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# Wage Income Distribution and Mobility in Malta

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# Abstract

This paper uses information from a detailed administrative database on reported full-time employment incomes to study the distribution of wage incomes and mobility between 2000 and 2015 in Malta. Developments in wage distributions and mobility are discussed within the context of the structural changes that took place in the Maltese economy over the last decade. The main finding is that while inequality in Malta remains subdued by international standards, there has been an increase in recent years as low wages have remained stable in real terms, while those in the middle and at the top of the distribution have seen significant rises. Due to the rising demand for certain types of skills, wage mobility appears to have declined, particularly for older workers. This points to an importance of increased investment in education and retraining.



**Keywords:** Income distribution, mobility, administrative data, Malta

**JEL Codes:** D31, D63, J31, J62, J69

# Executive Summary

Despite the vast interest in inequality in recent years, there appears to be a gap in the literature concerning income distribution and economic mobility in Malta. This paper aims to fill this gap. The analysis is based on a micro database from the Inland Revenue Department covering employment incomes in the period 1998-2015. The distinct advantage of using this database is its completeness: all reported wage incomes from the entire population for this period are included. Since this database was not collected for research purposes, an extensive cleaning process was conducted to obtain a database that contains only incomes for full-time employment over the course of a whole year.

The database has a number of limitations that have to be borne in mind when interpreting the results. Limitations arise from the fact that only individual-level wage income can be analysed, as there is no information about links between members from the same households. Therefore, correct tax rates and transfers could not be calculated. Since the economic situation of individuals is determined by disposable household incomes, the analyses in this study do not treat inequality per se but rather the distribution of individual wage incomes. Data on individual incomes from full-time employment is not adequate to analyse poverty either, as the notion of poverty refers to living conditions and usually arises from a lack of work, i.e. unemployment (Darmanin, 2018). Moreover, this data set pertains to only working individuals, and therefore cannot be used to comment on the income situation of non-working individuals, particularly pensioners.

The analysis suggests that the wage income distribution has widened throughout the whole period, leading to increasing income inequality in all measures considered (the variance of log wages, the Gini coefficient and the Palma ratio). Despite these developments, incomes inequality is still relatively low by international standards and the income distribution is characterised by a strong middle class, which has seen substantial real income increases throughout recent years. Adjusting for inflation, the income of the lowest decile has stagnated over the last fifteen years. This does not necessarily mean that those who were in this specific bracket did not receive pay raises, as individuals are able to move within the distribution. However, it points to a general development, where those on the lowest wage bracket have benefitted much less from economic growth compared to those on higher income deciles.

The widening of the wage income distribution is mostly due to developments in the private sector. Wages are more equally distributed in the public sector, perhaps due to its established salary structure and the prevalence of collective bargaining. However, some widening of the distribution has also been observed in the public sector in recent years. This might be a reaction to the rising wages for highly skilled individuals in the private sector, which both sectors are competing for.

The availability of micro data allows for the computation of statistics that describe the probability that an individual moves upwards or downwards in the income brackets over the course of his career. The transition matrices of mobility show that individuals are more likely to move up in the distribution than down. This points to returns on experience and opportunities due to the dynamics of a fast-growing economy. Furthermore, individual mobility decreases over time, suggesting that the biggest changes to one's income happen in the early period of the career. This is in line with the higher values for mobility amongst younger individuals, who also change their jobs more often. It appears that the economic boom and the structural changes to the economy have improved income mobility, but larger income changes are necessary for an individual to move into a different quintile because the income distribution has been stretched out. The 20-34 age bracket is the most mobile, while the private sector is more mobile than the public sector.

Long-run wage mobility is low in Malta compared to other countries. Those starting at low-to-medium incomes (median or below) have limited chances to move upwards in the distribution, even in a 15-year time frame. Those starting at higher incomes on the other hand experienced large increases in relative incomes, further distancing themselves from the middle of the distribution. The probability to fall to low relative incomes has been small, allowing little exchange between high-income and low-income wage earners over time.

The share of individuals working for wages below the low-wage threshold of two-thirds of the median wage has been on an increasing trend. This is a natural development of the widened income distribution, where higher wages have increased more than lower ones. Individuals from the 20-34 age bracket, are the most likely to earn low wages, but the trend has been flat in recent years. Those in the 50-65 years age bracket have experienced a rapidly increasing probability to work for low wages. This is related to the educational outcomes of each generation, where the levels improve continuously through the generations. As the economy is now based more on sectors that require a well-educated workforce, younger employees have an advantage over their older peers. In terms of firm sizes, smaller companies employ a greater share of their employees at low wages compared to larger firms. The share of individuals below the low wage threshold is thus the most pronounced in micro companies (i.e. those employing less than ten employees). New entrants to the labour market have a higher probability to work for low wages than the rest of the labour force. This is in line with the observations on different age groups and can be explained by the lack of experience. However, due to the high level of education amongst younger generations, the probability has decreased for this group.

Since growth in wages for those in the middle of the distribution has exceeded that for those at the bottom, the ability of low-wage earners to raise their incomes above the threshold is falling. This finding is less true for younger individuals on low wages, as rising experience helps them achieve faster wage growth. Public sector employees, even though their general wage mobility is lower, also have

higher probabilities to receive pay raises sufficient to lift them above the threshold, while larger companies also provide better wage growth opportunities than smaller ones for those on low wages.

The key policy conclusion is that in future years it will be increasingly important to boost the skills of those on low wages. The evidence suggests that experience and improved skills can boost wage income prospects significantly and could result in some convergence of employment incomes. Boosting skills of younger individuals remains important. However, in view of the ageing workforce, it is becoming ever more critical to develop strategies to upskill older workers, as otherwise ageing could result in increasing inequality.

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# 1. Introduction

Incomes at the top and the bottom of the distribution have diverged in most parts of the world since the 1970's, especially in developed countries and those that are economically catching up (e.g. Piketty, 2014; Dabla-Norris et al., 2015; OECD, 2011; OECD, 2015; Keeley, 2015; Li and Sicular, 2014).[2] This has led to an increase in both public and academic interest in the topic. Increased data volume and quality, advances in econometric methods and improved computer processing power have enabled a rapidly expanding research output. Inequality is not a niche topic anymore, manifested by the widespread interest in Piketty's book "*Capital in the 21st Century*" (2013). Economists researching inequality now enjoy vast exposure even in mainstream media (e.g. Alvaredo et al., 2017) and journals that are not primarily concerned with economic issues (e.g. Piketty and Saez, 2014).

The distribution of incomes and mobility are multi-disciplinary subjects, with economic, sociological and political implications. In economics, the distribution of an economy's output has been a central topic at least since Adam Smith's *Wealth of Nations* (1776), where he argues that malfunctions of the economy create high inequality, as competitive markets should prevent persistently high profit rates (Boucoyannis, 2013). Due to data and computing power requirements, comprehensive empirical research became possible only after WWII. Increasing output of empirical literature on inequality sparked attempts of theoretical explanations of the observed trends (Sahota, 1978). However, as the focus of economic research shifted to other topics, often using representative agent models, distributional aspects were largely ignored and their relevance was at times forgotten. The financial crisis of 2008 laid bare the shortcomings of this approach, as some economists identified inequality as one of the factors leading towards the crisis (e.g. Rajan, 2010; Kumhof and Rancière, 2010). Hence, distributional questions have once again received increased attention of the economics profession since.

Inequality analyses typically offer only static evaluations of income distributions, "snapshots" at a particular point in time (Fields and Ok, 1999). However, mobility – the ability of individuals to move within the income distribution – is as relevant as inequality. As individuals from the bottom of the distribution move to the top and vice versa, long-term inequality is reduced. The value of mobility to society goes beyond the mere reduction of lifetime inequality though. In a highly mobile economic system, it is more likely that those with higher productivity end on top of the income distribution. Mobility thus creates and maintains a meritocratic system, which is more likely to be perceived as "fair" and gains higher public acceptance. Moreover, having the most productive individuals in the highest paid positions ensures efficiency of the economy (Atkinson, 1983). There are also negative aspects of mobility though, e.g. uncertainty due to short-term volatility of incomes. However, these are not assessed in this paper.

[2] Latin America has been an exception to this trend, but the region remains one of the most unequal even after declining inequality in the last decade (Tsounta and Osueke, 2014).

The economic literature on income distribution and income mobility is relatively scarce in Malta. This is especially unfortunate in the light of recent structural changes to the Maltese economy, as the effects of these changes of income distributions would be valuable information for policymakers. Analyses of two waves of the Household Finance and Consumption Survey (Caruana and Pace, 2013; Gaskin, Attard, and Caruana, 2017), conducted in 2010 and 2013 respectively, have been published as of time of writing. However, survey data carries the risk of bias due to misreporting, selection bias and underrepresentation of high-income households (e.g. Morgan and Sonquist, 1963; Bricker et al., 2016, Koijen et al., 2015). Migrants are often under-represented in these surveys, an issue which is particularly relevant to Malta, given the sharp increase in foreign workers in recent years (Grech, 2017). Furthermore, two waves of this survey, conducted only three years apart, do not offer any insight into medium to long-term developments of income distributions and mobility.

This paper tries to fill this gap by using an administrative data set from the Inland Revenue Department covering all reported gross individual wage incomes from 1998 to 2015. It differs from the HFCS and SILC analyses in the important aspects that there is no information on household formation and disposable income. Moreover, it does not cover other sources of income, such as benefits, and so does not shed any light on the income situation of non-working households, such as pensioners. Hence, this study is not intended to analyse overall inequality, but rather examine wage income distribution and mobility within the labour market, as well as how they have evolved over time. Theoretical questions about economically, socially, or morally optimal levels of inequality will not be addressed either.[3] The wealth of information contained in this database also allows for studying developments in low wages. Adopting the OECD definition, low wages are defined as those below two-thirds of the median income (e.g. OECD, 1996). Again, the lack of information on household formation and other sources of income mean that this analysis should not be taken to be an analysis of poverty trends.

The rest of the paper is organized as follows. Section two provides a non-exhaustive review of empirical literature on inequality and mobility. In section three, the data and the methodologies used to analyse wage income distributions and mobility in Malta for this paper are described. In section four, the main results of the distribution studies are presented, followed by section five, in which the results of the mobility studies are brought forward. In section six, low-wage employment is analysed. Finally, section seven concludes, discusses the policy implications that arise from an outlook into possible future developments, and points to remaining open questions that are left for further studies. Throughout the whole analysis, the reader will encounter many graphics, as visualisations are helpful

[3] A certain level of inequality is necessary to maintain the incentives system (Stiglitz, 2012; Dabla-Norris et al., 2015) and efficiency (Tinbergen, 1981) of a market-based economy, and psychological studies show that most people do not perceive total equality as a fair system (Starmans et al., 2017). As pointed out above, excessive inequality is potentially harmful for the economy, so an optimal level between "too high" and "too low" might exist, but is not the research aim of this paper.

to make the data more accessible and trends easier to understand. All graphs are based on the authors own calculations using the data described in section three.

# 2. Literature Review

## 2.1. Inequality

Even though interest in inequality has not always been as deep and widely spread as nowadays, the distribution of the economy's output has long been a topic of interest for economists. However, empirical analyses were not feasible before the two world wars, due to lack of data and the ability to process them. Simon Kuznets was one of the first to publish systematic analyses of wealth inequality (1953) and pre-tax, individual-level income distributions (1955), using data from the US, the UK, and Germany. He found that after an increase in income inequality prior to the two world wars, it decreased. Thus, inequality followed an inverted U-shaped curve during that particular period. This "Kuznets Curve" was to become highly influential in analyses and policymaking in the following decades, even though Kuznets himself expressed scepticism about generalising these evolutions that happened in very particular times. He explained the increase in inequality with a large influx of uneducated people from rural areas, which were equally poor, to the industrial urban areas, where inequality between entrepreneurs, managers, and labourers was high. The influx initially insured ample supply of cheap labour, allowing entrepreneurs and managers to appropriate most of the economic gains. As the migration slowed, labour markets got tighter, so that labourers got greater bargaining power; in democratic systems they also experienced growing political influence. These developments allowed low incomes to partially catch up with higher ones and narrow the gap. Wealth inequality decreased mostly because of the physical destruction of capital in the two world wars, collapsing asset prices in the Great Depression and an erosion of real values due to high inflation following the monetary financing of the wars.

After a time of stagnant inequality levels in the immediate post-war period, incomes got back onto a diverging trajectory in the late 1970's. This long-term trend has not finished as of yet. Despite the use of different methodologies (e.g. the Gini coefficient or shares in total income of certain parts of the distribution) and types of data (individual-level or households, gross income or disposable), the evidence points to increasing income inequality in most parts of the world (e.g. Piketty, 2014; Dabla-Norris et al., 2015; OECD, 2011; OECD, 2015; Keeley, 2015; Li and Sicular, 2014).

Improved data availability, econometric techniques and computing power have allowed researchers to move on from purely descriptive studies of inequality to analyses of the causes and drivers of these developments in recent decades. Globalisation, especially the increasing trade with poor countries, creates competition for low-wage sector employees in developed countries, keeping low wages from increasing in line with higher incomes. The entry of China and Eastern Europe into the global economic system in particular boosted the global supply of cheap labour (Goodhart, 2018). Borjas and

Ramey (1995) find empirical evidence for the relationship between trade deficits and inequality. Hémous and Olsen (2016) modelled an economy where automation depresses low wages, as labourers are facing increasing competition from machines, in an effort to build a theoretical framework that can explain this real-world phenomenon. Skills and education are the most obvious factors in the supply of labour: Card and Lemieux (2001) note lower educational attainment, which explains higher bargaining power of white-collar workers, preceding times of rising inequality; Goldin and Katz (2007) make similar observations, describing inequality developments as a "race between education and technology".

