A Transnational Analysis of Elderly European Wealth Distributions:

Developing and Testing New Methodologies within the new Household Financial and Consumption Survey

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ii. Abstract

Transnational wealth inequality is an expanding field of study. However, the field has many limitations especially relating to problems of data availability, methodologies used, and the very limited pool of existing transnational literature. Alongside these basic limitations is a predominating focus on populations as a whole that correspond with a dearth of studies concerned specifically with elderly wealth distributions.

This thesis' objective is to tackle these three problematic areas in the field, but with a specific focus on the elderly. In particular, new methodologies for analysing transnational distributions of wealth are explored and developed. These new methodologies are then tested within the Household Financial and Consumption Survey environment specifically focusing on the elderly population. This new survey provides an extensive high quality database on household financial characteristics that are pivotal to transnational and sub-cohort focused analysis.

The analysis generates several results. The first is a tested framework of a multifaceted approach for describing wealth distributions. This approach counters the widespread habit of using summary statistics which do not fully describe distributions. The results also provide evidence for two distinct macro distributions of wealth within the countries observed. These distributions represent two ends on a spectrum which contains all the possible wealth distribution shapes.

The combination of developing new methodological tools of analysis and testing them within a new data environment contribute significantly to the field. These new tools will allow for a standardized view providing deep level analysis which is still applicable to a large dataset.

Keywords: wealth, inequality, distribution analysis, sociology, gerontology, demography.

iii. Preface and Acknowledgements

I would first and foremost like to thank my partner Loren Goslett for her continued support across moving cities, starting a job, buying a house and the myriad of enjoyments our new life together has created.

Thank you to my mother and father Mary and Graham for supporting me through university. I hope you may read this one day and feel proud of the accomplishment I have achieved and will achieve into the future.

David Neilson has taught me for over four years at the University of Waikato. He continues to be my teacher, debating partner and a good friend. David teaching and guidance is now a quintessential part of me and I hope that writing this thesis is only the first step of repaying an irreplaceable reservoir of wisdom I've received.

I would like to thank the University of Waikato for accepting me into the masters' thesis program. The University of Waikato was especially kind in awarding me with the Full Masters Research Scholarship for €12,000 which was pivotal in completing my thesis.

Lastly I would like to thank the European Central Bank for providing me with the opportunity to work with the latest Household Financial and Consumption Survey data.

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1. Introduction

Inequality is a topic which stains academics and politicians of the 21st century. It is arguably one of the most captivating and destructive economic forces. For much of the 20th century inequality was relegated to the offices of philosophy and fringe economists. However, in 2014 Thomas Piketty opened the flood gates on the discussion. His book *Capital* dragged the discourse of inequality further into the public sphere and opened the academic field into a frenzy of questions about wealth, income inequality and the chasm of problems facing academics when studying this subject area. However, a spectre lurks beneath the guise of inequality, a glacial and inevitable problem which haunts the developed world and its social fabric; population aging. Unfortunately many governments and politicians have chosen to avoid the question of population aging and leave it for another generation and the 21st century is now the chronological *cul-de-sac* of time in which an interlinked trio of issues converge.

Inequality is by no means a well-established or clearly defined concept. Cowell warns that inequality is a subject where a lot of energy can be spent arguing about terms because 'inequality' is not self-defining (Cowell, 1998, p. 1). There are no clear boundaries between equal and unequal but rather only degrees to which the general public and individuals think that the notion of inequality is too extreme. This epistemological problem of defining inequality is further exacerbated when measuring very complex and even dynamic concepts such as wealth. Because of this complexity there is a common failure to recognise, or knowingly conflate, wealth with income. Wealth, or net wealth, is the sum total of assets minus liabilities and fluctuates with market tides. Income, on the other hand, is the rate in which monetary value is gained either by participating in the labour force or through invested capital. Politicians and the media have conflated these two concepts under the blanket of inequality as if both problems were similar. Both problems are ones concerned with inequality but it would be like saying lawn bowls and Muay Thai are both sports. They are both rightly called sports, however other

than the taxonomy, they don't share any other qualities. There are further compounding difficulties when describing wealth distributions. One must take into account careful considerations surrounding the quality of data, the methods used, the population sampled and other external variables which *will* affect the end result.

This thesis explores the levels and compositions cross-nationally of the elderly population. It provides a multidimensional approach to demonstrate the distributions of wealth across 15 European countries. A large part of the multidimensional approach involves developing new methods of analysis to tackle an underdeveloped and summary-based approach to analysing wealth distributions (Cobham & Sumner, 2013; Murtin & Mira d'Erocole, 2015; Sierminska *et al.*, 2006). Summary statistics, such as the Palma ratio or the GINI, are two examples of many different metrics which are weighted and represent a skewed perspective of a much wider picture (Best, 2012, p. 131). Therefore, the development of new methodologies is intended to expand upon a limited size of academic literature and provide a greater insight into the nature of inequality at both the transnational comparative level and national level. The thesis' contribution expands upon wealth analysis to draw an overarching conclusion that the wealth-distribution characteristics of the European elderly population can adequately be described within two distinct wealth-distribution types. The population-based distribution graph produces two distribution types which are referred to as 'U-shaped' and 'Slope-shaped' distributions. The U-shaped distribution, as shown below, describes a wealth distribution in which the ratio of the rich and poor is significantly polarised and a hollowing out of the middle wealth ranges occurs.

