derived for Malta are contrasted with measures of human capital for other countries. This will serve to highlight the need for a more harmonious approach to measuring human capital by laying out the differences, benefits and shortcomings of the measures of human capital across countries.

2 Measuring Human Capital

Before measuring human capital, it is essential to define the term on which research has been built. Becker (1964) views human capital to include "embodied knowledge and skills". Becker, Mincer and Schultz, the founding fathers of human capital theory, regard human capital as the result of investment activities. This paper will examine human capital within the framework of growth theory. The knowledge and skills that will be considered will be those entering the production process and yielding an income to the individual. Human capital will be viewed as the "productive capacity of individuals" (Nerdrum, 1998).

As stated by Kiker (1966), throughout the history of economic thought, many economists have considered the skills and capacities embodied in human beings as a component of capital. In his "Wealth of Nations", Smith (1937) treated the acquisition of a skill as an investment which had a cost and returns a profit. Therefore, the basic idea of the human capital theory is that the variety of talents is mainly acquired through different activities, such as education or working experience. These activities have a cost, but produce benefits in future.

Schultz (1961) noted that the increases in national output could not be solely explained by the increases in the conventional factor inputs of land, man-hours and physical capital. He attributed this discrepancy to the quality of the labour input. Mincer (1958) provides an extensive study which establishes the term "human capital" and lays the foundation for human capital theory, with his major contribution being the "human capital earnings function". Becker complemented Mincer's work in the theoretical and empirical work on human capital. Becker (1964) initiates the book "Human Capital" with a lengthy discussion on on-the-job training, explaining that training is unlikely to be profitable for the firm in the current time period but may be profitable for the firm if future receipts are sufficiently raised or future payments sufficiently lowered.

Given that human capital is not directly observable, its measurement can be quite complex. It can be captured in different ways giving way to subjectivity in the assumptions imposed. It is generally acknowledged that there are three main approaches to measuring the human capital stock: the education approach, the cost-based approach and the income-based approach.

The education approach involves quantifying one of the key elements to human capital formation, that is, education. In the literature, several education measures are used such as literacy rates and school enrolment rates. Psacharopoulos and Arriagada (1986, 1992) and Barro and Lee (1996) used years of schooling as a proxy for human capital. Other measures include test scores (J.-W. Lee & Barro, 2001) and educational attainment, as measured by the International Standard Classification of Education (ISCED). However, educational attainment measures ignore learning that does not lead to a recognised qualification. Although it is a relevant indicator of the quality of human capital, this approach focuses solely on one input to human capital formation.

The cost of production approach estimates the human capital stock by taking the depreciated value of the monetary amount spent on the resources invested in the education and other human capital related sectors. Kendrick (1976) and Eisner (1985, 1989) are among those that have made use of this approach in measuring human capital. In "The Formation and Stocks of Total Capital" (1976), Kendrick divided human capital investments into tangible, being the durable goods owned by government and consumers, and intangible investment, including research and development, education and training, health and mobility. This approach focuses on the supply when in reality the value of human capital is also determined by its demand. Another limitation of this approach is that not all costs may be classified as an investment in human capital. Some costs may provide some consumption benefits. Therefore, some difficulty lies in distinguishing between investment and consumption costs (Schultz, 1961). Furthermore, determining the depreciation rate is crucial when using this approach since skills wear out due to ageing, illness or insufficient use or may become obsolete due to technological change or shifts in employment.

The income-based approach measures human capital by taking the sum of all discounted future income streams that all individuals in the population expect to earn over their lifetime. This approach focuses on the expected returns on investment and can therefore be described as 'forward-looking', as opposed to 'backward-looking' approaches taking into account the historical costs of production. Fender (2013) explains that the

depreciation rate is implicitly captured when using this approach, avoiding the need to determine an arbitrary rate. This approach is however based on some limiting assumptions. It assumes that labour is paid according to the marginal productivity, thus ignoring non-market impacts on wages such as unions and government intervention. It also assumes a discount rate and a retirement age and relies upon accurate data of earnings, employment and life expectancy tables.

Becker (1964) adopted this approach to estimate the rate of return on the human capital investment. He derives the rate of return on the investment by calculating the differences in the present value of the net earnings between an activity that requires investment and an activity requiring no investment beyond the initial period. Mincer (1974) also contributed further to the development of this approach through his "human capital earnings function". He points out that investment after schooling is likely to decline as earnings and experience increase, due to the higher opportunity cost of investment as more skill is acquired.

This paper applies the income-based approach to measuring the human capital of Malta and uses a variant of the Jorgenson and Fraumeni method (1989, 1992b, 1992a). Through their method, they estimated the human capital of the whole US population using 2,196 cohorts of sex, age and education. Their major contribution was in simplifying the discounting of future income streams to the present value. They estimated the lifetime labour income of a particular cohort by adding that cohort's current annual income and the present value of that cohort's lifetime income in the next period weighted by survival probabilities. It is given as

$$V_{s,a,e} = Y_{s,a,e} + S_{s,a+1} V_{s,a+1,e} \frac{1+g}{1+i}, \qquad (1)$$

where V is the lifetime income, Y is the annual earnings, S_{a+1} is the probability of surviving for another year and the subscripts s, a and e represent the sex, age and education of the individual.

An estimate of Malta's human capital is given by the Human Capital Index published by the World Economic Forum (WEF). This index takes a life-course approach to human capital, evaluating the levels of education, skills and employment available to people on a scale from 0 (worst) to 100 (best) across different age groups. Malta's human capital index in 2016 was estimated to stand at 75.66, ranking Malta at the 35th place from the 130 countries studied. The highest score of 85.86 was attained by Finland. To the best of our knowledge, there is no other study which derives an estimate of the human capital in Malta and studies its dynamics over time. This highlights the need to engage in further research within this domain so as to address gaps in the literature.

The income method of measuring human capital is preferred to the cost-based approach or the education-based approach for several reasons. It allows the output from investment in human capital to be measured independently of the inputs. Both the cost and education-based approach focus on what is invested whereas the income-based approach looks at the productivity of the education sector, on-the-job training and other inputs. Quantifying the elements of inputs to human capital which yield higher output is quite difficult. The income-based approach immediately seeks to evaluate the labour market to determine the worth of an individual. Higher investment in an individual (for instance, due to slow learning difficulties) may not always result in higher productivity. Finally, the Organisation for Economic Co-operation and Development (OECD) adopts the Jorgenson-Fraumeni lifetime income approach to compute the monetary value of the stock of human capital for each country. The Atkinson Report (2005, para. 9.33–9.34) also recommends exploring a lifetime income approach to measuring human capital.