However, recent evidence shows that simple demand and supply factors cannot explain the developments of inequality levels fully. Piketty and Saez (2014) analyse income tax data from several European countries and the US, finding that after WWII inequality remained at low levels until the 1970's in both regions. Since then it has increased steadily, reaching pre-WWI levels in the US. In Europe inequality increased too, but far less, although the developments of the economies were similar. In continental Europe the increase was somewhat less pronounced than in the UK. They thus conclude that policies, which were more market-based and favoured lower regulation in the US and the UK, are an important factor too. Policies shape the legal and institutional framework the economy is operating in. Quantifying effects of this framework on income distributions is not a simple task, but two factors have received attention from researchers: unionisation and minimum wages. Analysing Current Population Survey data on hourly wages, DiNardo, Fortin and Lemieux (1995) find visual and quantitative evidence for the effect of declining real minimum wages on income inequality in the bottom part of the distribution. Minimum wages, if high enough, buoy wages of the bottom and therefore compress the low end of the distribution. Autor, Manning and Smith (2016) find similar evidence, but estimate the effect of minimum wages on inequality to be smaller than previously believed. Card (1992) and Freeman (1991) find evidence for a positive effect of unionisation on equality in the US.

Inequality on a global scale is difficult to measure because of a lack of uniform micro data. Methodologies on this level affect the results, even concerning the main trends (Milanovic, 2006). Due to the economic development of some emerging markets, especially China, many people were lifted out of poverty, resulting in evidence for decreasing global inequality since the early 2000's. However, not all people benefit equally from this economic growth, so within-country inequality has increased globally, while the decrease stems from the narrowing of gaps between average incomes in different countries (Milanovic, 2013). In the quoted study, survey data on household incomes was used, which should in theory be comparable. However, survey designs and data collection might still vary substantially. The short time series makes it additionally difficult to find meaningful trends.

## 2.2. Mobility

Even though there have been considerable efforts to theoretically derive measurements that can be universally agreed upon, there is no consensus about how to measure mobility: in fact, there is not even consensus about the correct concept these measures should be based upon (see section 3.2.2). Results from empirical research can thus differ substantially depending on the methodologies. Due to the complexity of the topic it is less accessible to the public and as a result does not receive as widespread attention. Empirical research on mobility is therefore not as ample as its counterpart on inequality. Further to the methodological issues, as Atkinson et al. (1988) explain, access to longitudinal microdata on incomes is often hard to come by; this was still an issue over three decades after Kuznets' seminal contributions to empirical analysis of inequality. However, a few studies (and certainly a few more than brought up here) are worth mentioning to illustrate the state of the research in that particular area. Note that most of these studies are more concerned with the measurement of mobility and descriptive empirical research, and not with the drivers of the main trends. This is most probably due to the above-mentioned lack of consensus concerning concepts and measurement of mobility (e.g. Fields and Ok, 1999).

Burkhauser et al. (1998) compare mobility in Germany and the US using transition matrices based on survey data (PSID and SOEP). They find somewhat higher mobility in Germany; as does Trede (1998), using the same data and a methodology created for the same study (see section 3.2.2.). Gottschalk and Spolaore (2012) as well use these data, and kernel smoothed joint densities of household incomes from 1984 and 1993. This methodology suggests higher mobility in the US, illustrating the difficulties that come with the measurement of mobility. Using the same data and analysing similar time periods, they arrive at opposing conclusions.

Carroll and A. Chen (2016) examine household mobility in the US between 1968 and 2013, building a Shorrocks index with PSID data. Y. Chen and Cowell (2015) examine mobility in China, using data on household incomes from the China Health and Nutrition Survey to calculate the Shorrocks index. US mobility was on a declining trend until the 1980's, after which it increased. In the last decade, it somewhat declined again. In China, mobility was higher in the period 1989-2000 than 2000-2011, and rural areas were always more mobile than urban ones.

Upward mobility is studied by Aretz and Guertzgen (2012) using a subsample of social security administrative data from West Germany between 1984 and 2004. They find that low-wage employment persistence has increased, mostly since the beginning of the 1990's. Old individuals earning low wages are the least likely to break out of the low-wage bracket, but they were also the least likely to earn low wages. Young individuals were more likely to earn low wages, but also exhibited higher upward mobility. This indicates that those who are not able to escape low wages in a young age, e.g. due to increased experience, will not have any means to do so at a later point in time.

# 3. Data and Methodologies

## 3.1. Data

### 3.1.1. The Database

The data used in this study are anonymised tax data for the period 1998-2015. Income tax has to be paid by all individuals who are residents in Malta, and on all incomes received in Malta by those who are not residents. All sources must be reported, including income from employment, self-employment, and capital (Laws of Malta, Chapter 123). However, this database contains only wages, i.e. incomes from employment. As all incomes in this database are wages, the terms will be used synonymously throughout the remainder of the text. The relevant variables given in the dataset are: the year, part-time emoluments, main emoluments (full-time work), total emoluments, basic weekly wage, number of weeks worked in the respective year, social security payments, number of employees working for the same company, the individual's birth year and whether someone is working in the public or private sector. Some of those variables are not reliable though: e.g. the number of weeks worked and the weekly wages often do not multiply to the reported annual income. The irregularities are so ample that it appears unlikely to be the result of bonuses and overtime pay only. Weeks worked also vary substantially throughout the years, even for individuals working constantly for the same employer and earning similar wages throughout. Using the given variables, a few other, useful variables can be calculated: age, a dummy for change of job, and one's rank in the distribution calculated by dividing the number of people earning less in the same year by the number of total entries of the same year, and real wages, using inflation data from the National Statistics Office (NSO)[4]. Information that is not included is non-wage sources of income, the individual's educational level, economic sector of the employer, gender, and household or family links between the different individuals.

Despite the opportunities this rich data set offers for research, there are important limitations. For instance, individual-level data can be misleading. To give an example, increasing low-wage employment is generally conceived as a negative development. If it is the result of the rapid increasing female labour market participation rate in Malta[5], it might reflect a positive development where females who were previously not working enter the labour force and earn an additional income for their household. Even though being low, e.g. due to low education or a lack of prior work experience, this income improves the household's financial situation. This dataset does not inform about gender or household connections between individuals, so interpretations about certain trends have to be made carefully, always keeping in mind the nature of these specific data. A review of household-level inequality of disposable incomes, which is much more closely related to economic welfare, can be found in Darmanin (2018). Moreover, it is not possible to analyse directly which types of labour benefitted

[4] The measure used here is the Retail Price Index (RPI), as it is a better measure for the price level faced by Maltese residents.
[5] For a review of this development, see Micallef (2015).

the most from the economic changes in Malta, as no information on education or the sector of the employing company is given. The differences between incomes from employment, self-employment and capital cannot be assessed either, given that only wages are available. One can however compare growth of wages and national account measures, such as GDP and GNI, in order to examine whether labour has benefitted proportionately from economic growth. Wage differentials between males and females would be interesting to analyse, but as gender does not matter for taxation, there is no data on it. Another problem with these data arises from misreporting. Naturally, tax data does not provide any information about undeclared incomes, so there is always a possible bias in some of the reported wages which cannot be addressed.

### 3.1.2. Cleaning

The advantage of administrative data is its completeness, vis-à-vis income data collected via surveys. However, administrative data are not collected for statistical purposes, and therefore need extensive cleaning before they can be analysed. First, some obvious issues had to be addressed: Malta joined the European Monetary Union in 2008, so all monetary values before that had to be converted from the previously used Maltese Lira to Euro, using the official conversion rate of 0.4293 MTL/EUR. Furthermore, there were occurrences of individuals having more than one job in one year, e.g. because of a job change within the year. In such cases, the sum of incomes, weeks worked, social security contributions and the unweighted mean of both basic wages were imputed, and all other values were imputed from the job the individual worked in for more weeks. Entries of individuals who are younger than 20 years of age were eliminated. Then, in line with the suggestion of Kuznets (1955) and the WID.world methodology (Alvaredo et al., 2016), we focused on full-time wages received for an entire year (52 weeks) of work. Even after removing all part-time job entries there remain a high number of incomes below the annual minimum wage. These are most likely due to reduced-hours schemes and employment that did not cover the whole year. Doran, McCarthy and O'Connor (2016) use cut-off values for wages and number of weeks worked, and remove all observations for which at least one of the variables is below the respective cut-off value. However, this approach is not useful to clean the Maltese income tax data. The data on weeks worked show too many irregularities to be used as a main indicator in the cleaning process. Furthermore, removing only incomes that are below a certain value is a biased approach, as it does not clean reduced-hours employment, or short-term employment in well-paid positions that receive incomes above that value even though working less than full-time for a whole year. Therefore, Stata codes were designed to find irregularities in incomes that hint to less than full-time employment. These detect sudden movements, e.g. substantially lower annual incomes in the first or last year in a job during which the respective individuals might not have worked form January until December. These and other patterns that indicate irregularities are described in more detail in an Appendix. In the end, less than 1% of the remaining observations were incomes below the

minimum wage, as not all could be detected by these algorithms. Hence, all incomes below 95% of the minimum wage were removed.

After the cleaning, out of the initial 2.5 million observations, 1.8 million remain. Comparing the developments of employment numbers according to the cleaned and the uncleaned data bases (figure 1) shows a growing discrepancy towards the end of the observation period. This is due to the increased relative importance of part-time employment, which has been removed for better analysis. Data from the Labour Force Survey (LFS) and on gainfully occupied (GO) individuals suggest higher numbers of employment than the cleaned data as well. However, the growth rates of employment according to the LFS and the cleaned administrative data are relatively well-aligned, with the average growth rate slightly higher for the latter. The uncleaned administrative data exhibit much higher growth rates on average, partially because of the increase during the last three years of the observation period. The variance of growth rates is significantly higher in the uncleaned database as well because short-term fluctuations are taken into account. These are not of interest for an analysis of medium-to-long-term trends though. The absence of this noise can therefore be seen as a sign of successful cleaning. The high growth of employment during the last year, as measured by the cleaned database, is likely to result from entries that are missed by the cleaning algorithms. Therefore, any sudden movements in the measures of inequality or mobility during the last year are likely to be caused by problems with the cleaning of the data.

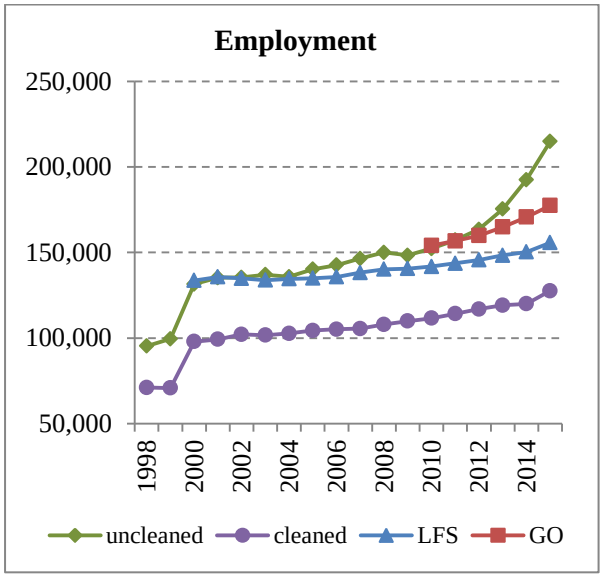


*Figure 1: Employment according to different sources*

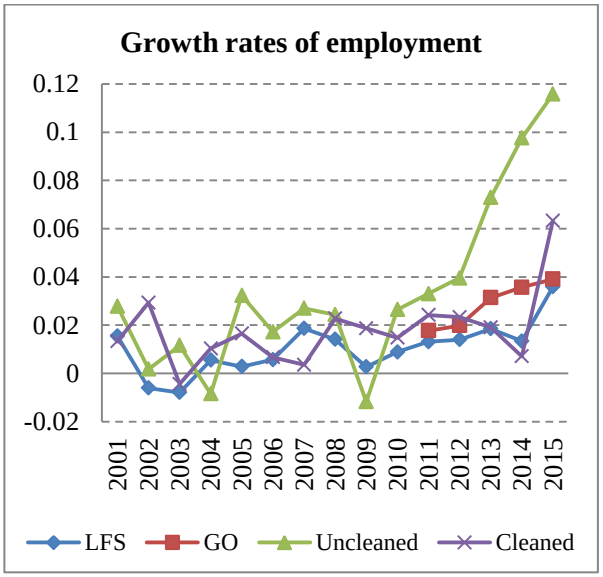


*Figure 2: Growth rates of employment*

Another remarkable development is the sudden increase of observations in 2000, which appears in both the cleaned and the uncleaned datasets. 81% of these new entries are employment in the public sector. As during the same period, the new departmental accounting system (DAS) was introduced, this step represents new practices in tax recording rather than an increase in employment. Most of these wages are positioned around the median, leading to decreasing inequality measures between

1998 and 2000. This large number of observations also affects the ranking of individuals in the distribution, leading to distortions in the mobility measures. Due to these irregularities during the first two years, and the resulting lack of representativity, all analyses will be restricted to the years 2000-2015.

As income distributions and mobility are disaggregated by age and company size, a few trends in the composition of the data must be mentioned. In general, the Maltese labour force is ageing. The mean age has increased by almost two years between 2000 and 2015, while the tenth and the 90$^{th}$ percentile of the age distribution have increased by two and three years respectively. The largest age-group are the 20-29 year-olds, though their numbers in total employment have marginally declined according to the cleaned data. This is most likely related to decreasing fertility rates and the increase in those pursuing higher education. The largest relative increase of employment happened in the 60-69-years age group, even though they started from a low level and are still the least represented group. This is related to an increased retiring age, incentives to work beyond the official retirement age, and, possibly, the need to work longer because pensions can put households at risk of poverty (Darmanin, 2018). The largest increase in absolute terms, and second largest in relative terms was achieved by the 30-39-years age group. The remaining two age brackets (40-49, 50-59) increased moderately. In terms of the age groups chosen to disaggregate the data in the analyses in sections 4-6 (young = 20-34, middle-aged = 35-49, old = 50+), the "young" age group is the largest, but has the lowest growth rates and thus falling shares in total employment. The "old" age group is the smallest group by levels, but experienced the fastest growth and therefore rising shares in total employment. The middle-aged group grows moderately, while its share in total employment is stable throughout the time series.

In terms of company size, the greatest amount is employed in large companies, though their share in total employment is falling in favour of micro, small and medium-sized companies, reflecting the shift away from industry to the higher value-adding services sector. In 2000, about 60% of large-company full-time employees were working in the public sector, but the share gradually decreased to about 50% in 2015. Relative to total employment, public sector employment decreased from 36% in 2000 to 26% in 2015. Statistics about large companies are largely driven by the public sector, so the disaggregation by company size excludes all public sector employees, in order to focus on private sector companies. The public and private sectors are compared separately.