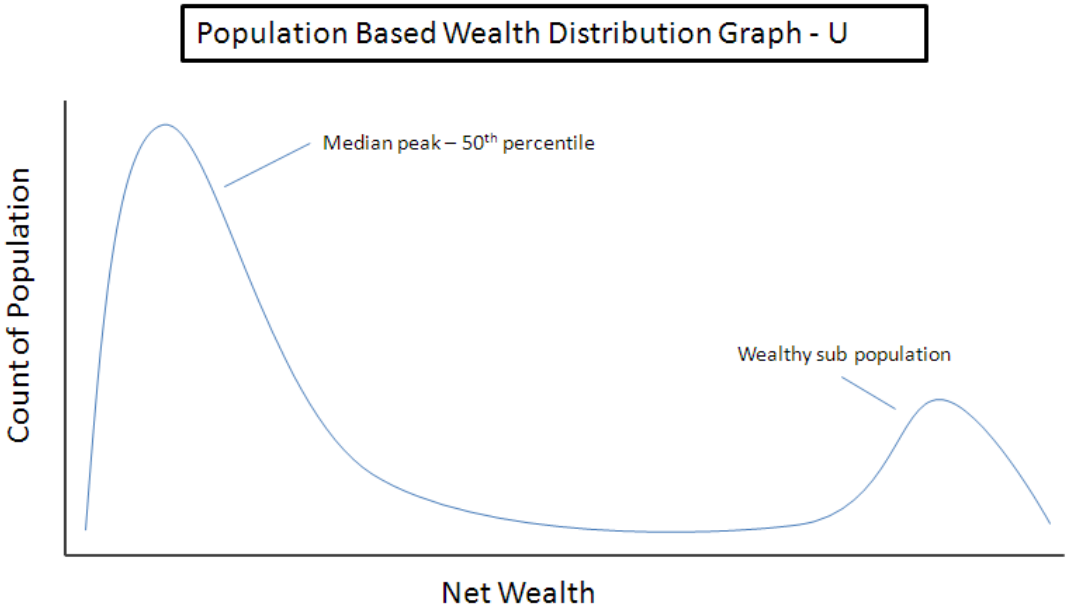
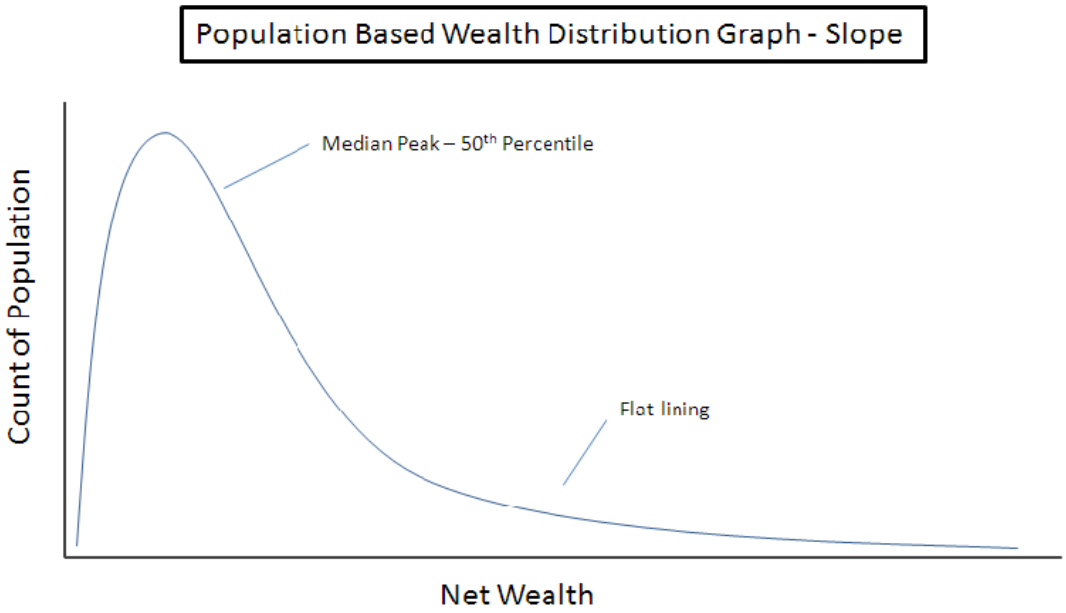


Figure 1 - Example of U-shaped distributions.

This provides a baseline measurement of the ratios and shapes of the differences between the wealth ranges in societies by showing how the total population is distributed across the lower and higher wealth ranges. A U-shaped distribution provides the ideal example of a polarised country.