3 Data and Methodology

The starting point for the measurement of lifetime labour incomes using a variant of Jorgenson and Fraumeni's approach was the construction of a data set including data on the employment rate, annual labour compensation of employees and survival rates classified by age and education. The Jorgenson-Fraumeni income-based approach applies the neoclassical theory of investment to human capital. According to this theory, the price of capital goods depends upon the discounted value of all future capital services derived from the investments. Similar approaches have been used by a number of countries, such as Australia (Wei, 2004, 2007, 2008), New Zealand (Le, Gibson & Oxley, 2002), the United Kingdom (O'Mahony & Stevens, 2009; Fender, 2013), Norway (Greaker & Liu, 2008, November) and Canada (Gu & Wong, 2010). This method is also used by the OECD human capital consortium (Liu, 2011). The method adopted by this paper differs in a number of aspects from the approach taken by Jorgenson and Fraumeni:

- Jorgenson and Fraumeni considered the whole U.S population whereas this paper focuses on the Maltese labour force population, thus trying to estimate the "effective" human capital.
- Jorgenson and Fraumeni also took account of non-market activities which increased labour income, with full labour income being defined as the sum of market and non-market labour compensation after taxes. The main criticism to this approach is that it assumes that human capital raises the productivity of time spent at work and leisure equally. In

this paper, only labour market activities were considered. Several other studies, such as Wei (2004, 2007), Greaker and Liu (2008, November) also focus on the labour market activities when estimating this variable.

- The cohorts within Jorgenson and Fraumeni's study were classified according to their age, sex and education level. This paper does not distinguish between the sex of the individuals due to severe data limitations. This may impact on the human capital estimate for Malta and its dynamics since labour market prospects and survival probabilities tend to differ between males and females.
- The age cohort within Jorgenson and Fraumeni's study initiates from the age of 14 and continues up to 74 years old. This paper takes those individuals aged between 15 and 65 years old, allowing comparison to cross-country estimates of human capital produced by the OECD.
- In estimating lifetime incomes, Jorgenson and Fraumeni distinguish among three stages in the life cycle. In the first stage, individuals may participate in formal schooling but not in the labour market. In the second stage, individuals may enrol in school and also work. In the third stage, individuals may participate in the labour market but not in formal schooling. This paper does not consider the school enrolment rates in the estimation of human capital since such data was not available for the period studied[1].

To construct a measure of aggregate human capital in Malta, the population is cross-classified by 4 age groups (15–24 years old, 25–49 years old, 50–64 years old and 65+ years) and 3 education levels (ISCED 0–2, ISCED 3–4 and ISCED 5–6). Therefore, the lowest level of education considered coincides with early childhood education or education received before entering primary school.

Variables used in the estimation of human capital such as age, educational attainment, labour force count, employment rates, mean annual basic salary and survival rates were obtained from the Labour Force Survey (LFS) issued by the National Statistics Office (NSO) or directly from the Eurostat database. The sample period chosen was the period from 2005 till 2013. The choice of this sample period was based on data availability and consistency in the methodology adopted by the NSO when compiling the LFS.

The mean annual basic salary used in this study is calculated before any social contributions or tax deductions. It also excludes payments on overtime, allowances and bonuses. This paper uses survey data obtained by a private Human Resources consulting firm[2] to top up the mean annual basic salary by a percentage amount so as to take account of any performance bonuses, allowances and commissions earned. For those having an education level of ISCED 0–2, the mean annual basic salary is topped up by 4%, for those having an education level of ISCED 3–4 by 7% and finally, for those having an educational level of ISCED 5–6, it has been topped up by 12%.

For the variable of educational level, the ISCED was employed to facilitate international comparison. This paper defines educational attainment levels as per ISCED 1997, the second version of ISCED. The new version of ISCED was adopted by NSO in 2014. The 65+ age group refers to the working-age population aged 65 years and over, thus there is no limit on this age cohort. However, given that the data is related to employment, it is assumed that the majority of this age group is 74 years or less. The data on survival rates were obtained from the 'Life Table' published by Eurostat. While education tends to increase survival rates, no such data exists for Malta. The survival rates were assumed not to vary across education levels but to depend on age only.

To derive a measure of the effective human capital of Malta, this paper focuses on labour market activities with earnings potential for the working-age population. This paper truncates the age from the upper bound at an age limit that is defined as 65, by assuming that the mean annual basic salary of those aged over 65 years old amounts to zero. In doing so, two main assumptions were made:

- the official retirement age of 65 years old applicable to those born after 1st January 1962 was assumed for all the labour force population and;
- those aged over 65 years old do not pursue employment after retirement.

These assumptions, although necessary, inevitably lead to an under-estimation of the human capital value.

The constructed cross-sectional data set forms the basis of the estimation of market lifetime labour income for all individuals aged 15 years and over. For individuals having the same level of educational attainment, the expected future income of an individual is assumed to be equal to the income of those having an age which the individual will have in the future time period. This income is then adjusted for increases in real income. The lifetime incomes are therefore computed by a backward recursion, starting from the last age cohort of 65+.

Alternatively, this means that the expected lifetime income of a particular individual of age a is their current labour income plus their expected lifetime income at age $a + 1$ multiplied by survival rates and adjusted

[1] School Enrolment rates for different cohorts of age, sex and educational level have been made available on Eurostat for the years starting from 2013.

[2] The Misco Salaries and Benefits Report 2014–2015.

for increases in real income. The following equation is used for estimating average human capital per capita for a cohort of individuals with age a and educational attainment e,

$$h_{e,a} = w_a^e y_a^e + sr_{a,a+1} h_{e,a+1} \frac{(1+r)}{(1+\delta)}, \tag{2}$$

where e is the educational attainment levels, a is the age, $h_{e,a}$ represents the average human capital for individuals with age a and educational level e, $w_{e,a}$ is the probability of engaging in paid employment for individuals with age a and educational level e, defined as the employment rate for that cohort, $y_{e,a}$ is the annual labour compensation of paid workers with age a and education level e, $sr_{a,a+1}$ is the probability of surviving one more year from age a, r is the growth rate of real income (labour productivity growth rate) and δ is the social discount rate.