## 3.2. Methodologies

### 3.2.1. Income Distributions

Due to the high degree of public interest in the topic, it is important to use simple measures of inequality, which are easy to understand and accessible to non-experts. A simple, yet effective way to visualise income distribution are density curves: the more incomes are crowded in a certain range of incomes, the higher the density. DiNardo, Fortin and Lemieux (1995) propose kernel smoothed distribution curves to analyse the impact of minimum wages on lower-income inequality. The method can

also be used to provide an initial overview over the most important developments of the distribution of wages in general.[6]

One of the most standard measures of dispersion is the variance. As it squares the deviations from the mean, it is disproportionately sensitive to incomes in the tails of the distribution, but this problem can be easily solved using logarithms of incomes. It is not a simple measure to interpret single values, but useful to observe general trends in income inequality.

Though often criticised, the most widely-used and well-known measurement of inequality is the Gini coefficient. The Gini coefficient is the area between the actual Lorenz curve and a fictional Lorenz curve of full equality relative to the area under the full-equality Lorenz curve. Its weaknesses have been well-reported, e.g. for placing more weight on middle incomes, when the tails of the distribution are more interesting for inequality analyses (Palma, 2011; Cobham and Sumner, 2013), but the simplicity of the measure is compelling. As it is an index number that takes values between 0 and 1 it is easy to understand, interpret and compare different time periods and various countries or regions.

Palma (2011) notes that most changes in inequality happen in the top 10% and the bottom 40% of the income distribution: while their shares in total income vary, and drive most of the changes in the Gini coefficient, the share in total income of the middle 50% remains remarkably stable through time and across very diverse countries from all continents at about 50% of total income. As the tails are the most interesting parts of the distribution for inequality analyses, he suggests using the ratio of the top 10%'s and the bottom 40%'s share in total income as a measure of inequality. It is simple and easy to understand, while also being explicit about the parts of the distribution which receive the attention; it fails to take changes of inequality within these groups or changes to the middle incomes' share into account though. Despite the different calculations behind these indices, Cobham and Sumner (2013) note that the Palma ratio is highly correlated with the Gini coefficient.

Distribution curves, the Gini coefficient and the Palma ratio are useful to describe general inequality developments, but do not tell much about where in the distribution most of the changes happened that led to these developments. Documenting different percentiles of the income distribution, and their evolution over time, allows quantifying the differences between income levels and the growth rates of high and low wages. This provides better information for the analysis of the effects of the structural changes the Maltese has gone through (and is still going through) on the developments of inequality. Furthermore, growth rates of percentile ratios of different age groups are compared. Percentile ratios are a common measure of income dispersion (e.g. Autor, Katz and Kearney, 2008). Using growth rates allows examining differences in trends while controlling for different initial levels.

[6] The kernels used are Epanechnikovs with the Stata default bandwidth. Though it is understood that the choice of bandwidth is important, this should be sufficient for a visual analysis.

### 3.2.2. Mobility

*3.2.2.1 Concepts of Mobility*

The use of mobility for this analysis is twofold: first, it complements inequality measures, as in a highly mobile society, lifetime income inequality is lower than inequality at singular points in time. Second, it serves as an approximate measure for how merit-based differences in earnings are. Wages can be determined by family background, connections, or pure luck. High mobility is likely to reflect a higher degree of meritocracy, as it is easier for individuals to improve their situation based on their own work and skills. Hence, in a system of low mobility, inequality is less acceptable, as it cannot be justified by skills or effort.

Short-term mobility on the other hand, might generate difficulties for individuals or households as it creates lower income security and thus higher uncertainty (Fachinger and Himmelreicher, 2012). This is particularly problematic if they have long-term financial commitments, e.g. mortgage loans. However, to analyse short-term mobility, smaller observation intervals might be necessary, i.e. data on monthly or even weekly (instead of annual) incomes. Therefore, this paper focuses on the positive aspects of opportunities and reduction of lifetime inequality by analysing medium-to-long-term mobility.

It is important to keep in mind that mobility refers only to movements within the distribution. The analyses of income distributions are concerned with relative differences in wages, so mobility is about the change of an individual's relationship to the rest of the distribution (Cowell and Flachair, 2011). Thus, a general shift of the entire distribution – an equal change in income for everyone – does not reflect mobility.[7] Therefore, the analyses and methodologies in this paper examine *rank* mobility, the change of individuals' ranking in the income distribution over time (e.g. Shorrocks, 1978; Carroll and A. Chen, 2016). However, income mobility is also concerned with movements that change the dispersion of incomes but not the ranks. E.g. in a two-person economy, where both individuals earn different wages for different work, there is mobility if the poor person receives a pay raise and narrows the gap, even if the rich one still earns more. However, one cannot expect large differences between income and rank mobility if the database is relatively large.

Mobility can be measured both in an *intergenerational* or *intragenerational* context. The former refers to the relationship between an individual's income and the individual's parents' income, while the latter describes and the relationship of an individual's income to prior incomes of the same individual. As we do not have data on family links, only intragenerational mobility will be addressed.

[7] "Equal" in this case means an equal *relative* change, as only this keeps the relative difference between incomes constant. If everyone receives the same *absolute* pay raise i, inequality approaches zero as $i \rightarrow \infty$ (Fields and Ok, 1999).

In order to measure mobility, one must clarify what is understood to be perfect mobility. Perfect mobility can refer to complete lifetime equality of incomes, thus individuals earning high incomes in period $t_0$ earn low incomes in period $t_1$ and vice versa. This concept is called *reversal* (e.g. Gottschalk and Spolaore, 2002). A transition matrix[8] of two income classes, where $p_{ij}$ denotes the probability to move from state i to state j, which describes a perfectly mobile society under the concept of reversal looks like this:

| | | $t_1$ | |
|---|---|---|---|
| | | low | high |
| $t_0$ | low | 0 | 1 |
| | high | 1 | 0 |

Those who earn a low wage in $t_0$ have a probability of one to earn a high wage in $t_1$ and a zero probability to still earn low wages. Those earning high wages have a zero probability to still earn high wages in $t_1$ and a probability of one to earn low wages; the income distribution was reversed. This concept becomes more complicated once more than two income classes are considered. These complications will not be discussed at here though.

Perfect mobility can also be defined as the independence of one's income from previous incomes. This concept is called *origin independence*. The transition matrix of a perfectly mobile system would then look like this:

| | | $t_1$ | |
|---|---|---|---|
| | | low | high |
| $t_0$ | low | 1/2 | 1/2 |
| | high | 1/2 | 1/2 |

The probability is the same to be in any income class in $t_1$, independently of one's income class in $t_0$.

As origin independence characterises a system of equal opportunities, it is often associated with intergenerational mobility. Reversal equalises incomes over the course of a lifetime and is therefore often associated with intragenerational mobility (Fields and Ok, 1999). But as Shorrocks (1978) points out, the concept of reversal describes a system as rigid as one that is perfectly immobile, one in which an individual's rank in the future is determined by one's rank in the present. Mobility has a value to society of its own though, beyond the equalisation of lifetime incomes: it ensures that effort and acquisition of valuable skillsets pay off. Mobility does not necessarily need to be equalising, but rather to ensure a meritocratic system. Therefore, origin independence is the concept of perfect mobility that the measures in this paper are built upon.

[8] See the following sub-section for a discussion of transition matrices.

*3.2.2.2. Measuring Mobility*

Before turning to the methodologies used to measure mobility, some limitations arising from the nature of the data need to be mentioned. The final database contains only full-time employment, so individuals moving in and out of less-than-full-time employment cannot be considered. Individuals might also move out of an income class and back into it until the second observation, but they appear immobile because only the rank in the beginning and the end of each period is observed. As we are mainly interested in persistent movements, this should not be regarded as a major limitation though; neither should trends be affected by this, as it affects measures throughout the whole time series.

Transition matrices, where $p_{ij}$ is the proportions that moved from quintile i to quintile j in a given period of time, are a useful tool to examine mobility between two points in time. One can easily assess how likely individuals are to end in a different part of the distribution, and how far they are able to rise or fall. One faces an important trade-off between simplicity of few classes, and completeness of transition matrices built by dividing the distribution into more and smaller subgroups. Furthermore, due to the large amount of information generated for each period, it is almost impossible to observe trends in mobility over time using transition matrices.

Shorrocks (1978) created an index to measure rank mobility based on transition matrices, which makes it easier to compare mobility in different periods or regions. The index is calculated by

$$S = \frac{n - \sum p_{ii}}{n - 1}$$

Where $p_{ii}$ are the probabilities on the diagonal of the matrix (the probability to remain in the same quintile of the income distribution) and n is the number of possible states. It measures the deviation from the identity matrix, which represents complete immobility, as an index that takes values between 0 and 1, which makes it a measure that is easy to interpret and therefore a useful tool for mobility analyses. One weakness is that it relies on arbitrarily chosen groups for the ranking of individuals (such as quintiles in this case). The size of classes furthermore affects the index value, as it is easier to move out of one's original income class if the class size is smaller. Movements within these groups are not measured, only the movements between groups. And as only the values from the diagonal are used, the index does not take the magnitude of movements into account. Whether one moves from the first quintile into the second or into the fifth does not make any change to the index. Furthermore, the quintile boundaries are subject to change as the income distribution shifts and changes its shape. To account for this effect, the analysis will be complemented by a Shorrocks index with fixed quintiles over each of the periods. This index accounts for changes in income that would move an individual to a different quintile if the distribution was not changing. Wages are inflation adjusted for that analysis, so movements are not recorded for mere price-level adjustments of incomes. The Shorrocks indices

for different age groups will furthermore be compared, as will be those for the public and private sector.

The time span chosen for these measures is 5 years, if not indicated otherwise, which is also the time span chosen by Atkinson et al. (1988), Trede (1998), and Aretz and Guertzgen (2012). Mobility indices increase if one uses longer time spans, as individuals have more time to change their economic situation. Therefore, shorter time spans are unlikely to yield valuable results. Longer time spans are possible, but given that our data spans only 16 years, there would not be much scope to track changes in mobility over time.

Trede (1998) proposed a graphical device using kernel-smoothed quantile regressions, regressing relative income in one period on relative income from a past period. Here they are calculated as relative to the median income, which has the advantage that we do not have to account for inflation. The more the curves are aligned with the 45 degree line, and the closer they are to each other, the more likely are individuals to earn a similar relative income as in the past. Horizontal lines indicate origin independence of relative wages. The methodology is simplified here: the $10^{th}$, $30^{th}$, $50^{th}$, $70^{th}$ and $90^{th}$ percentile in the end of the period, conditional on the relative income of the beginning of the period are calculated, similar to the adaptation of Y. Chen and Cowell (2015). This allows obtaining a similar result with significantly lower computing effort. The method provides a rich set of information about the movements of individuals, differentiating between different starting points in the distribution. However, it does not provide a number that can be easily tracked throughout time. As this methodology creates a set of information rather than a single index number, it cannot detect any trends in mobility. Therefore, it is used to analyse long-term mobility between 2000 and 2015.

### 3.2.3. Low-Wage Statistics

Of special interest for policymakers are low-wage earners, as they are the most likely to depend on supportive policies. Low wages are defined according to the official OECD measure (e.g. OECD, 1996) as less than two-thirds of the median wage; it thus changes proportionately to the median, it is a relative measure. It is not to be confused with poverty, as this is a multifaceted concept best measured in terms of living conditions (Sabates, 2008), which depend on household incomes; in Malta, poverty arises mostly from a lack of work (Darmanin, 2018). A database of full-time individual wage income is thus inappropriate for this type of analysis. These statistics show the proportion of full-time employees earning wages that are low relative to the median full-time wage income. In order to analyse low-wage employment, simple statistics shall be sufficient: in line with Aretz and Guertzgen (2012) the share of individuals earning low wages will be tracked. This will also be done with data disaggregated by age, sector and company size, to analyse the composition of low-wage earners.

"Low-wage mobility" is defined as the ability of low-wage earners to earn incomes greater than the low-wage threshold after a given period of time, i.e. upward mobility of low-wage earners. These

simple statistics reveal whether low-wage employment is likely to be a transitory or permanent status. It is presented as the probability to earn an income below the threshold in the beginning of a period and an income above the threshold at the end of the same period:

$$P(inc_{t+5} < tres_{t+5} \,|inc_t < tres_t)$$

However, as the low-wage threshold is a relative value, it is affected by the growth of median incomes. To account for this growth, the probability to rise above the low-wage threshold of the beginning of the period is computed as well:

$$P(inc_{t+5} < tres_t \,|inc_t < tres_t)$$

For this calculation, the end-of-period incomes are inflation-adjusted to account only for increases in real terms.

As for the other mobility measures used in this paper, mobility that lifts individuals above the threshold, but lets them drop back below it by the end of the 5-year period is not accounted for. There should not arise a bias in the trend of upward mobility from this limitation though. Furthermore, as we are assessing the opportunities to persistently improve one's financial situation, temporary movements are not of importance.

# 4. The Distribution of Wage Incomes

## 4.1. Distribution Curves and General Measures

Comparing density curves visually gives an initial idea about the main developments of income distributions. Figure 3 shows kernel-smoothed density distributions of nominal wage from 2000, 2005, 2010 and 2015. Each curve stops abruptly on the left because of legally binding minimum wages. On the right, they are arbitrarily cut off at annual incomes of €70000 to focus on the main part of the distribution. These curves are sufficient for the naked eye to recognise the main development: the widening of the distribution. The curves flatten in the middle and skew more to the right, indicating that parts of the middle class have been able to appropriate larger shares of the economy's growing output than the rest of the population, creating a high-income sector. Moreover, a peak just right of the minimum wage develops. This local maximum points to an increase in the number of individuals that depend on the minimum wage to maintain the real value of their wages, i.e. the minimum wage has become more binding. Furthermore, there seems to be a rightward shift of the curve, indicating a general increase of incomes. However, this is also true for the minimum-wage-induced cut-off on the left. Minimum wages are adjusted to a cost-of-living index, based on the retail price index (RPI). Part of the shift must therefore be due to inflation-adjustments of wages. This can be confirmed by constructing density curves with real wages.