Figure 2 - Example of Slope-shaped distributions.



The Slope-shaped distribution, as shown above, is one in which the vast majority of the population is centralised around a typically low level of median wealth. It describes a largely centralised peak of population

followed by a slope of decline which flattens out into the higher wealth ranges. This combination results in a graph which has one steep upward slope followed by a smooth downward slope and the measurements of these slope gradients take the form of further enquiry in the thesis. The Slope-shaped distribution provides the ideal example of a non-polarised country.

As early as 1951, in the midst of the baby boomer generation, Moor *et al.* and Kern write about the rapidly changing ratio of elderly to young and over the last six decades, their fears and warnings are now being realised (Moor *et al.*, 1952, p. 57; Kern, 1951). Mortality, life expectancy, fertility are the main components in the aging of modern populations and the primary drivers of much demographic change for the 21st century. Manton *et al.* and Carnes and Olshanksy have long contributed to the arguments which suggest that average human life expectancy will reach 100 towards the end of the century in some developed countries (Sonnega, 2006; p. 6, Manton *et al.*, 1991; Carnes & Olshanksy, 2007, p. 376). Secondly, declining mortality rates within the elderly population, as Christensen *et al.* note, will generate enormous pressures regarding the total net population of the globe (Christensen *et al.*, 2009, p. 1201). Thirdly, fertility has been a declining throughout all developed countries (Lutz *et al.*, 2001, 545). These three primary factors should be enough to see just how far skewed the notional dependency ratio between the young and the old will become in the future of Western countries. If the reason of economic uniqueness was not enough cause for intrigue when investigating the elderly population, then surely the looming spectre of structural aging will be. The elderly population, not just because of its sheer size is becoming an increasingly important sub-population to understand. The ramifications for this new found knowledge could impact the complete public sector expenditure, health care and retirement funds, just to name a few (Demeny *et al.,* 2003; Eberstadt, 1997).

Wealth distribution analysis with a specific focus on the elderly population has solemnly been neglected within the academic literature. Further, this research at a transnational level is devoid of any real contributions. There are cross-country analyses using wealth micro data,

however these papers do not focus specifically on the 65+ population and therefore overlook many of the features which are characteristic of only the elderly (Frick & Grabka, 2010; Sierminska *et al.*, 2006; Skopek *et al.*, 2014; Christensen, 2009). This thesis is attempting to cover and combine different subject areas of economics, demographics, political economy and sociology into a multidisciplinary paper which can present a substantial case for new approaches to wealth distribution studies and the visualisation of data outside of the conventional spheres of thought.

As visualising the data, and developing new methodologies for analysis, are a large part of this thesis, it would be appropriate to describe the overall approach of the thesis in a similar fashion. Figure 3 shows a flow chart which displays the logical reasoning, outcomes and original decision aspects of the thesis.

As shown, the original thinking behind a hypothesis for this thesis is derived from a gap in both the literature and methodologies of studying wealth. This hypothesis served as a good investigation standpoint but morphed into a concept which drove the developmental tools established in the analysis section. An overarching pressure from the aging population then adds a dimension of importance with respect to the policy implications which this paper may help inform. The standardised population-based distribution graph is used throughout the thesis and from analysing the population-based wealth distribution graphs of the retired population there has been an identification of a polarisation continuum. This continuum measures the polarisation of wealth through the population-based graph which separates into two distinct ends. At one end are the slope distributions which have a very population in the high wealth ranges and a large mountainous population in the lower ends. The other end is the U-shaped distribution which still has the median peak of the population in the lower wealth ends but has a significant percentage of the population in the higher wealth ranges which forms a disparity of wealth between rich and poor. In this continuum there are, typically low net wealth countries, slope countries with a the vast majority of the population within a few wealth ranges versus the other end of the continuum which has

countries, typically high median net wealth levels, with many rich and poor simultaneously.