Eq. (2) is applied to each cohort of individuals for each period analysed – assuming that each individual progresses through time using the relative incomes of the succeeding cohorts. The relevant survival rates and employment rate for the period concerned are assumed. Future incomes are augmented with a projected labour income growth rate and discounted to the present with a constant discount rate. The real income growth rate r is assumed to be equal to labour productivity growth in the Maltese business sector, standing at 0.5% per annum. The discount rate employed in the economic analysis of investment projects to discount economic costs and benefits is the Social Discount Rate (SDR). Here it is assumed to be equal to 5% in line with the European Commission's Guidance for Cost-Benefit Analysis for investment projects (2014).

In this approach, the lifetime labour income of any individual is equal to his/her current income plus his/her expected lifetime income. Therefore, for an individual who is aged 64 years old (i.e. one year before the assumed retirement age), this is simply his/her current labour income because their expected lifetime income at 65 is assumed to be zero. Similarly, the lifetime labour income of a person aged 63 years old is equal to his/her labour income plus the present value of the lifetime labour income of a person aged 64. This is worked out for each age by backward recursion.

The annual basic salary was assumed to be constant for all ages pertaining to a particular cohort. Since the analysis is conducted in age groups, the proportion of each single age from the total age cohorts presented in this study was found by using data from Census 2005 and Census 2011.

The total stock of human capital is the sum of lifetime labour incomes across all classified categories of age and education and is given by

$$HC = \sum_a \sum_e LLI_a^e N_a^e, \tag{3}$$

where HC is the monetary value of the stock of aggregate human capital, LLI_a^e is the average lifetime labour income per capita for individuals with age a and education level e and N_a^e is the number of individuals in the labour force with age a and education level e.

After establishing the level of aggregate human capital, this study sought to determine the value of the real human capital. This facilitates comparison across countries and provides a better view of the improvement in skills and talents embodied in individuals. One common approach to deducing the human capital in real terms found in the human capital literature is the Divisia quantity indices. The Divisia Index is a continuous time index which is widely used in productivity analysis. The index is used to retrieve the real changes in human capital, using the number of individuals in the labour force. These were constructed to measure the growth rate of the volume index of aggregate human capital stock. This is essentially a weighted sum of the growth rates of the number of individuals across different educational and age categories, using their share of the nominal value of human capital as weights,

$$d \ln H = \sum_a \sum_e \bar{v}_{a,e} \, d \ln L_{a,e}, \tag{4}$$

where H represents the volume indices of aggregate human capital stock, $L_{a,e}$ is the number of individuals in the labour force with age a and education level e and d is the first difference, or the change between two consecutive periods, for instance,

$$d \ln H = \ln H(t) - \ln H(t-1). \tag{5}$$

The weights v are given by the average share of nominal human capital of the cohort concerned as a proportion of the aggregate human capital stock

$$\begin{aligned} \bar{v}_{a,e} &= \frac{1}{2} \left[v_{a,e}(t) + v_{a,e}(t-1) \right], \\ v_{a,e} &= \frac{h_{a,e} L_{a,e}}{\sum_a \sum_e h_{a,e} L_{a,e}}, \end{aligned} \tag{6}$$

where $h_{a,e}$ represents the lifetime labour income of the individuals with age a and education level e.

'Ceteris paribus', the Divisia index increases if there is either an increase in the population or an increase in the proportion of those having higher remaining lifetime earnings. The difference between the growth of weighted population counts as estimated by the Divisia index and the growth of unweighted population counts, that is, the

growth in the labour force measures the real growth of human capital per capita. Changes in human capital per capita may be mainly attributed to demographic changes in the population such as ageing compositional effects and higher education levels. 'Ceteris paribus', the higher the proportion of younger and more educated individuals, the higher the expected lifetime income and thus human capital. Aggregate human capital per capita can be defined as

$$h = H/L, \tag{7}$$

where L is the number of individuals in the labour force.

The rates by which the volume of human capital stock increases represents the real increase in human capital. When subtracting these rates from the annual growth rates of nominal aggregate human capital stock, the human capital deflator is determined. In turn, this is used to establish the real aggregate human capital stock.

4 Results and Comparative Analysis

4.1 Nominal Human Capital in Malta

The nominal value of the aggregate human capital stock in Malta represents a measure of the capital contributed by the Maltese labour force population through their education, skills and experience. Table 1 presents the resulting values of nominal human capital stock for the period 2005 to 2013.

The nominal aggregate human capital stock amounted to approximately €20 billion in 2005, increasing to roughly €33 billion in 2013. This implies that over the 8-year period 2005 to 2013, Malta's aggregate human capital increased by approximately 70% or an average compound growth rate of 7% per annum. This annual growth rate is quite significant. However, one must note that the dynamics of human capital stock are being analysed in the short-run. Nevertheless, this indicates that the level of nominal human capital in Malta has been improving over the past few years. In theory, this may be attributed to two main reasons:

- increase in labour force as more people join the labour market and;
- increase in earnings.

The earnings which are assumed to reflect the marginal productivity of the individual can increase either because the marginal productivity has increased (real increase in human capital) or else because the wages have increased (nominal increase in human capital).

Table 2 displays the results for average lifetime labour income or human capital per capita[3] by types of individuals in the labour force population.

The results for the selected years 2005, 2009 and 2013 are presented[4]. The first row of Table 2 reports the average lifetime income for all individuals in the labour force, irrespective of their characteristics. The results reveal that human capital per capita increased from €122,366 in 2005 to €177,888 in 2013, that is, an average increase of 5% per annum.

Fig. 1 illustrates the average lifetime labour income per capita for different educational attainment categories. 'A priori', one would expect that the human capital per capita would be larger for those having a higher educational attainment. In fact, as is apparent in Fig. 1, those having an educational attainment level of ISCED 5–6 have a higher average human capital per capita than those possessing an educational level of ISCED 3–4. Similarly, the latter has a higher average human capital per capita than individuals with an ISCED 0–2 educational level. This is attributed to differences in lifetime incomes.