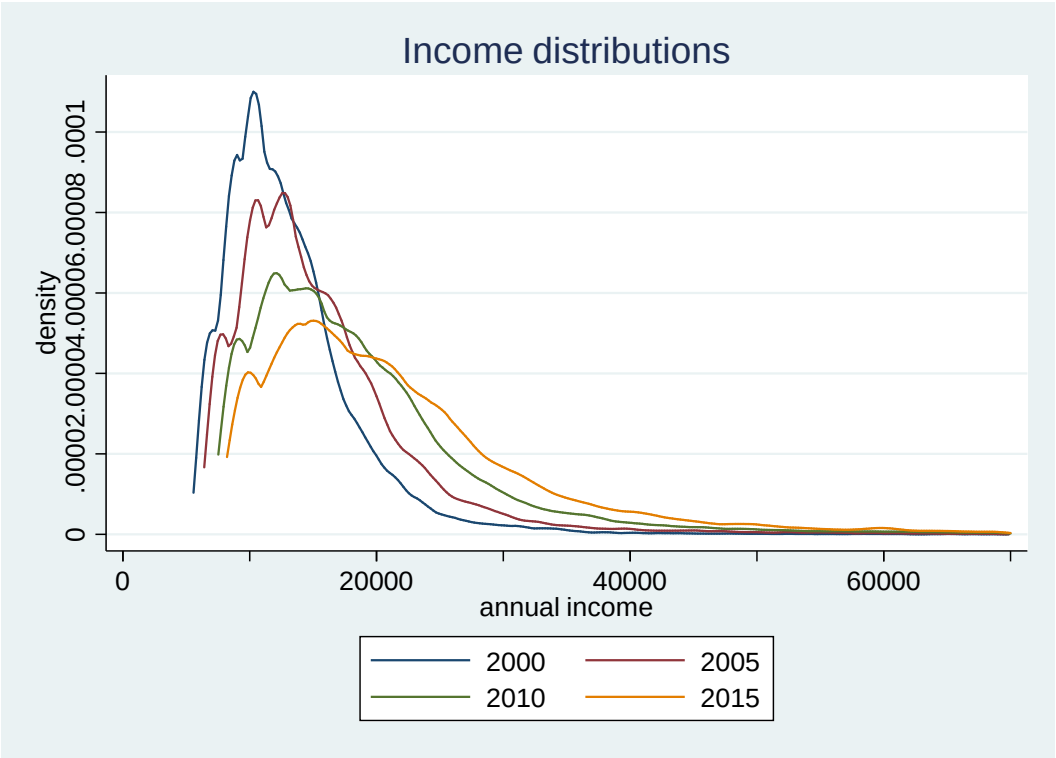


*Figure 3: Income distributions (nominal).*

Deflating incomes by the RPI, the rightward shift of the distribution disappears (figure 4). The curves start at similar values on the left and the peaks are at similar levels for all curves as well. Hence, wages at the bottom of the distribution have not increased in real terms between 2000 and 2015. This does not mean that individuals who earned minimum wages in 2000 did not improve their situation, as it is unlikely the same people are at exactly the same position in the distribution 15 years later. These are issues that will be addressed in section 5, where the mobility of individuals is examined. As the density increased at higher income levels, while it decreased at medium and lower levels, it is apparent that many individuals do enjoy higher incomes in 2015 than they would have in 2000. Wage growth exists, but it is unevenly distributed. Minimum wages have become more binding, the share of full-time employees earning an income between 95% and 110% of the minimum wage increased from 2.7% in 2000 to 5.5% in 2015. It is thus clearly not the reason for the lack of growth in the low end of the income spectrum, but rather seems to compress this end of the distribution (i.e. having a decreasing effect on inequality) by buoying the lowest incomes.

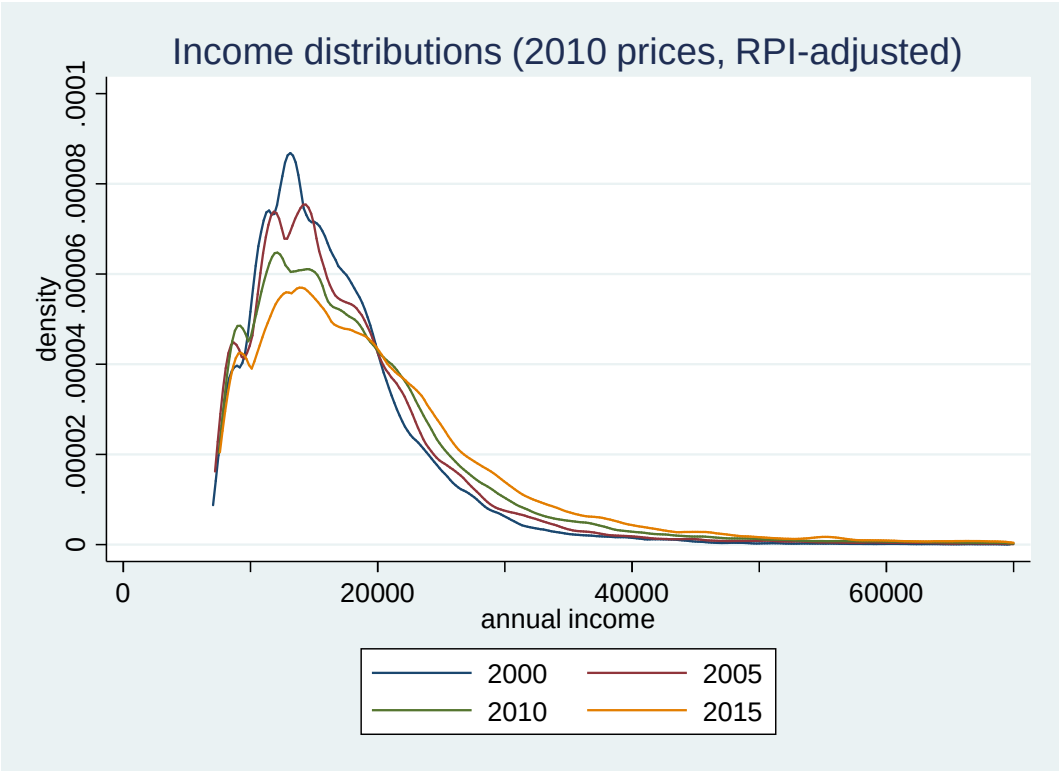


*Figure 4: Income distributions (real).*

The evidence of increasingly unequal individual incomes is also supported by the Gini coefficient, the Palma ratio and the variance of log wages (figure 5). The Gini coefficient follows a steady upward path, starting at 0.29 in 2000 and reaching a value of 0.39 in 2015. This trend was not interrupted at any time and continued even through the Great Recession 2007-2009 or other business cycle-related events. The variance of log incomes follows a similar continuous, upward trend. The Palma ratio growth is not as steady; it is interrupted in 2009, where it falls to a lower value than in the previous year. This is because the middle incomes lose towards the bottom, while the share of the top incomes remains stable (figure 7). The ratio therefore decreases, implying decreasing inequality. However, the top 10% are able to distance themselves further from the next highest 50%. Using only the ratio would imply that the top incomes lose in favour of the bottom incomes, so this measure can be misleading if the assumption of the stability of the income share of the middle 50% does not hold. Generally, the middle income's share in Malta is relatively high compared to the international average of 50%: it starts at around 60% in 2000 and drops to about 57% in 2015. This shows that Malta has a relatively strong, albeit declining, middle class. Inequality is thus overstated by the Palma ratio in the case of Malta and incomes are distributed more evenly than in other countries with a similar ratio. For instance, the income share of the middle 50% is higher than those of Nordic countries and Japan in Palma (2011), where the ratio is 1 and 0.9, respectively.

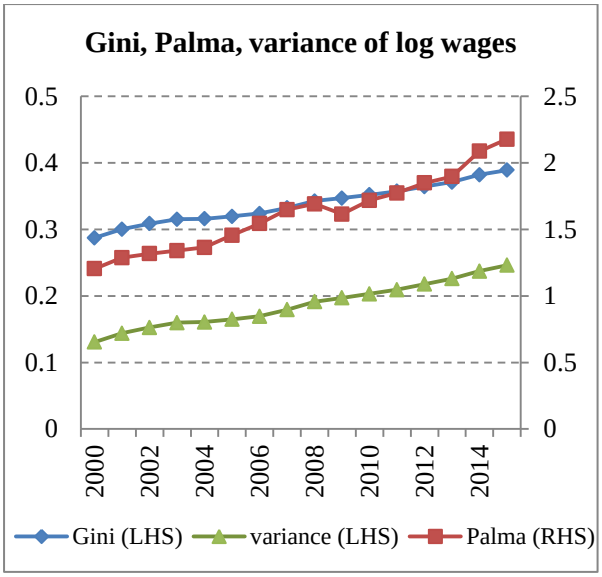


*Figure 5: Gini, Palma, variance of log incomes*

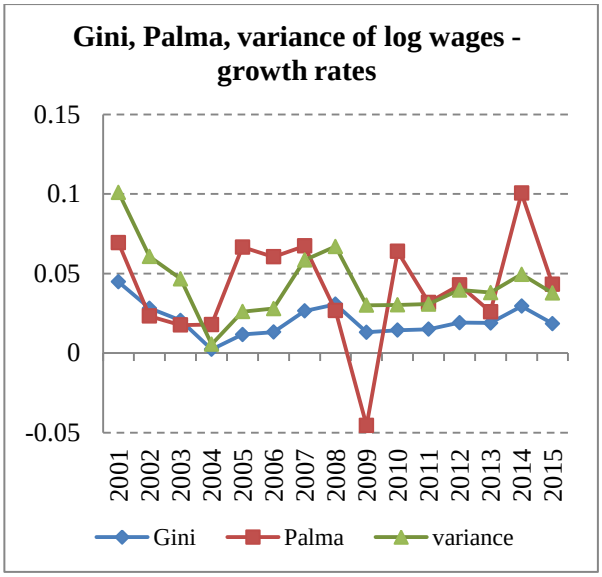


*Figure 6: Gini, Palma, variance - growth rates*

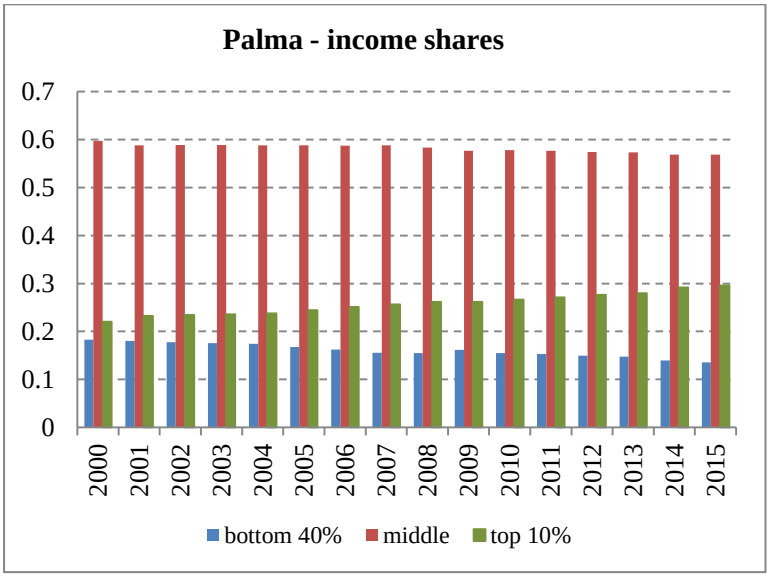


*Figure 7: Palma - income shares*

Showing the same trend, all three indicators are highly correlated: the Gini and the variance have a correlation coefficient of 0.9997, both pairs Gini-Palma and variance-Palma have coefficients of 0.983. The growth rates (figure 6) of the Gini coefficient and the variance of log wages are also broadly in line, following movements in the same direction in every period. This results in them being highly correlated as well, the coefficient stands at 0.983. However, the growth rates of the variance are consistently higher. This is likely to be caused by the weight the Gini coefficient puts on middle incomes. Most of the changes happen in the tails, as the income shares featuring in the Palma ratio show (figure 7), so this weighting leads to an understatement of the growth in inequality by the Gini coefficient. The growth rates of the Palma ratio are not as much in line with the other two. It misses all intragroup developments of inequality and half of the labour force is not included. Therefore it is likely to be less representative of the actual developments of inequality. The correlation coefficients of the Palma ratio growth rates are 0.36 with the Gini coefficient and 0.27 with the variance.

## 4.2. Percentiles

To analyse which parts of the distribution exactly experienced increases or decreases of incomes, and to help assess possible drivers of inequality, we examine the developments of a range of percentiles of the income distribution over time. Growth rates (in real terms) provide valuable information about the development of incomes in different parts of the distribution. Figure 8 shows that after adjusting for RPI inflation, the lowest wages have not increased at all, the 5th percentile even declined slightly. On the other hand, the 90th and the 95th percentile increased to 137% and 153% of their 2000 values respectively. Median incomes have increased too, standing at 117% of their 2000 values in 2015 (figure 10). Average annual real wage growth in that period was thus virtually zero for p5 and p10, half a percent for the 25th percentile, 1% for the median income, 1.5% for the 75th percentile, 2.1% for p90 and 2.9% for p95 in real terms. This wage growth is more pronounced for all levels during the last few years of the time series, but the differences remain. This is an important finding in the context of strong economic growth based on structural changes to the economy in recent years: while the growing output of the economy has helped to boost medium and high incomes, low incomes have hardly increased in real terms. This still compares favourably to other advanced economies, where median wages have not increased in real terms during the same period, e.g. in the US and Germany (Grabka et al., 2016).

Even minimum wages, which are usually adjusted to a cost-of-living index in Malta, have had slightly higher growth rates over these 15 years than the 5th and the 10th percentiles, which explains the observed increase in bindingness of the minimum wage.