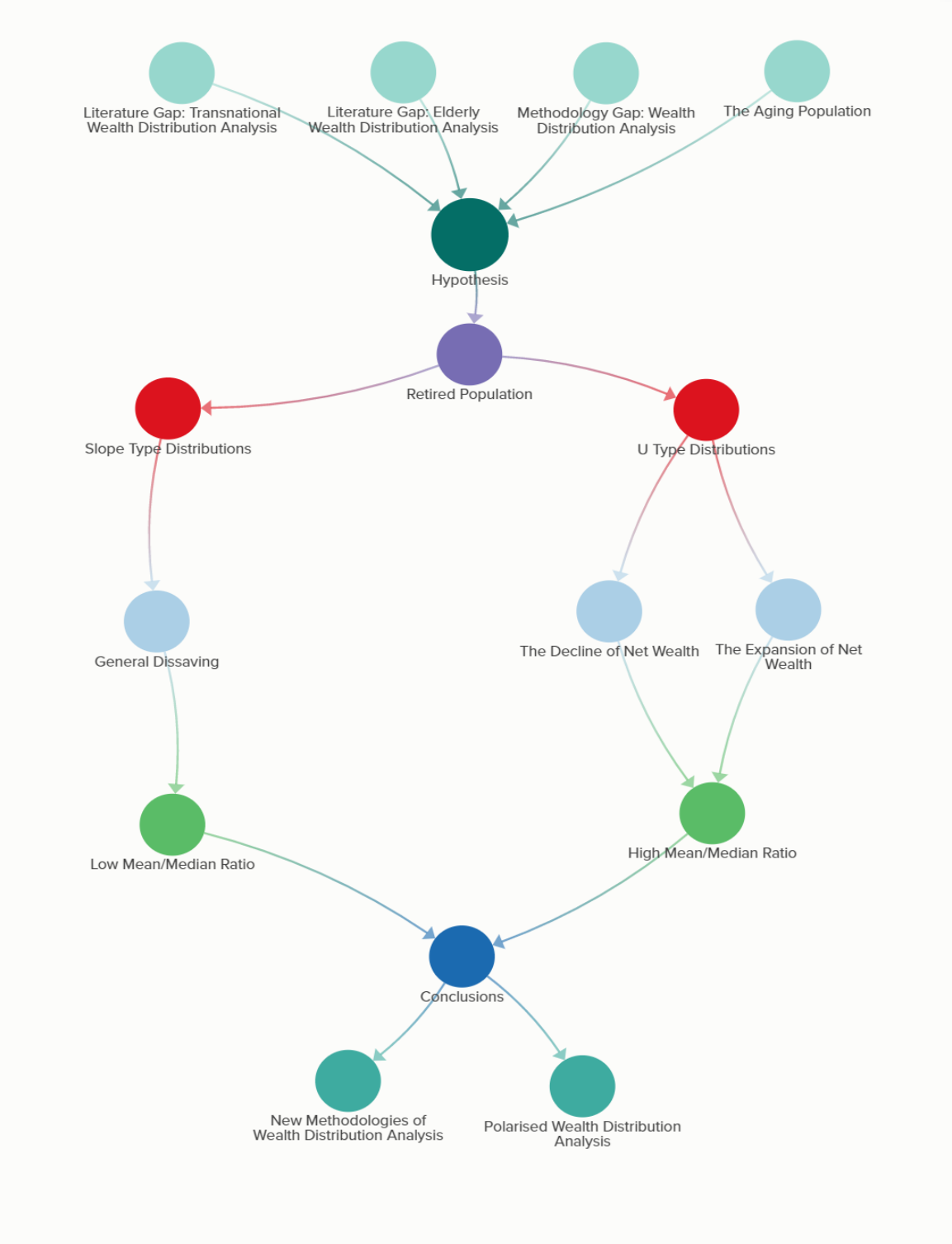


Figure 3 - Visualisation of thesis formation and organisation.

Given this continuum of polarisation, the process of retirement dissaving then affects all the population within the two distribution types. The

retirement entry levels of wealth in the U-shaped distributions allow the expansion of net wealth for the rich through their continual capital growth while the Slope-shaped distributions are affected by general dissaving at a systematic level due to their entry levels of wealth. Once these two types of wealth distributions have been discovered, the ratio of average/median net wealth for each country is then calculated. The results show a correlation between distribution type, median net wealth levels, and average/median ratios. These findings combine for the overarching conclusions of the thesis which offer new methodologies of inquiry and a converging divergence of wealth distributions types.

2. Literature Review

Inequality is an ambiguous concept. It is hard to define, describe and measure without inviting rigorous debate into the methodologies used and prescriptions prescribed (Atkinson, 1971; Cobham & Summer, 2013; Davies, 2008; Murtin & Mira d'Ercole, 2013; Piketty, 2014; Skopek, 2014). Wealth inequality is a topic which has potential implications for individuals from all walks of life. These implications, from a policy perspective, have the potential to impact both the global and national landscapes. The impact of wealth inequality today can already be observed within recent history with inequality levels today soaring to unparalleled heights in modern history and the public's concern matches this. The Occupy Wall Street Movement can be seen as one of the vanguards for inequality and public involvement. However while wealth inequality is at its height of public awareness, the subject area is a long-standing piece of political economy which has been touched on across the ages. Plato writes as far back as 380BC about the debate between Socrates and Adeimantus concerning wealth, poverty and virtue. Socrates explains "wealth and poverty, one is the parent of luxury and indolence, and the other of meanness and viciousness" in a manner related to the philosophy of justice and noting the unequal differences and sociological characteristics of two different wealth levels (Plato & Rowe, 2012, p. 277). In more recent times, Marx has described wealth inequality across several different accounts covering wealth inequality as a historical and systematic function of the capitalist system. Marx describes the historical influence of material status and wealth through the succession of generations and capitalist systems. "Men make their own history.... they do not make it under self-selected circumstances, but under circumstances existing already, given and transmitted from the past" (Marx, 1852, p. 5). He then later describes how wealth becomes centralised in the hands of few capitalists. "One capitalist always kills many. Hand in hand with this centralisation, or this expropriation of many capitalists by few.... economizing of all means of production by their use as means of production of combined, socialized labour, the entanglement of all peoples in the net of the world market, and with this, the international character of the capitalistic regime" (Marx,