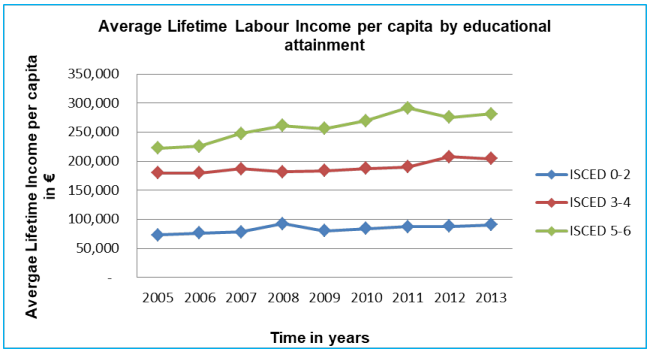


Figure 1: Average Lifetime Labour Income per capita by educational attainment. *Source: Authors' estimates.*

4.2 Cross-Country Comparison of Educational Attainment and Human Capital Stock

A cross-country analysis of the relationship between the educational level and lifetime labour incomes further confirms this positive relationship. One of the most ambitious recent projects in this field of research is the Human Capital Project of the OECD (Liu, 2011). This project covers sixteen countries: Australia, Canada, Denmark, France, Israel, Italy, Japan, the Republic of Korea, Netherlands, New Zealand, Norway, Poland, Romania, Spain, the United Kingdom, and the United States. It measures the stock of human capital over time between 1997 and 2007, with the years covered differing from country to country depending on data availability.

The OECD uses the lifetime income approach of Jorgenson and Fraumeni (1989, 1992b, 1992a), thus making comparison to the estimates of human capital in Malta derived by this paper easier. While the original

[3]The terms 'average lifetime labour income per capita' and 'average human capital per capita' are used interchangeably.

[4]Refer to Appendix A for the human capital per capita results for each year in the period 2005 to 2013.

Table 1: Human Capital Stock, Growth rate and Index.

Years	Nominal Aggregate Human Capital Stock €	Growth Rate of Human Capital Stock	Index of Human Capital
2005	19,628,684,007	-	100.00
2006	20,410,997,016	4%	103.99
2007	22,304,727,892	9%	113.63
2008	23,367,067,182	5%	119.05
2009	24,230,749,722	4%	123.45
2010	26,247,338,866	8%	133.72
2011	28,613,341,867	9%	145.77
2012	31,239,711,317	9%	159.15
2013	33,427,757,739	7%	170.30

Source: Authors' estimates

Table 2: Average Lifetime Labour Income per capita.

	2005	2009	2013
	€	€	€
All individuals	122,366	141,523	177,888
Educational Attainment			
ISCED 0–2	73,500	80,572	90,861
ISCED 3–4	179,633	184,048	204,596
ISCED 5–6	222,728	256,459	281,677
Age Group			
15–24	166,180	194,680	237,314
25–49	136,633	162,409	211,614
50–64	42,127	43,831	57,177

Source: Authors' estimates.

Table 3: Comparing approaches adopted by this paper and the OECD Project.

Estimates for Malta's Human Capital	OECD Project
Similarities	
Both studies use the lifetime income approach of Jorgenson and Fraumeni (1989, 1992b, 1992a).	
Both studies focus on the effective human capital and take the population aged from 15 to 64 years old.	
The treatment of education in both studies follows the 1997 International Standard Classification of Education (ISCED 97).	
Differences	
Period studied: 2005 to 2013	Period studied: 1997 to 2007
Does not consider the possibility for an individual to pursue studies at a higher educational level due to data limitations. This possibly leads to an underestimation of human capital.	Considers the possibility for an individual to pursue studies at a higher educational level. The human capital estimate for the age cohort 15–40 years old includes the school enrolment rates in its computation.
Annual social discount rate of 5%	Discount rate of 4.58% for all countries
Real income growth rate of 0.5%	Real income growth rate of 1.30%

Jorgenson-Fraumeni papers measured a version of the human capital stock that included all persons, including children, both this paper and the OECD project focus specifically on human capital embodied in persons of working age, defined as persons aged 15 to 64. This represents the "effective" or "active" human capital. Table 3 shows the similarities and differences between this paper and the OECD project.

An analysis of the educational distribution across a number of countries is presented in Fig. 2. The data for Malta was derived from the NSO whereas that for other countries was taken from the OECD study.

In 2006, Malta had one of the lowest shares of labour force population having an educational attainment level of ISCED 5–6 (16%). The share of the labour force having an educational attainment level of ISCED 5–6 was even lower in Romania, Italy and Poland. This situation improved so that in 2013, Malta had approximately 24% of the labour force population with an ISCED level of 5 to 6 and around 30% with an ISCED level of 3 to 4. This was principally attained through the implementation of measures targeting the early school leavers which dropped from around 32.2% in 2006 to 20.5% in 2013.

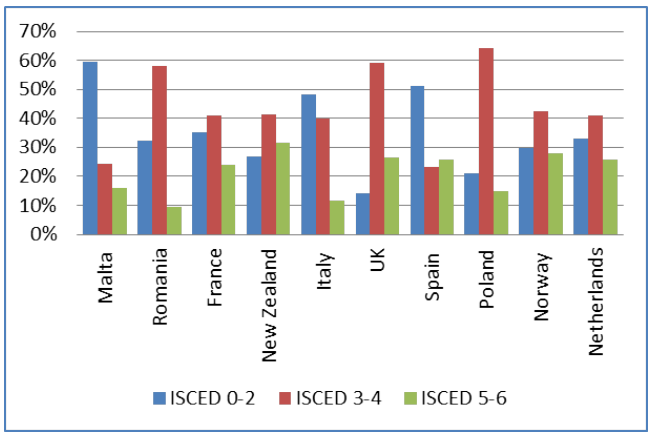


Figure 2: Distribution of educational qualifications in the labour force population in 2006. *Source: Authors' estimates based on OECD Data.*

Such measures included the significant investment in vocational training institutions.

Given that the education level of an individual represents or signals higher productivity, a positive relationship exists between the level of education and annual income. Alternatively, those possessing a higher educational level, generally have higher annual incomes than their counterparts with a lower educational level. Fig. 3 shows the annual incomes of a number of countries, including Malta, in 2006. Romania, Poland and Malta feature as the countries with the lowest annual earnings across all ISCED levels studied whereas New Zealand, Norway and France were the countries with the highest annual earnings for ISCED 0–2, ISCED 3–4 and ISCED 5–6 respectively, relative to the countries presented in Fig. 3.