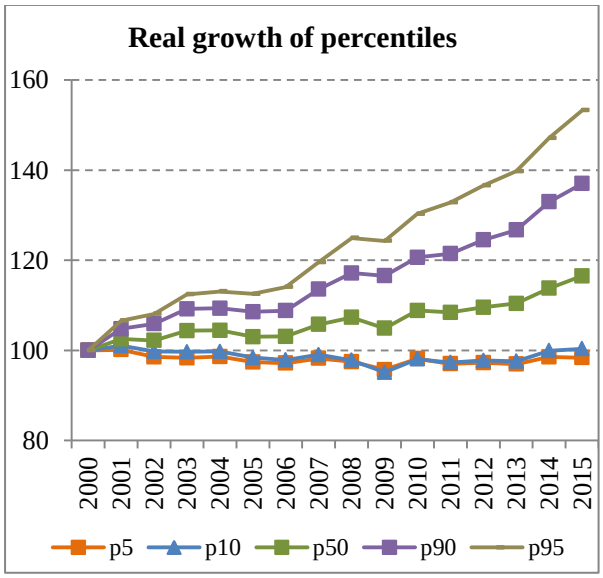


*Figure 8: Real growth of percentiles*

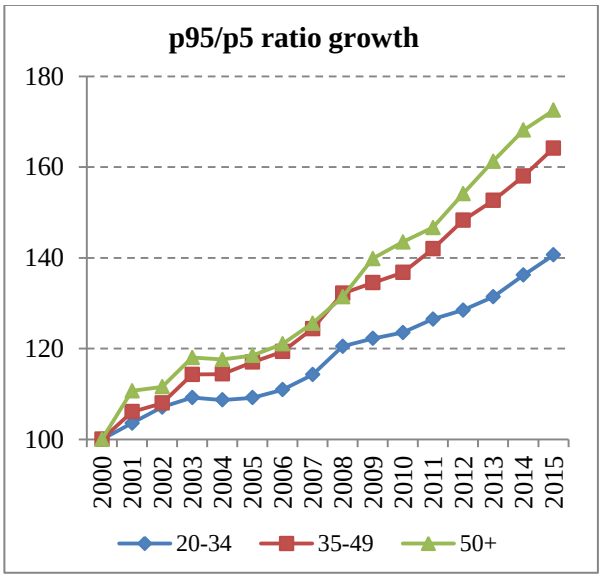


*Figure 9: Percentile ratio growth (by age group)*

Wage incomes evolved in this manner mostly because a growing share of the economy's output stems from the service sector, including financial services, IT, professional activities and administration. The importance of blue-collar sectors, such as manufacturing and agriculture, is declining, while tour-

ism and tourism-related sectors are the only ones employing low-income employees that experienced substantial growth in recent years.[9] Therefore, the demand for low-skilled labour has not increased in line with the demand for highly skilled employees. While the demand for labour is changing rapidly, labour supply is typically sluggish to adjust (e.g. Mok et al., 2012). Malta has a relatively low share of well-educated people in the labour force compared to other European countries (Varga and in 't Veld, 2014; European Commission, 2016), creating upward pressures for those on high incomes. The level of education differs substantially between different generations and indicates an adjustment process to the demand of the economy though: each generation has reached higher levels than the previous one, leading to an upward trend in education of the Maltese labour force. In 2015, the 35% of the employees of the 20-34 age group had university degrees, while 25% of the 35-49 age group and 15% of the 50-64 age group had one. Amongst the 50-64 age group, 59% had only low education (levels 0-2, O-levels not passed), while 46% of the 35-49 age group and 29% of the 20-34 age group had low education.[10] Accordingly, the trend in educational outcomes is upwards for the entire observation period because every generation is better educated than the last. This holds for the total labour force as for every single sub-group based on age, while younger generations are always more educated than older ones. Only higher education of the 50-64 age bracket is stagnant, as individuals are unlikely to return to formal education at this stage of their careers. Due to the developments in educational outcomes, the changes in demand for labour have had different effects on the dispersion of incomes of different age groups: the pressure on high incomes is highest for the 50-65 age group, as the supply of highly skilled is relatively the scarcest.

The youngest age group has by far the best educational outcomes, so the increased demand for well-educated employees could more easily be met and there was less pressure on high incomes accordingly. This is reflected by the growth of the p95/p5-ratio of different age groups (figure 9), where the ratio for the oldest generation has increased the most, while the ratio for the youngest generation has increased the least. The correlation coefficient between age and income has dropped, reflecting the relative advantage of young individuals as a result of the higher education levels (figure 10).The trends in education suggest that, over time, the skills-mismatch might be reduced. Fewer workers will be low-educated, so the supply of this type of labour might decrease to levels closer to the levels of the demand for it. At the same time, more well-educated individuals are entering the labour market, reducing the pressure on high wages. The effect of improving educational outcomes is furthermore enhanced by immigration from EU countries.[11]

[9] See Grech et al. (2016) for a description and analysis of the structural changes the Maltese economy has gone through in recent years.

[10] These figures are based on LFS data. Percentages for tertiary education of the 20-34 age group are understated, as only labour market participants are accounted for and those who are still studying do not enter the statistics. The percentage for 25-34 year-olds is about three percentage points higher.

[11] Immigrants from EU countries are predominantly employed in positions that require high educational levels (Grech, 2017).

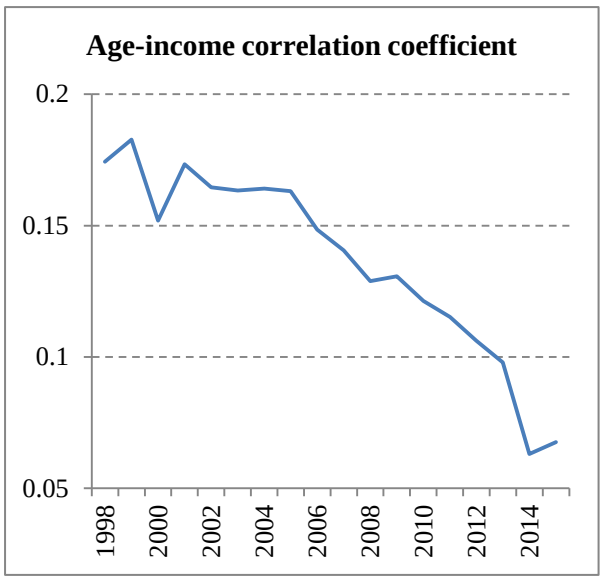

*Figure 10: Age-income correlation coefficient*

Even though there is no clear-cut evidence for the increased returns to education, the evidence from education levels and growth rates of percentile ratios strongly suggests that the structural change is the main driver of the divergence of incomes. This is also supported by evidence from other countries, where skill-biased technological change drove increasing income inequality (e.g. Goldin and Katz, 2007).

Most wages have experienced slower growth than the economy's output, only the top 5% of incomes increased in line with GDP per capita. One reason for this is that incomes are per employee and the labour force has expanded more than the total population. However, NSO data reveals that the wage share of total output has been on a declining trend, falling to its lowest value during the last year of our time series. This is surprising in light of the tight labour markets, which should, according to economic theory, enable employees to negotiate relatively higher wages. The changing structure of the economy could partially explain this development, as some of the sectors which gained importance generally exhibit higher profit shares than those that have decreased in size relative to the whole economy. However, there might be more factors playing into this development, which we cannot observe with the given data. It is beyond the scope of this paper to assess the main reasons behind this development, so the question why firms have been able to increase their profits faster than total output in times when the scarcity of labour is significant, remains open for future research.

## 4.3. Public and Private Sector Inequality

Although its relative importance in employment has declined since 2000, the public sector still constitutes a large share in total employment in Malta. Public sector wages are typically less unequal due to the presence of established salary structures and collective bargaining. As they are also less flexible, public sector wages might react slower to changes in market conditions. To investigate whether these

assumptions are true, we compare the variance of log wage incomes from the public and the private sector. This particular measure is chosen for the two reasons that it takes the whole distribution into account and that it does not arbitrarily place more weight on middle incomes and thereby underestimates the growth of inequality.

Public sector employment incomes are indeed more equal than private sector incomes, and the increase of inequality has been significantly less pronounced (figure 11). The widening of the distribution has been driven predominantly by the private sector, where wages are the most dispersed and have further diverged. The public sector has experienced a more subdued rise in dispersion of incomes. It was forced to follow the trend to a certain extent though, as qualified, experienced professionals have been subject to large income increases in the private sector. In order to compete with private sector employers for these individuals, high incomes had to follow private-sector wage-setting practices. Most of the increase in public sector inequality has happened after a new collective agreement was passed in 2006, while private sector inequality has increased steadily throughout the whole period, indicating a lag in the reaction of public sector wage setting to private sector wage growth.

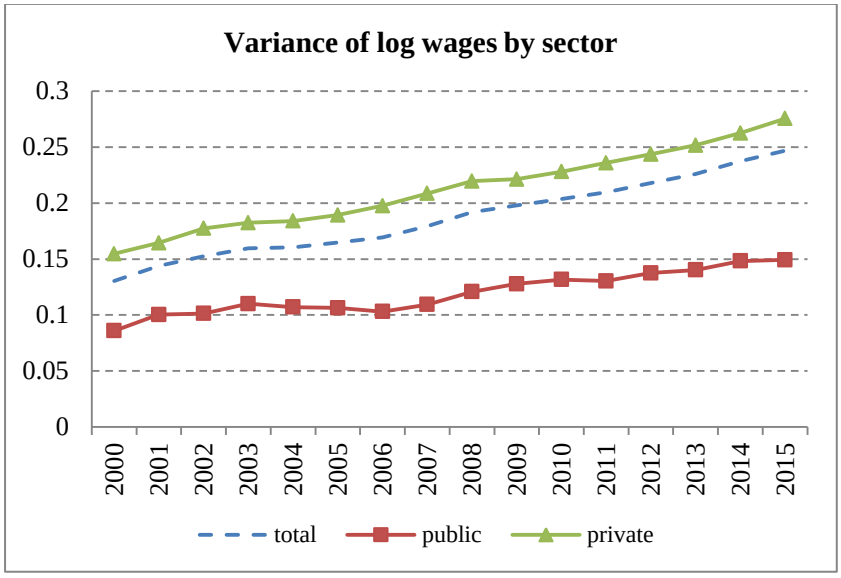


*Figure 11: Variance of log wages (by sector)*

# 5. Wage Mobility

## 5.1. Shorrocks Index

The Shorrocks index is based only on values from the diagonal of the transition matrix, the probabilities to be in the same quintile at the end of the period. As this means that a lot of information is lost, it is worth to have a brief look at the original transition matrices. The ones chosen here are the 5-year transition matrix for the period 2005-2010 and the 10-year matrix for 2004-2014.[12] The probabilities to end in the same quintile are always higher after five years than after ten years, confirming the as-

[12] Transition matrices for all periods can be found in the appendix.

sumption of higher mobility in longer time frames. This is easily explicable by the facts that it takes time for individuals to work on their careers and large changes of income are unlikely to happen in single events. The mobility indicated by the 10-year transition matrix is not as high as the hypothetical one of a squared 5-year matrix, pointing to non-linear mobility over time. Most probably this is because individuals make the biggest steps during the first years of their careers (mobility is highest amongst young individuals, see below). It could also mean that movements are conditional to prior movements. Mobility analyses of the US labour market indicate that it would further decrease if one chooses even longer periods (Carroll and A. Chen, 2016). Furthermore, one can observe that individuals are more likely to move into a higher quintile than to move into a lower one. This general upward movement is possible because individuals are likely to start their careers at a relatively low wage, move up the career ladder over time, and retire at higher incomes; it thus reflects returns to experience.[13] Transition matrices in Carroll and A. Chen (2016), studying disposable household income mobility in the US, do not show as clear upward movements. The labour force expanded at higher rates than the US labour force during the same time, explaining part of this difference: more individuals enter the labour force, usually at relatively low wages (compared to their more experienced colleagues), pushing other workers into higher rankings. It might also reflect the dynamics of a fast-growing, changing economy, as opposed to a mature, highly developed economy. These dynamics create opportunities for young people with good education to work their ways up in the income distribution quickly.

| **Quintile** | **Quintile 2010** | | | | |
|---|---|---|---|---|---|
| **2005** | *1* | *2* | *3* | *4* | *5* |
| *1* | **0.6** | 0.23 | 0.1 | 0.04 | 0.03 |
| *2* | 0.13 | **0.53** | 0.24 | 0.07 | 0.03 |
| *3* | 0.04 | 0.16 | **0.48** | 0.25 | 0.07 |
| *4* | 0.02 | 0.04 | 0.17 | **0.56** | 0.21 |
| *5* | 0.01 | 0.02 | 0.04 | 0.16 | **0.77** |

| **Quintile** | **Quintile 2014** | | | | |
|---|---|---|---|---|---|
| **2004** | *1* | *2* | *3* | *4* | *5* |
| *1* | **0.48** | 0.25 | 0.15 | 0.07 | 0.05 |
| *2* | 0.16 | **0.42** | 0.26 | 0.11 | 0.05 |
| *3* | 0.06 | 0.19 | **0.37** | 0.27 | 0.11 |
| *4* | 0.04 | 0.07 | 0.19 | **0.46** | 0.24 |
| *5* | 0.02 | 0.03 | 0.06 | 0.2 | **0.69** |

The Shorrocks index indicates slightly decreasing mobility, for both 5-year and 10-year periods (figure 12). However, as the increased mobility between jobs (figure 14) suggests, the tight labour markets of recent years are also likely to have created opportunities for employees. A large share of the decreasing trend of mobility therefore seems to stem from the widening distribution, which has the effect that the quintiles become larger too. This makes it increasingly difficult to move between them. Calculating the Shorrocks index with quintile boundaries that remain constant throughout each 5-year period thus does not only increase the level of mobility, but also reverses the trend (figure 15). Between the periods 2001-2006 and 2010-2015, one can observe a slight, unsteadily rising trend. It ap-

[13] In an unchanging labour force, for every upward movement there would have to be a corresponding downward movement. However, the composition changes, as young people enter the labour force and old people retire. New entrants tend to be paid less than highly experienced individuals, which allows this dominance of upward movements.

pears that the economic boom and the structural changes to the economy have improved income mobility slightly, but larger income changes are necessary for an individual to move into a different quintile because the income distribution has been stretched out. The divergence of the two trends might furthermore point to general wage growth amongst most individuals, but wage growth that is increasingly in line with the movement of the distribution. Individuals are able to break out of their initial quintiles, but as all wages increase, i.e. the entire distribution shifts, their position in the new distribution does not differ much from their past ranking. Mobility is defined as income changes that are independent from movements of the distribution though. Therefore, these movements do not reflect genuine mobility, but rather a lack thereof. The dynamics of an economy going through structural changes and the improved ability of individuals to increase their incomes in an expanding economy is thus not sufficient to offset the growing disparity of incomes and maintain or even increase rank mobility.