1887). While Marx is describing the generative mechanisms, he is undoubtedly commenting on the distribution of wealth within the future capitalist model of development. These are but two examples of the steeped historical inequality debates that have endured across the two millennia; however the 21st century brings forward the era of data and with it comes a new playing field for sociological discovery. This literature review will focus on three particular areas of improvement. Firstly, it will describe a mainstream research theme dominated by the use of summary statistics which does by no means adequately describe wealth distributions but rather a narrow interpretation of relative inequality. Secondly, it shows the lack of transnational literature in the field, and thirdly it shows how the limited existing literature tends to focus on the population as a whole rather than specific age cohort distributions.

Needless to say, while the latest debates of inequality use cutting-edge data, which offer an ever more-sophisticated and positivist interpretation, the general field of studying wealth inequality is still in its infancy. While data is the primary asset, it's also the largest constraint, and the quality and quantity of data has, thus far, severely limited the existing pool of literature. This limitation of the field will show through when analysing the existing literature especially within the transnational analysis. Of the two major areas of inequality research, income and wealth, income inequality has a large breadth of academic literature whereas wealth inequality is still an emerging field of inquiry. Naturally, the underdeveloped field of wealth inequality is trending to follow the methods of inquiry of income inequality, however as new literature emerges to discuss wealth, there are many large areas for improvement (Beinhocker, 2006; Davies *et al.*, 2008; Frick & Frabka, 2010; OECD, 2013; Skopek, 2014). These areas of improvement have gained much attention due to the Amazon bestselling book *Capital in the Twenty-First Century* by Thomas Piketty, which almost single-handily brought the discussion of wealth inequality into the mainstream (Piketty & Goldhammer, 2014).

Any discussion concerning the history of inequality cannot proceed without discussing the late Anthony Atkinson. Atkinson was, and still remains the largest scholar of both income and wealth inequality since and

before the field was popularised. He has been one the most prominent figures within the subject fields of income and wealth and was acknowledged by his fellow academics. “Tony was the founder and godfather of modern scholarship on the distribution of income and wealth” – Thomas Piketty, “he recognised half a century ago that inequality would become the major issue of the day” – Joseph Stiglitz and “foundational and prescient” – Emmanual Saez (Chan, 2017). Atkinson has taken an active interest and devoted multiple papers and book to the development of inequality measurements and testing their validity. Arguably one of his most influential books was written in 1978 and titled *The Distribution of Personal Wealth in Britain,* where Atkinson examined the inheritance of tax records between 1911 and 1975 to describe changes in the distribution of wealth over time (Atkinson & Harrison, 1978). In this book he uses several different methods of explaining wealth distributions but typically Atkinson has taken a relative percentile-based approach using tables instead of visual graphs. This may have been limited by a paucity of graphical technology available at the time.

Atkinson draws upon much of what this literature review will tackle in the form of summary statistics. In his paper *On the Measurement of Inequality* page 253, Atkinson describes the current state of play in the literature of inequality debates.

> “Much of the literature was in fact concerned with the problem of choosing between the different summary measures [GINI], and such properties were discussed as ease of computation, ease of interpretation, the range of variation, and whether they required information about the entire distribution. However, as I have emphasised earlier, the central issue clearly concerns the underlying assumption about the form of the social welfare function that is implicit in the choice of a particular summary measure” (Atkinson, 1970, p. 253).

Here Atkinson essentially says that in the current literature, and any discussion of inequality, there are measurements which imply some kind of assumption in their creation which is ultimately bound to the welfare function in which they’re designed to describe.

As discussed above there is a common trend of using summary statistics as a blunt instrument which usually is constructed within a social fabric. This often misses, or is unable to capture, the subtle nuances and unique characteristics of any population's distribution and composition. Atkinson in 1973 accepts this as he writes, "The conventional approach in nearly all empirical work (to compare distributions) is to adopt some summary statistic of inequality... with no explicit reason for preferring one measurement over the other" (Atkinson, 1970, p. 244). Atkinson was referring to the GINI Coefficient in particular as it was, and is, arguably the most famous of all inequality measurements. The GINI, as developed originally by the Italian statistician and sociologist, Corrado Gini, plots the Lorenz curve against the 45 degree line of equality on a graph (Gini, 1921). An example of the GINI can be seen in figure 4:

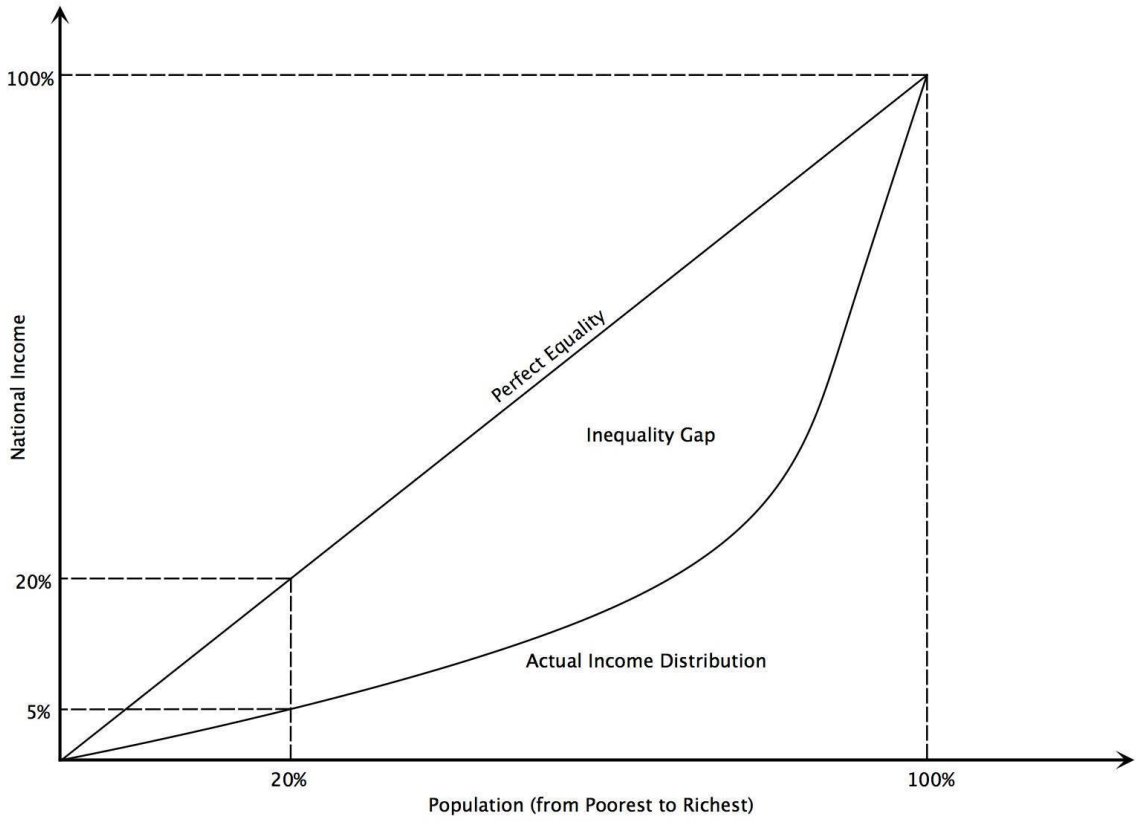


Figure 4 - Example of the GINI coefficient as derived from the Lorenz curve.

The ratio of the area between the lines of perfect equality and the Lorenz curve represents the coefficient. In this sense, Gini created a tool of summarising the total difference between the two lines as a statement about a given system's total distribution. This tool of summarising has proven to be one of the most prominent measurements within inequality.

One of the difficulties seen within the literature is describing the complete spectrum of wealth inequality. This is to say providing an accurate and relevant series of informative graphs and numerics which together produce a multifaceted description. The combination of multiple views clarifies, complements and covers the widest range of the population and yet should still be reproducible across a large range of studies. This view of multiple measurement points is often lost in the limited amount of transnational wealth inequality literature, where most authors opt for a single, standardised summary statistic for every country which severely limits the conclusions and only reinforces the subjectivity of inquiry (Davies *et al.,* 2008; Skopek, 2014). Regardless of which summary statistic is chosen, most if not all of the summary statistics, taking GINI as an exemplar, fail to *describe* the micro elements of a given distribution. Two countries, as shown by Cobham and Sumner may have different GINI coefficients and simultaneously have different underlying distributions. Many other scholars have demonstrated similar effects (Cobham & Sumner, 2013, Duro, 2008; Frosini, 2012; Greselin, 2013; Atkinson, 1973).

Cobham and Sumner in 2013 offered an alternative to the GINI coefficient using the Palma and the GINI coefficients together (Cobham & Sumner, 2013, p. 2). Their alternative is brought out of the long-standing criticism of the GINI in which they describe that the GINI is not explicit in its underlying effectively *normative* assumptions about inequality (Cobham & Sumner, 2013, p. 17). Their second argument against the GINI coefficient, which they used, existing countries data for, showed that the GINI coefficient's weighting is insufficient and focuses on the wrong ranges of the income. Murtin and Mira d'Ercole agree with the GINI's shortfalls and add that it does not account for negative or zero sum levels of wealth (Murtin & Mira d'Ercole, 2015, p.4). What Cobham and Sumner argue is for the hybrid GINI/Palma model which simply places the emphasis at a different end of the distribution spectrum. In their words, "We would argue that the Palma should be strongly preferred as being 'over'-sensitive to changes in the distribution at the extremes…since this is what matters to policy makers" (Cobham & Sumner, 2013, p. 25). In their argument, simply changing the weighting solves the problem, however it does not address the very problem of summary statistics they quote from

Atkinson and thus still does not address the problem of describing a complete picture of wealth distributions.