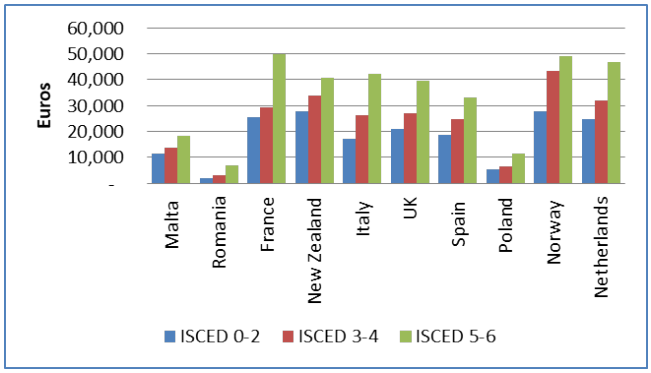


Figure 3: Annual income by the educational attainment level in 2006. *Source: OECD Data.*

This is also reflected when looking at the lifetime labour incomes of individuals having different educational attainment levels. As shown in Fig. 4, the lifetime incomes increase with higher educational attainment levels. Romania, Poland and Malta had the lowest lifetime income in 2006 for each educational attainment level considered in Fig. 4.

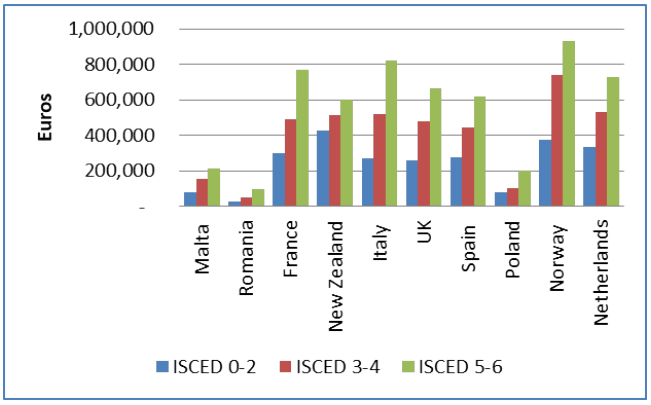
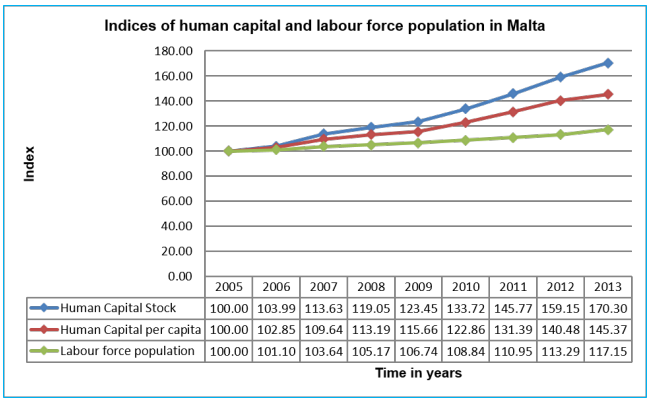


Figure 4: Lifetime incomes by educational attainment level in 2006. *Source: OECD Data.*

The countries recording the highest lifetime income vary across different educational attainment levels whereby New Zealand registered the highest lifetime income for the ISCED 0–2 cohort and Norway recorded the highest lifetime income for the ISCED 3–4 and ISCED 5–6 cohorts. Other countries with relatively higher lifetime incomes were Italy, the Netherlands and France.

4.3 Real Human Capital Stock in Malta

The indices of human capital stock, human capital per capita and labour force population were plotted so as to analyse the factors that contribute to the growth rate in nominal aggregate human capital stock for Malta.



	2005	2006	2007	2008	2009	2010	2011	2012	2013
Human Capital Stock	100.00	103.99	113.63	119.05	123.45	133.72	145.77	159.15	170.30
Human Capital per capita	100.00	102.85	109.64	113.19	115.66	122.86	131.39	140.48	145.37
Labour force population	100.00	101.10	103.64	105.17	106.74	108.84	110.95	113.29	117.15

Figure 5: Indices of human capital and labour force population in Malta. *Source: Authors' estimates.*

As described earlier, aggregate human capital rose at an average compound growth rate of around 7% per annum over the period 2005 to 2013. This represents the estimated nominal annual growth of Malta's human

capital stock. Fig. 5 shows that the growth rate of human capital stock can be explained by the growth in human capital per capita and the growth in the labour force population. From the indices shown in Table 4, it can be established that the average annual growth in the labour force is 2% while the average annual growth rate in nominal human capital per capita is 5%. This implies that the 7% average annual growth rate in nominal aggregate human capital stock is attributed to the growth in the labour force and to the growth in average lifetime income per capita. The latter reflects changes in an individual's productive potential, given one's age and educational level. However, this is not adjusted for changes in relative lifetime incomes[5].

The real movements in the composition of the population are analysed using the Divisia quantity indices. The Divisia quantity indices, worked out using Eq. (4) explain the change in the volume of Malta's human capital stock. This can be described as the real change in human capital and is presented in Table 4.

The figures in Table 4 represent the change in the volume of human capital for all the age-education categories analysed. The total percentage figure in the last row is the change in the volume of the aggregate human capital stock. Following the methodology outlined in Gu and Wong (2010), this represents the weighted sum of the growth rates of the number of individuals across different categories of the population (age and education) using their share of the nominal value of human capital stock as weights. Thus, different from the indices analysis conducted in Fig. 5, the labour force population change is weighted by each cohort's share of human capital from the aggregate human capital stock. Table 4 reports that the estimated annual average growth rate of the volume index of the human capital is approximately equal to 3%. This can be interpreted as the real change in aggregate human capital stock since this measure abstracts from changing prices – that is, changing relative lifetime earnings across individuals. If the growth of unweighted population, that is, the growth rate of the labour force which was equal to an average of 2% per annum, is subtracted from the growth rate of weighted population counts equal to 3%, the real growth of human capital per capita can be measured. In this case, the real growth of human capital per capita is equal to approximately 1%.