Individuals of the 20-34 age bracket are the most mobile (figure 13). They are also the most likely to move between employers, so their careers can unambiguously be described as the most dynamic. At early stages of the career, their paths are not as clear-cut yet, which might enhance these dynamics. Furthermore, as they are less experienced, additional time spent on a job makes a larger contribution to their productivity than for older individuals who have worked in their jobs or similar occupations for many years. The 35-49 and 50-65 age groups are similarly mobile, with the levels for the older ones slightly lower. Mobility of the 20-34 age bracket has decreased in line with mobility for the whole labour force, mobility of the other two age groups does not exhibit a clear trend after the period 2003-2008. It does not mean that the young age group entirely drives the decreasing trend though: the share of the less mobile age groups in total employment increases gradually due to the ageing of the labour force and therefore their lower Shorrocks index values feed into the total with a larger weight. This compositional effect is another factor driving the decrease in mobility. One must take into account that many of the old age individuals retire towards the end of each 5-year period. The sample is thus biased towards the younger individuals of this age group and those who decide to work beyond the official retirement age. Whether this creates a persistent bias in the measure cannot be addressed at this point though.

Comparing Shorrocks indices of the public and private sectors reveals that the public sector has lower mobility, and a faster declining trend than the private sector (figure 16). This is likely to be due to more rigid and less performance-based remuneration and promotion systems. However, it is unlikely that this system changed much and became less flexible since 2000. In section 4.3, we observed that public sector inequality increased less than private sector inequality, and hence less than total inequality. As public sector incomes have become less dispersed relative to the total income distribution, they are more centred in fewer quintiles. The quintile boundaries that are used here are based on the total

labour force, so it is more difficult for public sector employees to move between them, which drives the difference between the slopes of both trends.

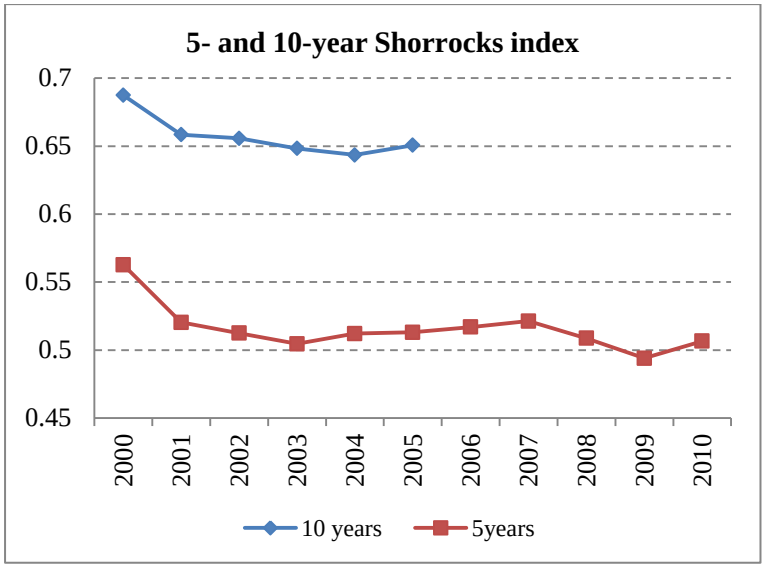


*Figure 12: Shorrocks index*[14]

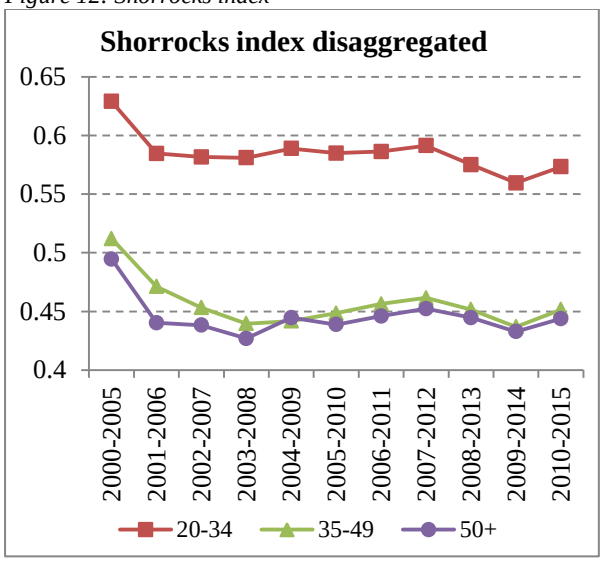


*Figure 13: Shorrocks index by age*

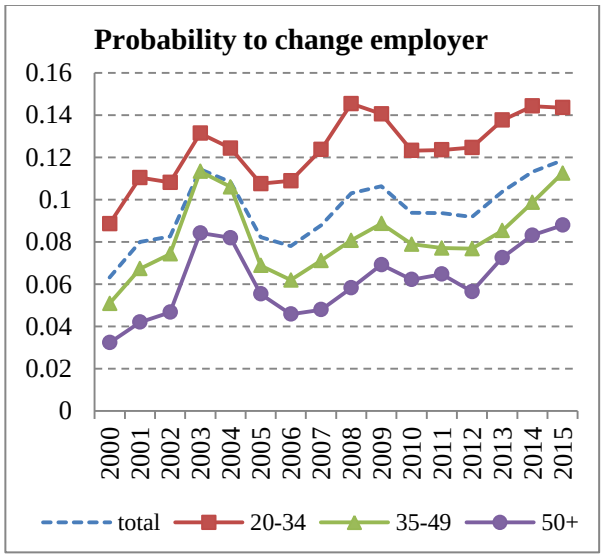


*Figure 14: Probability to change employer*

[14] The years on the abscissas are the first year of the period, e.g. the value of the 5-year index in 2000 denotes the mobility between 2000 and 2005.

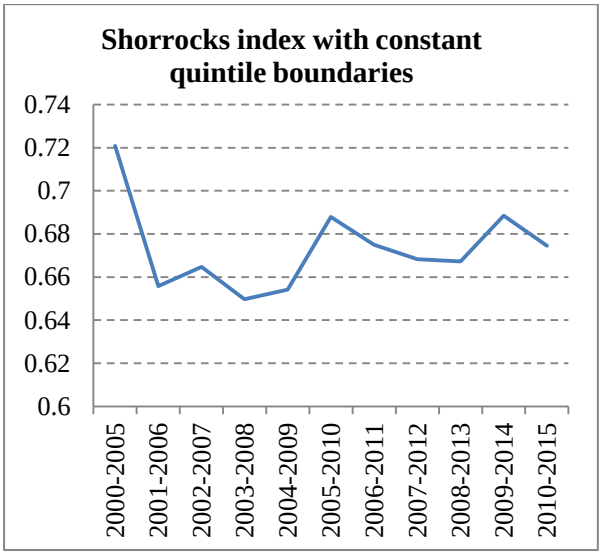


*Figure 15: Shorrocks index with constant quintile boundaries*

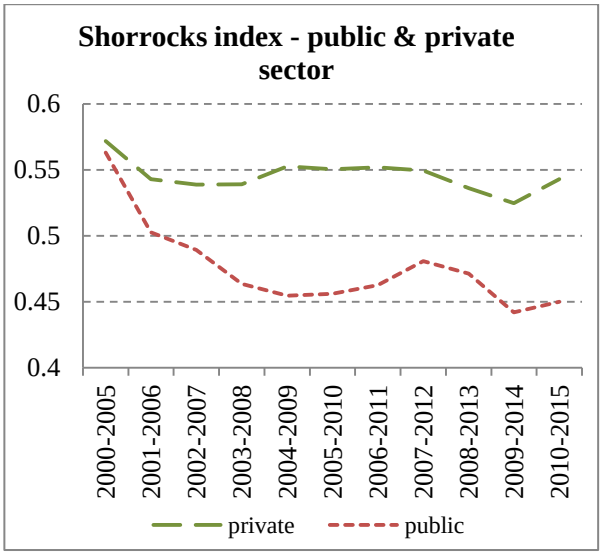


*Figure 16: Shorrocks index - public and private sector*

## 5.2. Trede method

The strength of the Trede method graphics is not to create a brief summary of mobility based on a single number, but rather to offer a rich set of information. This usually does not lead to unambiguous results, so it is not possible to clearly observe trends. However, it allows us to observe the complexities that come with the topic. For these reasons the method is used to analyse long-term mobility over the whole period of 2000-2015. The chart shows the 2015 relative incomes of a subsample of individuals who worked in 2000 and 2015, conditional on their 2000 incomes. This subsample contains 51379 entries. A significant ageing process of 15 years takes places by construction, as only who worked in both years could be included. The youngest are 20 in 2000 and 35 in 2015, while less than 0.02% are older than 50 and more than half are under 35 in 2000.

The lines are fairly well-aligned with the 45 degree line, no line crosses it (figure 17). This suggests that mobility is relatively low in Malta. They furthermore fan out towards the right, as the variability of movements, and therefore mobility, is higher for those with a higher starting income. The lines of higher percentiles exhibit a steeper slope than those of lower percentiles. About 70% of those who earned half the median income in 2000 were still earning below-median incomes in 2015, showing relatively little possibilities to make large upwards movements for minimum wage earners, even in the long run. The p10 of those earning three times the median in the beginning is higher than the p70 point of those earning half the median in the beginning of the period. For those earning 2.5 times the median in the 2000, the tenth percentile is even higher than the p90 point of those earning half the median in 2000. This indicates very little exchange between those at the top and the bottom of the income distribution. Moreover, top incomes have distanced themselves further from the median, exposing that mobility has helped those who were already well-off to increase the difference to the rest: almost 70% of those earning 2.5 times the median income in 2000 are able to earn the same relative

income or more in 2015. It is partially an effect of the ageing process: wage differentials, as measured by percentile ratios, are higher amongst older individuals, as even well-educated ones start at a relatively low income, but have better prospects to progress than their less educated peers. Thus the slightly higher wages of well-educated in the beginning of the individuals' careers increase the gap over time, explaining part of the diverging effect of mobility as displayed by the Trede method graphic.

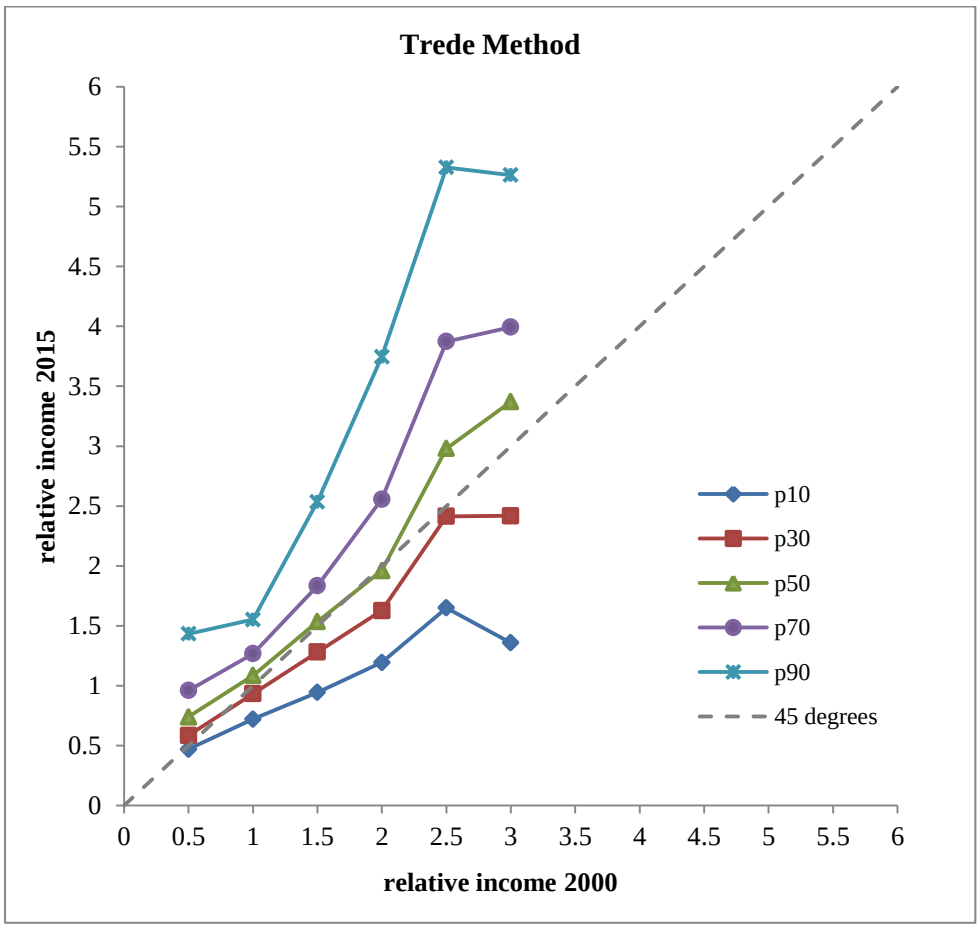


*Figure 17: Trede method*

However, this does not necessarily imply that mobility is understated by this method, but rather shows that one's future is highly dependent on the first years of the career. It is in line with the results of income distribution analysis: the highly skilled were able to reap large gains, while those with little education remained in the low income part of the distribution. Between the two highest-earning groups there appears to be a large degree of mobility, the slopes of all lines are close to horizontal and do not show any similarity or patterns in trends between the last two points. However, this represents only mobility between the top 5% and top 1% of incomes and therefore does not change the observation of generally low long-term origin independence mobility. Mobility is also low compared to other countries too, e.g. Germany and the US (Trede, 1998) and China (Chen and Cowell, 2015).

# 6. Low Wages

## 6.1. Low-wage Employment

Low wages are defined according to the official OECD measure as less than two-thirds of the median income. As that, it is unsurprising that the share of the labour force working for low wages has increased following the widening of the distribution (figure 18). It does not come as a surprise the youngest age group is the most likely to earn low wages either, as they have the least experience and did not have time to advance their careers yet. Even without further education, many of them can be expected to increase their human capital by acquiring skills on the job. This is also in line with results from Aretz and Guertzgen (2012) studying incomes in Germany. What is striking is the sharp increase of 50-65 year-olds working for low wages starting around 2005, even passing the middle-aged group in 2012. The share of 20-34 year-olds working for low wages on the other hand has been constant since 2008, defying the general upwards trend. This situation is the opposite of the one in other southern European countries, where young people are struggling to find paid employment.