There are many other means of describing wealth inequality and Desilver highlights some other metrics in an article he wrote titled *The many ways to Measure Economic Inequality* under the pew Research Centre in 2015 (Desilver, 2015). The first of his metrics is a percentile-based approach which essentially breaks the population into different percent ranges and shows how much relative wealth they account for. For example, Desilver uses data from a paper by Wolff to show how much wealth the bottom 0-40%, 41-60%, 61-80%, 81-90%, 91-95%, 96-99%, and top 1%, account for out of the total wealth pool examined (Wolff, 2016). While the results of this study are interesting, what is more interesting are the decisions which have been made beforehand to emphasise specific areas of the wealth spectrum; these show a greater importance placed on the top 10 percent as they account for the highest relative wealth. On the other hand, and arguably more importantly, on a relative population count, is the bottom 40% which seem to be all treated as equal, while they account for the lowest amount of wealth they account for the largest percentage of the population. It appears therefore that Wolff and Desilver agree that the percentage-based approach and level of depth when describing wealth distributions should be prioritised by relative wealth accountability rather than population.

Another contemporary method of wealth distribution analysis is the median and mean levels of net wealth. This can be seen across many different papers, all of which use either the median or mean as an important variable, and some point out the difference between the two (Atkinson, 1970, p. 247; Cowel, 2004; Davies *et al.*, 2008; Murtin & Mira d'Ercole, 2015; Skopek *et al.*, 2014; Weil, 1994). Atkinson has used the median and mean measurements in both of his papers from 1970–1971 and this represents some of the earliest work in the field. However moving forward into the 21st century and in the very recent years, the measurements of inequality do not seem to have progressed very far - this is likely due to the statistical standards rising considerably faster than the capturing of data and the sudden resurgence of inequality concern.

Academics, such as Murtin andMira d'Ercole, Skopek *et al.* and Cowel, make little attempt to engineer new methodologies and seem to rather focus on the implications of the information. There are no real 'go to' textbook methodologies to describe wealth inequalities and the academic field is yet to come to a consensus, outside of the GINI arguably, as to how descriptions of inequality can be created outside of the standard macroeconomic viewpoint of aggregate sums and single variable depictions. Despite Atkinson's attempts to push new inequality measurements, yet Atkinson clearly had an interest in methodologies, the field does not seem to have moved very far and, if it has moved, only seems to be interested in the summary side of statistical analysis.

As wealth inequality is in its infancy as a subject field, there still remain many large gaps of research. One of these areas is the lack of transnational analysis of wealth compositions. Typically, due to the availability of data, the wealth distribution literature has focused on the national level and on the population as a whole. Some recent notable authors and examples of nationally focused work can be seen by Keister, Skopek and Stiglitz (Keister, 2000; Skopek *et al.*, 2014; Stiglitz *et al.*, 2015). Murtin and Mira d'Ercole have provided a brief look into how countries wealth distributions compare against each other in an OECD report titled *Household wealth inequality across OECD countries: new OECD evidence*. Their paper uses data from the new OECD wealth distribution database released on 15 June 2015 and encompasses 18 countries out of the total 35 in the OECD (Murtin & Mira d'Ercole, 2015, p. 2). Murtin and Mira d'Ercole analyse the 18 countries across multiple simplistic economic household measurements, these include: mean and median net wealth, wealth shares of the top percentiles, average net wealth by quintile and household debt levels. These indicators are common among the limited number of papers which provide transnational analysis (Davies *et al.*, 2008; Murtin & Mira d'Ercole, 2015; Sierminska, 2006). Murtin and Mira d'Ercole's primary findings are that the impact of the 2008 financial crisis on household wealth in that the mean net wealth per household has changed in very different ways across different countries. They also find that the median net wealth has fallen in the United Kingdom while the top percentiles have risen. In their short