OECD (Liu, 2011) also estimated the volume growth of human capital for 12 countries for the period 1997 to 2007. This growth rate varied between 0.5% to 1.3% per annum for the countries analysed. Four countries, being Israel, Korea, Norway and the US, experienced a decrease in the human capital per capita. In four other countries (Australia, Canada, France and New Zealand), there was zero growth of human capital per capita. In three countries (Italy, Spain and the UK) it increased with 0.1% to 0.3% per year. Poland is an outlier with 0.9% increase in human capital per capita.

The findings for Malta reveal that the volume index of human capital increases throughout the whole period studied. For instance, in 2013, Table 4 reports that the volume index of human capital increased by 4.53%. This implies, either that the number of individuals in the labour force increased; or that the composition of the population moved towards those that have increasingly large remaining lifetime earnings.

The rates by which the volume of human capital stock increases represent the real increase in human capital which potentially leads to higher productivity and economic growth. By subtracting these real growth rates from the annual growth rates of the nominal aggregate human capital stock outlined in Table 1, we can deduce the human capital deflator and therefore the real aggregate human capital stock.

The second column of Table 5 below displays the nominal aggregate human capital while the third column includes the values of the deflator which reflects the growth in the prices of human capital, being the lifetime incomes. The reason for computing this deflator and not using the inflation rate for the whole economy is because the prices being examined are those of human capital, that is, the earnings of individuals. By dividing the nominal aggregate human capital stock by this deflator, the real amount of human capital stock was determined.

Whereas nominal aggregate human capital stock increased by around 70% over the 8-year period studied, the real aggregate human capital stock increased by 32%. This reflects the 3% average annual growth in the actual volume of human capital stock and the 4% average annual growth in the prices of human capital. Fig. 6 compares the nominal human capital stock and the real human capital stock. The base year is taken to be the first year under study, that is, 2005.

Fig. 6 reflects the fact that the largest increase in Malta's human capital stock can be attributed to a growth in prices rather than real increases in productivity and labour force population. In 2007, the difference between nominal and real values of the human capital stock increased by approximately 2.5 times from 2006. In 2008 and 2009, a lower growth in the price of human capital was registered. In fact, in 2009, the discrepancy between nominal and real values of the human capital stock increased by only 4% from the previous year. This may reflect the decline in wage growth that occurred in 2009. Wage growth fell to 3.8% from a peak of 4.7% in 2008 (Central Bank of Malta, 2010).

[5]It is expressed in nominal terms.

Table 4: Growth of Human Capital Divisia Indices.

Growth of Human Capital Divisia Indices								
	2006 %	**2007** %	**2008** %	**2009** %	**2010** %	**2011** %	**2012** %	**2013** %
ISCED 0–2								
15–24	0.1246	−0.7422	−0.3853	−0.7337	−0.6428	−0.1117	−0.1352	−0.2121
25–49	0.0855	0.4617	−0.0335	−1.2293	−0.596	−0.693	−0.6875	−0.0542
50–64	−0.0562	0.1643	0.1203	−0.1095	0.0754	0.0574	−0.0482	−0.0027
65+	-	-	-	-	-	-	-	-
ISCED 3–4								
15–24	−1.9073	1.2101	0.6193	0.2953	0.0915	−0.0514	−0.3532	1.0677
25–49	0.6851	0.0832	−0.0841	3.1059	0.7546	1.3018	1.3753	0.567
50–64	0.4854	−0.3107	0.1998	0.3733	0.3157	−0.1067	0.355	0.3145
65+	-	-	-	-	-	-	-	-
ISCED 5–6								
15–24	1.5876	0.5168	−1.3394	0.6031	0.7825	0.5249	−0.0025	0.0699
25–49	0.8147	2.6339	2.3226	1.3081	1.8005	3.2453	2.7339	2.6155
50–64	−0.0798	0.1316	0.0197	0.0345	0.2431	0.1167	0.2356	0.1605
65+	-	-	-	-	-	-	-	-
Total	**1.74**	**4.15**	**1.44**	**3.65**	**2.82**	**4.28**	**3.47**	**4.53**

Source: Authors' estimates

Table 5: Real Human Capital Stock.

Real Human capital stock (Base year = 2005)			
	Nominal Human Capital	**Deflator**	**Real Human Capital**
2005	19,628,684,007	1.00	19,628,684,007
2006	20,410,997,016	1.02	19,962,629,395
2007	22,304,727,892	1.07	20,772,667,048
2008	23,367,067,182	1.11	21,108,674,965
2009	24,230,749,722	1.11	21,879,287,874
2010	26,247,338,866	1.16	22,579,261,852
2011	28,613,341,867	1.21	23,652,024,766
2012	31,239,711,317	1.27	24,659,950,536
2013	33,427,757,739	1.29	25,880,916,025

Source: Authors' estimates

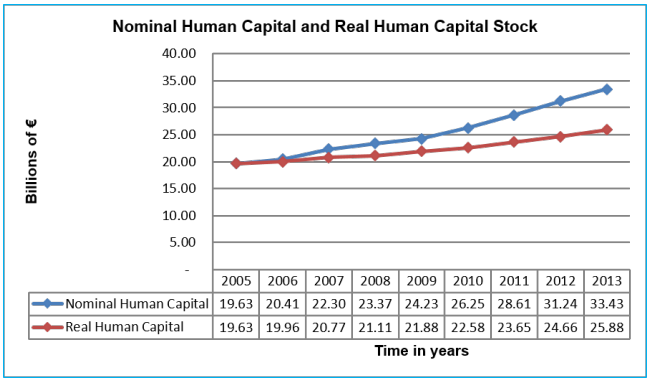


Figure 6: Nominal and Real Human Capital Stock. *Source: Authors' estimates.*

Fig. 7 illustrates the dynamics of real human capital per capita. From 2005 to 2013, real human capital per capita increased from €122,366 to €137,727, that is, by 13%. On average, the lifetime income per capita for all individuals increased by 1% per annum. This growth rate reflects compositional shifts in the populations. Ageing is expected to have a negative impact on the growth of human capital because older people are expected to have less remaining years of work and thus lower remaining lifetime earnings. Conversely, rising education levels improve Malta's human capital base.