While the overall upward trend is due to the widening of the distribution, and the high levels of low-wage employment amongst young individuals is a result of the lack of experience, the divergence of the trends in low-wage employment between the different age groups is driven by the interplay of the structural changes the economy went through and the differences in educational outcomes. Older people got educated according to the needs of a very different economy, while young people nowadays are more likely to get secondary and tertiary degrees. In the changing economy, the rapidly growing financial, IT, and online gaming sectors exert increasing demand for well-educated employees. This improves the opportunities for young individuals, who have the necessary skills, and dents the prospects of older people who are less educated. While companies are searching for employees and even reporting shortages (Micallef and Caruana, 2015), the skills these companies are looking for are different to those that many older individuals acquired during their education and career. Even though the skills mismatch might be reduced over time, due to the improvements in educational outcomes, the current situation creates difficulties for some individuals of the older generation to adjust to the rapidly changing economy, not allowing them to benefit proportionately from economic growth.

A second reason for the rise in low-wage employment amongst old workers is the increased female labour market participation rate. In 2006, only 38% of working age females participated in the labour market (Central Bank of Malta, 2007), while in 2014 the female participation rate stood at 52% (Micallef, 2015). This is because young females with education are more likely to enter the job markets than some decades ago, but also because middle-aged and old females, mostly former housewives, entered the job market. The latter ones do not have any job-related experience, and thus earn low wages. As many individuals experience rising incomes, this influx into the labour market at the bottom end of the distribution naturally creates divergence of individual-level incomes and a rising share

of low-income employees amongst this age group. Low incomes in this case are not necessarily problematic for these individuals, as the former housewives add an additional income to the total household income, thereby improving their financial situation substantially.

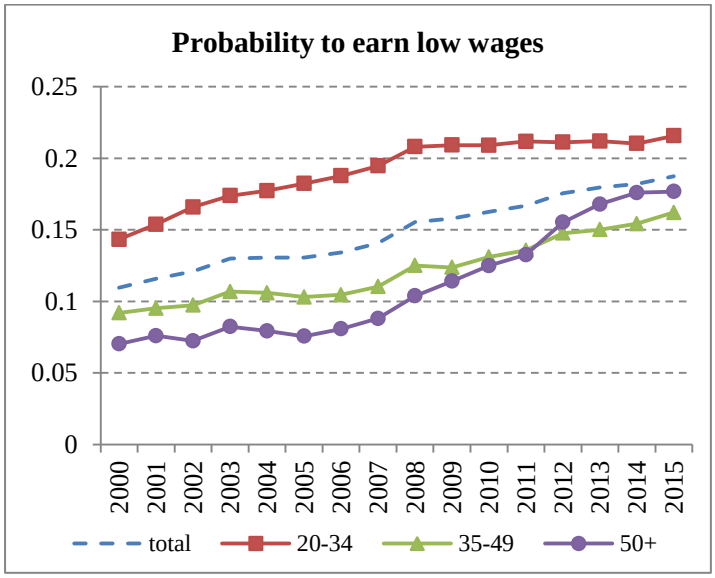


*Figure 18: Probability to earn low wages*

The probability to earn an income below the low-wage threshold is also related to the size of the company one works in: The bigger the company, the lower the low-wage probability (figure 19). Large companies have more complex hierarchical structures, with more layers than smaller companies. Therefore, the relative importance of those working on the bottom, for low wages, is smaller. At the other end of the scale, in micro companies, there are likely to be just one owner/manager and a few employees. These are likely to be comprised to a large share of small shops, restaurants etc., employing many individuals at low wages. Those entering the labour market are also more likely to work for low wages than the rest of the labour force (figure 20). However, the trend is declining[15], while the main trend of low-wage probability is upwards. This is most likely due to the better education of young individuals and EU immigrants, who are the most important groups amongst the new entrants into the labour market. Immigrants might also have experience in their field and enter at relatively higher incomes than young individuals without experience in the same field. As their previous employment was outside of Malta, they would enter the database as new entrants to the labour market though.

[15] Cleaning algorithms are likely to miss some entries that are not full-year employment in 2015, which is especially relevant for new entrants. Therefore, the analysis only goes as far as 2014..

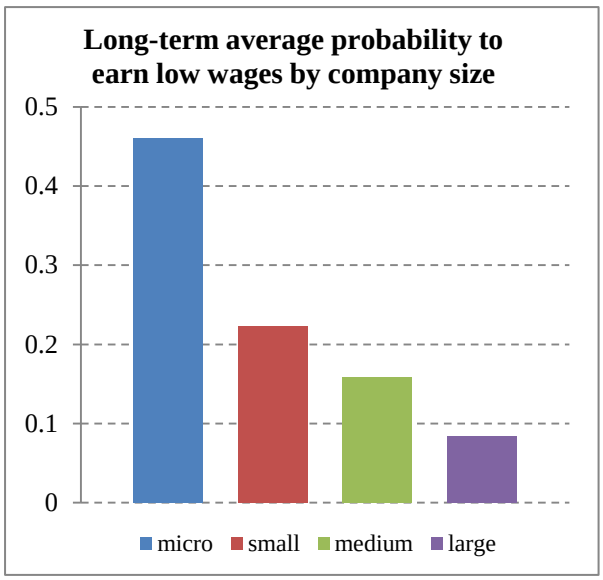


*Figure 19: Probability to earn low wages (by company size)*

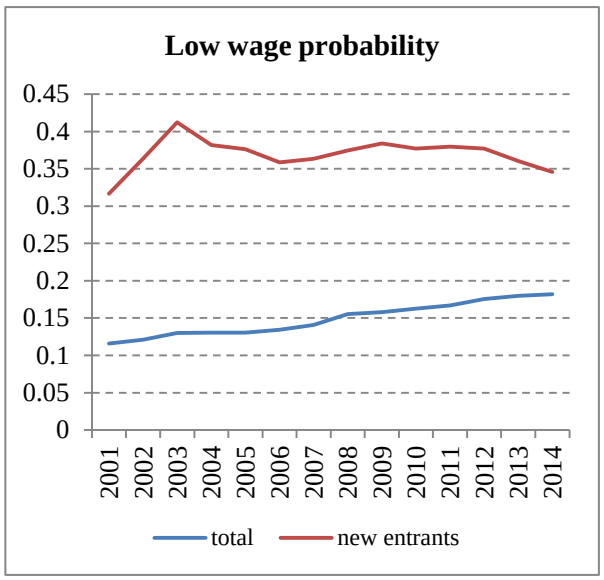


*Figure 20: Probability to earn low wages (new entrants)*

## 6.2. Low-wage Mobility

The ability of low-wage earners to move up is especially interesting for policymakers, as it determines whether low-wage employment is a permanent or a transitory status for the affected individuals. The general trend to pass the low-wage threshold in five years' time is slightly declining (figure 21). This is a natural effect of the widened distribution, where median incomes have increased more than lower percentiles. To pass the threshold, a larger movement is needed if one starts the period earning the minimum wage. Holding the threshold constant at the initial value of each 5-year period yields opposing results: starting in the period 2003-2008, the trend turns positive (figure 22). It is more volatile, which might be due to the changes in inflation and the poor adjustment of wages to inflation. The difference in trends shows that there is a growing share of low-wage earners who are able to move above a threshold held constant at the level of the first year of the period, but not above the time-varying threshold. Hence, low incomes increase (almost) in line with general wage growth, and the opportunities to earn higher wages after five years have improved. Higher incomes, including the median, increase even faster though, leaving low-income earners behind. Old individuals are the least probable to lift themselves out of low-wage employment. Their ability to do so has deteriorated further, so that towards the end of the time series only about one third earn incomes above the low-wage threshold after five years. 20-34 year-olds are the most likely to escape low wages. Between 45% and 50% of them earn wages above the threshold after five years. However, the trend is declining and they are also the most likely to earn low wages in the first place. Five years of added experience make a higher relative difference for them than for those who have been working for many years already, explaining the bigger effect of time and experience on incomes. Older individuals are less likely to earn low wages, but if they do, they are most likely low-educated and have experience in sectors that

do not exert high demand for labour anymore. Therefore, it is more difficult for them to improve their situation.

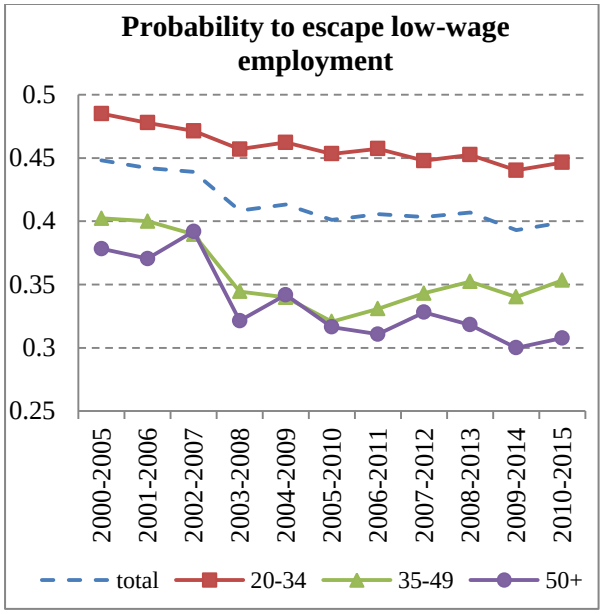


*Figure 21: Probability to escape low-wage employment*

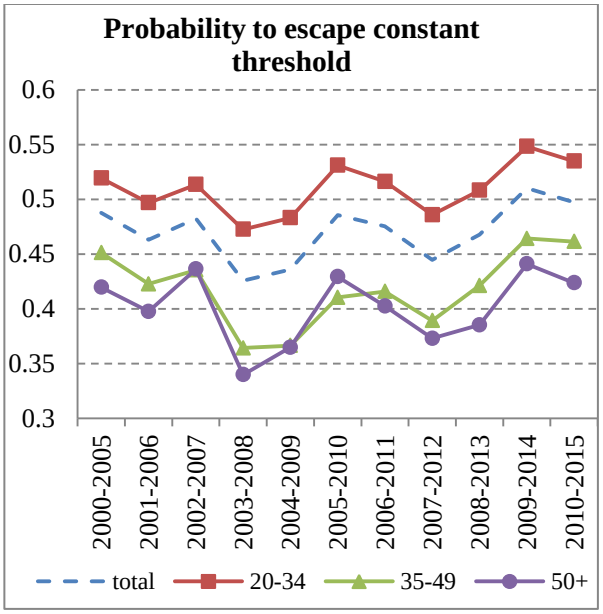


*Figure 22: Probability to pass constant low-wage threshold*

The public sector offers better opportunities for low-wage employees than the private sector, even though overall mobility is lower (figure 23). Over 50% of public sector low-wage employees make it above the low-wage threshold[16] five years later, while it is slightly less than 40% for the private sector. The more rigid and less flexible remuneration and promotion systems of the public sector might be an advantage for low-wage employees. Furthermore, the public sector employs people mostly in administrative roles, where minimum wages are less common. Those who earn below the low-wage threshold might therefore have a smaller gap to close than some private-sector employees. In the private sector, those who work for low wages are likely to be amongst those whose bargaining power has been eroded by the structural changes of the economy. Escaping low-wage employment therefore requires considerably more effort. Large companies offer better chances for employees to work their way up in the income distribution than smaller ones (figure 24). This might be due to more complex hierarchies, with more layers that one can work his or her way through. Micro companies are likely to be comprised of one owner and a few employees, so there are no possibilities for employees to work their ways up the hierarchy within the company and they neither have opportunities to work their way up in the income distribution.[17]

[16] This threshold is based on the entire population and the same for every sub-sample.

[17] Only individuals who worked in companies of the same size in the beginning and the end of the period were considered here, so movements between firms of different sizes are not accounted for. This could be relevant in cases where people gain valuable experiences in small companies that allow them to get higher-paid jobs in bigger firms and move up in the distribution later. Including all movements between different types of companies would go beyond the scope of this paper.

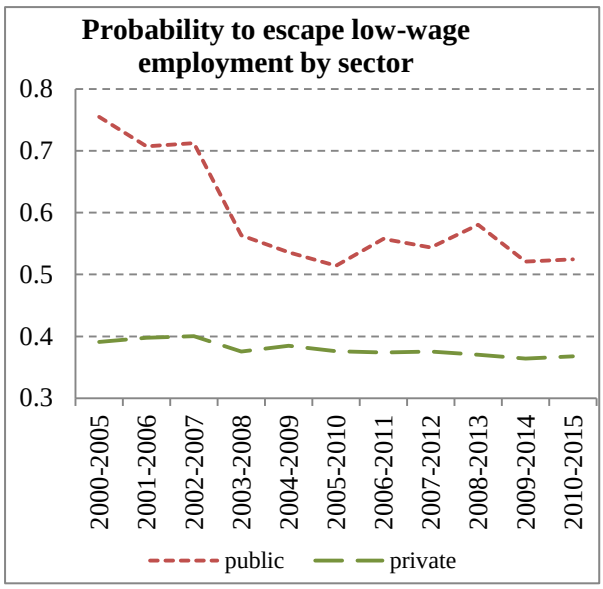


*Figure 23: Probability to escape low wages (by sector)*

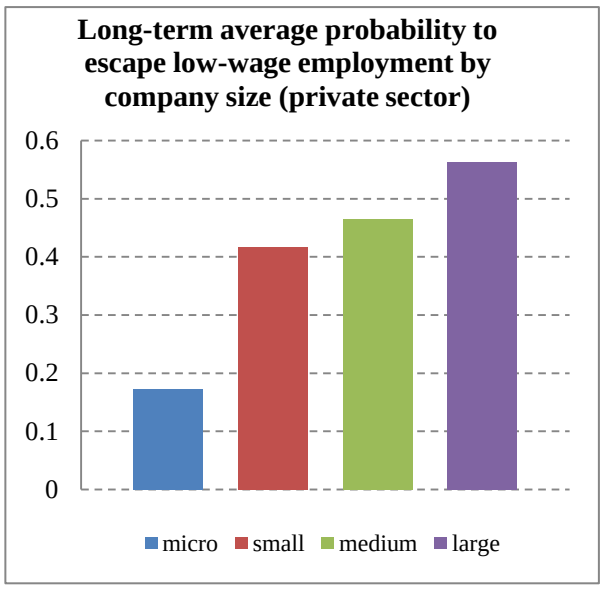


*Figure 24: Probability to escape low wages (by company size)*

## 7. Conclusions

The widening of the wage income distribution reflects the structural changes of the Maltese economy and the slow adjustment of the labour supply to the rapidly changing demand. Despite these developments, income inequality is still relatively low by international standards and the income distribution is characterised by a strong middle class. Wages at the middle of the distribution have increased significantly, which implies that a large part of the labour force are benefitting from the economic growth. Yet lower percentiles of the wage distribution have not increased, indicating that some segments of the population, such as older workers, have not benefitted as much from recent economic growth. Employment incomes are also persistent, with those starting at the bottom of the distribution facing severe difficulties to increase their relative incomes substantially and individuals earning less than the low-wage threshold are likely to still do so after some time.

An important factor determining the success in the labour market is education. The increase in the share of high-value added industries in the services sector require highly-skilled individuals with good numerical, analytical and IT skills. The age-group with the lowest outcomes in formal education (the 50+ age bracket) has thus fared worst. The proportion of low-wage earners amongst those individuals is now larger than the one of the 35-49 age bracket, which is unlike the typical situation where older generations tend to be less likely to earn low wages, e.g. in Germany (Aretz and Guertzgen, 2012). Educational outcomes have been gradually improving in Malta. In the long-run, this development can reduce the shortages of highly-skilled employees, aligning supply and demand of labour and thereby reducing some of the upward pressure on already high incomes. That said, the rates of early school leavers are still high compared to other EU countries. Malta has one of the highest percentages of early leavers from education and training amongst EU countries, and the share of those with only a compulsory level of education is one of the highest in the EU. While the gap between the EU average

is gradually closing down, more efforts are required to raise the education level of the Maltese work-force.

The decline in rank mobility was due to the increasing dispersion of wages and the ageing of the labour force. The 20-34 age bracket is significantly more mobile than the other two age groups. As the labour force gets older, this had a negative effect on overall wage mobility. The increasing dispersion of incomes could also make it more difficult for individuals to move between income classes. The same factors also affect low-wage mobility, as does the size of the employing company. Large companies offer better opportunities for low-wage employees to move above the threshold. As the share of large companies in total employment decreases, low-wage mobility might further decrease as well.

The evidence presented here suggests that experience and improved skills can boost wage income prospects significantly and could result in some convergence of employment incomes. Hence, in future years it will be increasingly important to boost the skills of those on low wages. Long-term mobility for older workers is low, as incomes are to a large extent dependent on initial levels of education and the early years of one's career. Upskilling and on-the-job training as part of lifelong-learning schemes could help older individuals to progress even at stages of their careers where they are unlikely to return to formal education.

Despite the wealth of information contained in this database, there are important limitations that do not allow analysing some interesting questions. First, as mentioned in the introduction, inequality analyses are best conducted using disposable (after taxes and transfers) household incomes. Therefore, the analyses in this paper are meant to describe the development of the distribution of wage incomes between different types of labour in a rapidly transforming economy, and the mobility of individuals within this employment income distribution. Furthermore, the absence of sectoral information limits the analysis of the evolution of income dispersion by sector of economic activity. The real effects of education on incomes, and the related "college premium" cannot be assessed and quantified either, as there is no information about the educational level of the individuals covered in this database. Due to a lack of data on family links, intergenerational mobility, i.e. equality of opportunity, cannot be examined either. Finally one needs to note that administrative data could also be subject to under-reporting of employment of income.

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# Appendix

## Cleaning

This section aims to explain the cleaning and imputation methods used to create a database that contains only full-time incomes received for a whole year's work. Some have been explained in the main text and will not be repeated here.

Nine entries were of individuals called "High Net Individuals", which are usually self-employed individuals with high earnings. However, they provide estimates at the beginning of the year rather than their actual incomes, thus the reported incomes in this database are not reliable and were eliminated. Furthermore, if there is no entry for the variable weeks, the entry is eliminated as well. These are mostly very low incomes, often below the minimum wage. The omission of the "weeks" variable is therefore likely to be related (at least statistically) to less-than-full year incomes.

There are large one-off movements in some individuals' incomes, which seem suspicious. In some cases these movements are accompanied by drops in weeks worked of similar relative size. Then the last year's (or next year's, if it is the first year of the series) income is imputed. Otherwise, the entry is eliminated.

In certain cases the first of last years of a career were marked by substantially lower wages than in the following or previous years. In these cases it is assumed that these are incomes for less than a whole year, i.e. individuals started work during the course of the year, but not in January, or retired before the year was over. Furthermore, there were cases where these suspiciously low wages happened in the middle of individuals' careers, accompanied by a job change. In this case it is assumed that the individual was not working for an amount of time between the two jobs. In the case of job changes and retirees the previous year's income was imputed, while in the case of newcomers the following year's income was imputed. There were also incidences of employees working more than one year in the beginning, the middle, or the end of their career for less than their usual incomes. In these cases it is assumed that they worked part-time or on reduced-hours schemes (even though they declared full-time incomes) and the entries are deleted. If after this treatment of the data an individual still has more entries below the minimum wage than above, all entries for this individual are removed.

Additionally, if weeks worked is between 30 and 50, and the weekly income (one algorithm uses the income divided by the number of weeks worked and another one uses the reported basic wage) is between 95% and 110% of the minimum wage, the weekly wage multiplied by 52 is imputed. Due to the irregularities of the "weeks" variable, this could not be done with all entries. In these particular cases, it can be assumed that individuals worked for the minimum wage during less than the whole year. If the social security contributions were more than 75% of the year's income, there appears to be something wrong with the data, so that the entry is removed.

## Transition Matrices

### 5-Year Mobility

2000-2005

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.587748 | 0.266919 | 0.084307 | 0.041225 | 0.0198 |
| **2** | 0.113517 | 0.480979 | 0.314987 | 0.071631 | 0.018886 |
| **3** | 0.038771 | 0.147436 | 0.429341 | 0.322737 | 0.061714 |
| **4** | 0.018231 | 0.041718 | 0.170635 | 0.489716 | 0.279699 |
| **5** | 0.007704 | 0.011015 | 0.043741 | 0.176047 | 0.761492 |

2001-2006

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.598635 | 0.253531 | 0.087649 | 0.041196 | 0.018989 |
| **2** | 0.129025 | 0.517938 | 0.266525 | 0.065749 | 0.020763 |
| **3** | 0.037254 | 0.184422 | 0.480225 | 0.247767 | 0.050332 |
| **4** | 0.017549 | 0.033562 | 0.175495 | 0.544162 | 0.229232 |
| **5** | 0.007246 | 0.009811 | 0.029176 | 0.17621 | 0.777557 |

2002-2007

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.596529 | 0.253033 | 0.088619 | 0.04047 | 0.021348 |
| **2** | 0.128858 | 0.532586 | 0.255892 | 0.063686 | 0.018978 |
| **3** | 0.041529 | 0.152468 | 0.49531 | 0.250275 | 0.060418 |
| **4** | 0.019756 | 0.03825 | 0.16411 | 0.552231 | 0.225652 |
| **5** | 0.006964 | 0.00985 | 0.028421 | 0.181504 | 0.773261 |

2003-2008

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.611296 | 0.239196 | 0.084413 | 0.041741 | 0.023353 |
| **2** | 0.127827 | 0.536833 | 0.241336 | 0.06924 | 0.024763 |
| **3** | 0.041045 | 0.159912 | 0.492793 | 0.244845 | 0.061405 |
| **4** | 0.019249 | 0.038182 | 0.166172 | 0.560682 | 0.215715 |
| **5** | 0.00688 | 0.00991 | 0.034274 | 0.16916 | 0.779777 |

2004-2009

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.599086 | 0.237881 | 0.094403 | 0.041133 | 0.027497 |
| **2** | 0.124773 | 0.534932 | 0.245166 | 0.067843 | 0.027286 |
| **3** | 0.042892 | 0.155057 | 0.495292 | 0.240067 | 0.066692 |
| **4** | 0.020483 | 0.040587 | 0.169345 | 0.552909 | 0.216676 |
| **5** | 0.008604 | 0.010566 | 0.036252 | 0.175503 | 0.769075 |

2005-2010

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.604982 | 0.233615 | 0.095047 | 0.040925 | 0.02543 |
| **2** | 0.12849 | 0.533009 | 0.240951 | 0.069369 | 0.028181 |
| **3** | 0.041459 | 0.162088 | 0.476149 | 0.253434 | 0.066871 |
| **4** | 0.020301 | 0.037527 | 0.168071 | 0.559951 | 0.214149 |
| **5** | 0.010889 | 0.01542 | 0.036317 | 0.164023 | 0.773351 |

2006-2011

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.604835 | 0.228904 | 0.097428 | 0.04245 | 0.026384 |
| **2** | 0.128896 | 0.530158 | 0.238857 | 0.071052 | 0.031037 |
| **3** | 0.040154 | 0.170794 | 0.472414 | 0.247068 | 0.069571 |
| **4** | 0.018846 | 0.039956 | 0.175182 | 0.559506 | 0.20651 |
| **5** | 0.008881 | 0.015755 | 0.036194 | 0.173855 | 0.765314 |

2007-2012

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.608799 | 0.225848 | 0.099935 | 0.041392 | 0.024025 |
| **2** | 0.135974 | 0.521739 | 0.245411 | 0.068921 | 0.027955 |
| **3** | 0.040203 | 0.17452 | 0.459307 | 0.26435 | 0.06162 |
| **4** | 0.02003 | 0.04176 | 0.181002 | 0.555083 | 0.202124 |
| **5** | 0.010837 | 0.01752 | 0.037387 | 0.164359 | 0.769898 |

2008-2013

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.615272 | 0.230263 | 0.097074 | 0.039124 | 0.018267 |
| **2** | 0.130448 | 0.532046 | 0.248946 | 0.06384 | 0.024719 |
| **3** | 0.039485 | 0.159624 | 0.472433 | 0.26586 | 0.062598 |
| **4** | 0.022332 | 0.040019 | 0.169128 | 0.56378 | 0.20474 |
| **5** | 0.011313 | 0.01646 | 0.036153 | 0.154726 | 0.781349 |

2009-2014

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.622036 | 0.232387 | 0.092927 | 0.037116 | 0.015534 |
| **2** | 0.14387 | 0.529968 | 0.238995 | 0.066153 | 0.021015 |
| **3** | 0.038947 | 0.163087 | 0.495842 | 0.240203 | 0.06192 |
| **4** | 0.019098 | 0.038432 | 0.170874 | 0.588127 | 0.183468 |
| **5** | 0.009596 | 0.013457 | 0.02984 | 0.159382 | 0.787725 |

2010-2015

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.606915 | 0.236262 | 0.100146 | 0.041678 | 0.014999 |
| **2** | 0.141148 | 0.520678 | 0.245463 | 0.068075 | 0.024636 |
| **3** | 0.040501 | 0.164056 | 0.482142 | 0.247736 | 0.065565 |
| **4** | 0.016237 | 0.037923 | 0.174488 | 0.578125 | 0.193227 |
| **5** | 0.007162 | 0.011392 | 0.029495 | 0.166422 | 0.785529 |

**10-Year Mobility**

2000-2010

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.453367 | 0.280088 | 0.142926 | 0.074152 | 0.049467 |
| **2** | 0.128654 | 0.376273 | 0.324056 | 0.123974 | 0.047044 |
| **3** | 0.061314 | 0.173764 | 0.321472 | 0.330918 | 0.112532 |
| **4** | 0.037106 | 0.072832 | 0.17733 | 0.411497 | 0.301234 |
| **5** | 0.018451 | 0.029885 | 0.065762 | 0.198076 | 0.687825 |

2001-2011

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.467983 | 0.266811 | 0.142425 | 0.075463 | 0.047318 |
| **2** | 0.148602 | 0.399807 | 0.277666 | 0.122317 | 0.051608 |
| **3** | 0.062308 | 0.208308 | 0.360208 | 0.27054 | 0.098636 |
| **4** | 0.032733 | 0.07206 | 0.186395 | 0.442833 | 0.265979 |
| **5** | 0.017945 | 0.029452 | 0.058019 | 0.199163 | 0.695421 |

2002-2012

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.46628 | 0.258894 | 0.148004 | 0.074681 | 0.052141 |
| **2** | 0.14676 | 0.415494 | 0.277323 | 0.111502 | 0.04892 |
| **3** | 0.062964 | 0.187655 | 0.359472 | 0.285615 | 0.104295 |
| **4** | 0.039417 | 0.073879 | 0.187927 | 0.440874 | 0.257902 |
| **5** | 0.017422 | 0.02806 | 0.06198 | 0.197734 | 0.694804 |

2003-2013

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.477468 | 0.259316 | 0.142715 | 0.072445 | 0.048055 |
| **2** | 0.149781 | 0.421105 | 0.263314 | 0.116258 | 0.049542 |
| **3** | 0.06277 | 0.180068 | 0.366682 | 0.284504 | 0.105977 |
| **4** | 0.039031 | 0.067417 | 0.19319 | 0.443077 | 0.257285 |
| **5** | 0.019259 | 0.029557 | 0.062023 | 0.190865 | 0.698294 |

2004-2014

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.480457 | 0.253036 | 0.146415 | 0.070371 | 0.049721 |
| **2** | 0.161434 | 0.416571 | 0.261549 | 0.111869 | 0.048578 |
| **3** | 0.063805 | 0.189791 | 0.373395 | 0.266357 | 0.106651 |
| **4** | 0.03659 | 0.06888 | 0.193436 | 0.461637 | 0.239457 |
| **5** | 0.017075 | 0.025458 | 0.059143 | 0.204517 | 0.693806 |

2005-2015

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **1** | 0.469299 | 0.253233 | 0.149525 | 0.076989 | 0.050955 |
| **2** | 0.164033 | 0.408387 | 0.260233 | 0.112541 | 0.054806 |
| **3** | 0.068609 | 0.189876 | 0.363875 | 0.271085 | 0.106555 |
| **4** | 0.032861 | 0.065222 | 0.197377 | 0.466462 | 0.238078 |
| **5** | 0.017567 | 0.029924 | 0.062602 | 0.200462 | 0.689445 |