4.4 Human Capital relative to Physical Capital and GDP

In order to put the value of nominal human capital stock into perspective, this paper compares the value of human capital with the value of physical capital and the value of GDP.

Figure 8 plots the nominal values of the estimated aggregate human capital stock and aggregate physical

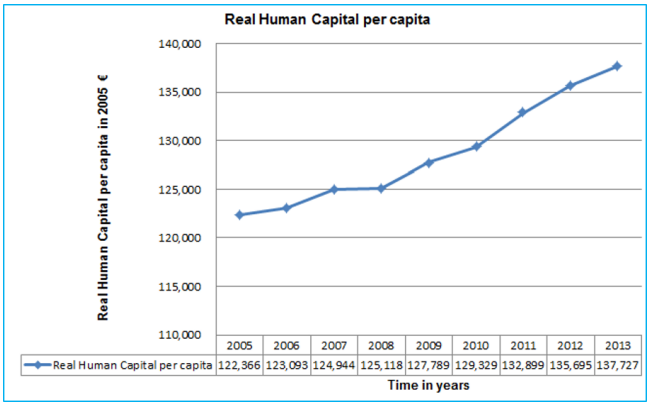


Figure 7: Real Human Capital per capita. *Source: Authors' estimates.*

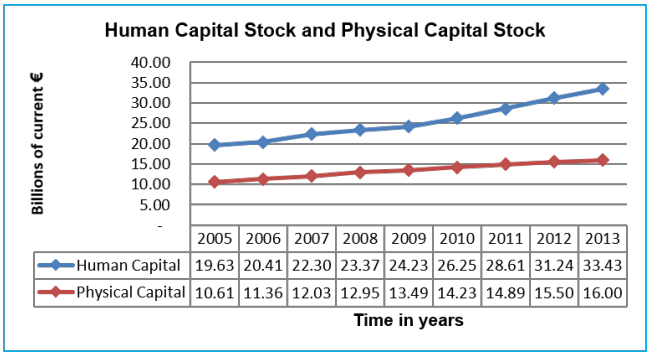


Figure 8: Human Capital Stock and Physical Capital Stock in nominal terms. *Source: Authors' estimates.*

capital stock for Malta. The human capital stock was approximately twice the value of the physical capital stock for the whole period 2005 to 2013. The ratio of human capital stock to physical capital stock ranged from 1.80 registered in 2006, 2008 and 2009 to 2.09, which was registered in 2013.

A comparison of the human capital stock to physical capital stock ratio across a number of countries shows that this ratio is relatively low for Malta. The OECD Human Capital study presents the ratio of human capital to physical capital and GDP for a number of countries in 2006. The data shows that ratios between human and physical capital range between 3.6 in the Netherlands and Italy and 7.0 in the United Kingdom, with a mean value of 4.7. The ratios of human capital to GDP range between 8.3 in the Netherlands and 16.3 in Korea, with an average value of around 10.6[6].

Fig. 9 illustrates the ratio of Malta's estimated aggregate human capital stock to the country's GDP.

The highest human capital stock to GDP ratio was

[6]Measuring the Stock of Human Capital for Comparative Analysis: An Application of the Lifetime Income Approach to Selected Countries, OECD Statistics Directorate, Working Paper no. 41, page 29.

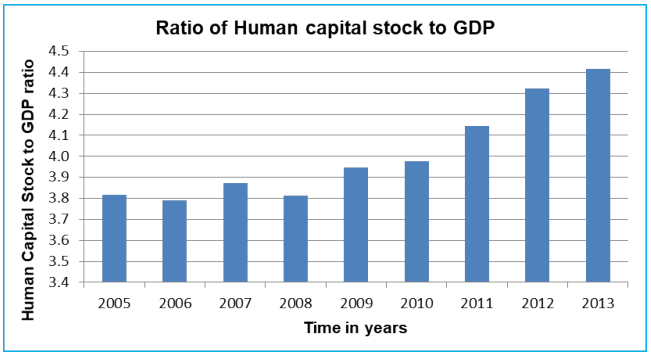


Figure 9: Ratio of Human capital stock to nominal Gross Domestic Product (GDP). *Source: Authors' estimates.*

recorded in 2013 with a value of 4.42 while the lowest ratio (equal to 3.79) was registered in 2006. This may be because the human capital stock increased by 4% whilst nominal GDP registered a growth rate of 5%. Thus the ratio of human capital to GDP declined marginally from 2005 to 2006. Thus this ratio is also relatively lower compared to countries considered in the OECD study.

4.5 Sensitivity Analysis

The estimates of human capital depend on the expected future real income growth and the discount rate used to discount future income. In this paper, the future real income growth rate was assumed to be equal to average labour productivity growth in Malta and was taken as 0.5% per annum. The discount rate was assumed to be equal to 5% in line with the European Commission's Guidance for Cost-Benefit Analysis for investment projects (2014).

This paper examines the sensitivity of estimates for human capital stock and investment to alternative assumptions about the real income growth and the real discount rate, with the results presented in Table 6.

Table 6 reports the sensitivity of an aggregate human capital stock to changes in the real income growth rate and the real discount rate. The first row presents the baseline scenario with the initial assumptions of a 0.5% real income growth rate and a 5% real discount rate. The second row makes alternative assumptions on the real income growth rate while keeping the discount rate at 5%. Two real income growth rates are assumed: 0% and 1.05%. Finally, the third row from the bottom keeps the real income growth rate constant at 0.5% and assumes two real discount rates different from the base scenario. The rates assumed are 4% and 6%. Thus, an increase and a fall of 1% in each rate were assumed, except for the real income growth fall which was assumed not to fall below 0%.

The first column reports changes in the human capital stock for the selected year 2013, to the different assumptions made. First, the level of human capital

Table 6: Sensitivity analysis on aggregate human capital estimates.

Sensitivity Analysis on aggregate human capital estimates							
	Human Capital Stock at current prices			**Growth in quantity of human capital stock**		**Growth in price of human capital stock**	
	2013 Level	**Relative to baseline**	**%Δ**	**Annual Growth in 2013**	**Difference with baseline**	**Annual Growth in 2013**	**Difference with baseline**
	Billions of €	**Billions of €**	**%**	**Percent**	**Percent**	**Percent**	**Percent**
Baseline estimate with 0.5% real income growth and 5% real discount rate	33.43	...	...	4.53	...	2.48	
Changes in real income growth leaving the 5% discount rate constant							
0% real income growth	31.68	−1.75	−5	4.52	−0.0018	2.49	0.0096
1.05% real income growth	35.54	2.11	6	4.53	0.0022	2.47	−0.011
Changes in real discount rate leaving the 0.5% real income growth unchanged							
4% real discount rate	37.29	3.86	12	4.53	0.0042	2.46	−0.0197
6% real discount rate	30.23	−3.2	−10	4.52	−0.0032	2.50	0.0179

Source: Authors' estimates

stock under the new assumptions are reported. The change in human capital stock from its value under the baseline scenario is then analysed in absolute and percentage terms. The growth in the volume of human capital and the growth in the price of human capital are examined in the second and third columns respectively. For each of these growth rates, the new annual growth rate and its percentage change from the baseline scenario is presented.

From Table 6, it is apparent that changes in the expected future income growth and the discount rate have only a marginal effect on the growth rate of the quantity and price of human capital. Conversely, the findings indicate that changes in the human capital stock to changes in the real income growth rate or discount rate appear to be quite significant. Eq. (2), which was employed to estimate lifetime income, indicates that an increase in real income growth has the same impact as a decline in the discount rate. In fact, the aggregate human capital stock increases by 6% when the real income growth increases to 1.05% and by 12% when the discount rate falls by one-percentage point to 4%. Conversely, when the real income growth falls and the discount rate increases, the aggregate human capital is expected to fall. The results in Table 6 show that when the real income growth falls to 0%, the human capital stock falls by 5% whilst when the discount rate increases to 6%, the human capital stock declines by 10%.

5 Conclusion

The main aim of this paper was to produce an estimate for human capital stock for Malta over the period 2005 to 2013 and to compare Malta's performance with that of other countries. The objectives of this research were to answer the following two main questions:

i. how can one give a value to the amount of capital embodied in humans and;
ii. what were the human capital dynamics in Malta over the years, particularly when compared with other countries.

This research was primarily motivated by the fact that human resources are Malta's major resource, in the absence of any natural endowments. The conclusions of

this study suggests that:

First, the three main approaches for estimating human capital are the education-based approach, the cost-based approach and the income-based approach. This paper concluded that while the first two approaches use indicators which may be suitable for other purposes, the lifetime income approach could provide a more reliable monetary metric.

Second, the human capital stock of Malta grew by 70% in nominal terms from 2005 to 2013. The nominal average annual growth rate was approximately equal to 7%. The real human capital stock grew by 32% over the same period and was approximately equal to €25.88 billion in 2013. The real average growth rate was around 3% per annum. This real change in human capital was attributed to a 2% increase in the labour force population and a 1% increase in real lifetime income per capita. The latter represents compositional shifts in the education and age profiles of the population. Shifts in the population towards younger and better-educated individuals are expected to have a positive impact on real human capital per capita, and thus real human capital stock.

Third, the human capital stock was estimated to be on average twice the value of physical capital stock and four times the value of Malta's GDP.

Fourth, the level of the human capital stock estimates was sensitive to the choice of the expected future income growth and the rate used to discount the future income, but the growth of the quantity and price of human capital stock was much less sensitive to these choices.

The increase in human capital stock registered over the period studied was not always reflected in higher labour productivity. Conversely, labour productivity dropped year on year from 2011 to 2013, falling to a level below that of the average Euro Area. This may be attributed to the relatively high Early School Leaving (ESL) rate registered in Malta. NSO defines early school leaving (ESL) as those students between the ages of 18 and 24 who have left compulsory schooling and who have not obtained at least 5 Secondary Education Certificate (SEC) passes grade 1 to grade 7 and who are not in education or training. This represents lost potential and more likely than not, a lower human capital base for Malta.

As depicted in Fig. 1, those individuals with a higher educational level had larger average lifetime incomes. This is because they are expected to be more productive (as measured by earnings). Moreover, the difference in average lifetime incomes between the lowest educational level ISCED 0–2 and ISCED 3–4 was higher than that between ISCED 3–4 and ISCED 5–6. This might indicate that investing in those individuals with relatively lower levels of education may be more beneficial since the added productivity is expected to be higher. To put things into perspective, Malta's ESL rate in 2013 was equal to 20.5%. Notwithstanding the fact that from 25.7% in 2009, Malta's ESL rate went down by 5.2% in four years; in 2013 it was still classified as the second highest in the EU. The EU average stood at 11.9% in the same year.

The relatively high ESL rate for Malta is one of the main areas which should be given priority because these individuals would still be at a very early stage of their career path. Their remaining years of work and thus their productive potential is expected to be higher. With respect to the performance of Maltese students, according to the Programme for International Student Assessment (PISA) of 2009[7], Malta ranked 45th position among 74 countries in reading literacy, 40^{th} position in mathematics literacy and 41st position in science literacy. Malta's performance in these three key subjects was significantly lower than both the OECD and EU average.

The structure of the education system is an important determinant of the educational achievements of the country. The heterogeneity that exists between educational systems may somewhat hinder cross-country comparison. Some of the variances in educational systems across different countries include the school days, areas of focus, the number of mandated standardised exams and age at which students are placed at designated academic or vocational paths.

Another factor impacting on the growth of human capital is the female participation rate. Although significant progress has been made, the EU noted that Malta still has the highest gender employment gap in the EU. In fact, the female participation rate in the Maltese labour market was one of the key challenges listed by the European Union (EU) in Malta's Country-Specific Recommendations for 2013. Those women that choose to stop working represent lost human capital. Female participation is significantly affected by the flexibility of working-time arrangements, taxation, longer maternity leave and family support measures such as child care centres.

This analysis has shown that despite the significant improvement in human capital in Malta, there are still further avenues for improvement, particularly with respect to the percentage of youths who opt to leave school without having the necessary qualifications to be in demand within the labour market. This accentuates the need for more policy measures targeted at this social group.

[7]Malta, together with nine additional partner participants, was unable to participate within the PISA 2009 project timeframe. However, it participated in the PISA 2009+ project. Malta, together with the other nine participants administered the same assessments as their PISA 2009 counterparts, but in 2010.

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