conclusion, the authors comment that “wealth is a critical element of household economic resources, but also one where availability of comparable data remains severely limited” (& Mira d’Ercole, 2015, p. 7). These comments match their level of depth within the analysis. A similar example can be seen in a paper by Davies *et al.* titled *The World Distribution of Household Wealth – Personal Wealth from a Global Perspective* which attempts to provide a global wealth composition view however lacks much depth. In their paper, Davies *et al.* use data partially and fully covering 39 countries. Of these 39 countries, 61 percent of the world’s population is accounted for in the year 2000, which the authors estimate encompasses 80 percent of the world’s total wealth. The data is often constructed in conjunction with Flow of Funds data or the National Accounts which Davies *et al.* argues provides a solid foundation being rooted in government statistical agencies. It is interesting to note Davies *et al.* optimistic tone given that many authors cited within this paper have much higher qualities of data and still express many doubts about its reliability (Bank, 2016; Davies *et al.*, 2008, p.22; OECD, 2011; OECD, 2013; Piketty, 2014; Skopek *et al.*, 2014). Despite this, Davies *et al.* conclude that if the current trend of wealth inequality continues to grow, the bottom deciles in the world wealth distribution may become increasingly dominated by Africa, Latin America and low-income Asia-Pacific countries. This is in contrast to the fast growth by European countries in recent years which will increase upward movement. Davies *et al.* come to these conclusions via several inequality measurements. Quite often they have used the GINI coefficient as a means to measure differences between countries but also take a realistic approach to their wealth description too. They have separated the countries into their different monetary levels by using wealth per capita in USD (transferred with real exchange rates),however this does not account for the relative Purchasing Power Parity, commonly known as PPP. Much of Davies *et al.’s* work uses the relative measurements between countries to show their wealth encompassment for the relative top 5%, 1%, and 0.1% percentiles as a means to show some analysis for national compositions as well. Davies *et al.’s* paper shows how a construction and synthesis of data can provide a shallow but very wide level of data analysis although it

demonstrates the limitations of distributional analysis as it lacks the deeper understandings of individual countries.

The lack of transnational and comparative wealth distribution analysis has been highlighted within the existing literature. However in addition to this, there is a distinct lack of literature concerning the elderly population. Within the field of wealth inequality research, the studies mostly use the entire population set as a whole when describing their levels of inequalities. An example of this can be seen by Keister who uses American national data in 2000 and uses the general population as a basis for all the analysis. This is but one example of a wider range of studies which do not stratify the age cohorts into different population sets and, in fact, almost every paper cited in this literature review does not focus on specific age cohorts or ranges (Atkinson, 1970; Cobham & Sumner, 2013; Cowell, 1998; Davies *et al.*, 2008; Gini, 1921; Keister, 2000; Murtin & Mira d'Ercole, 2015; OECD, 2011; OECD, 2013; Piketty & Goldhammer, 2014; Stiglitz, 2014; Wade, 2014). There are several reasons why one may choose to include the full spectrum of age ranges and these may include: sample size, continuity, homogeneity and applicability to a wider range of audiences when the whole population set is included. It is difficult to cite from the literature why wealth-distribution analysis has not progressed into the specific fields of age cohorts or ranges because no scholars appear to be discussing the combination of these two issues. The issue of demographic structural aging and its effects on modern Western society is a hotly contested and debated field, especially with the implications being raised by the European Central Bank and many other scholars (ECB, 2012; Christensen *et al.*, 2009; Eatock, 2015; Harper, 2006; Murphy, 2010; Nyce *et al.*, 2005). While there is a large amount of literature on the aging of populations or within the fields of gerontology and demographics, there have been no attempts to marry the two fields together into a study of wealth distributions amongst the elderly. This represents both a literature gap within the knowledge pool of academia, and a fruitful exploration into what insights can be learned by studying this age group especially across national borders.

This literature review examines the existing academic writings within wealth-distribution analysis. There has been a deliberate effort to source wealth-distribution analysis with three specific aspects in mind, these are: wealth distribution methodologies, transnational wealth distributions and elderly wealth distributions. After reading this literature review it should seem clear that there is a distinct lack of research being done in these areas. There is yet to be a paper which brings all three of these central aspects together into a transnational analysis of a specific age range whilst developing new methodologies to fully describe the complete spectrum of wealth.

The literature review leaves several questions the thesis will attempt to answer, how can a multi-faceted wealth distribution framework be developed? How is wealth distributed among the elderly populations of European countries? And, do any overarching patterns of wealth distribution emerge from this analysis?

3. Methodology

The following section is purposed to provide the technical aspects of the database used and to also discuss the methodological vision of the new developmental. Specifically, these developmental methodologies can be separated into five distinct areas: the population-based wealth distribution graph, the rate of decline, the percentile-based wealth distribution graph and the mapping of relative increases between decile ranges. While there are many different methodologies throughout this thesis, the analysis comprised in the content section covers the main developmental areas.

3.1. The Household Finance and Consumption Survey (HFCS)

The analysis and testing environment of this thesis is constructed using data from the Household Finance and Consumption Survey (HFCS). Specifically, this thesis uses data from the second wave surveyed between 2013-2014 with the most common reference point being the year of 2014. The HFCS survey provides detailed household level statistical micro data on a very large range of variables covering areas including: demographics, real assets and their financing, other liabilities, private business/financial assets, employment, pensions and insurance policies, income, intergenerational transfers/gifts and consumption (ECB, 2013, p. 27). Overall, these categories combine for almost 180 different variables with roughly 150 core variables and 30 derived variables. The HFCS in 2013 surveyed over 84,000 households and the sample ranges in each country vary from 990 to 12,000. Of these 84,000 households, 14 countries are observed including: Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia and Slovenia.

The HFCS conducts over sampling to compensate for the lack of respondents found in the richest 10% of the population. The survey metadata information guide discusses their methodology for over sampling

and adjusts accordingly when oversampling has been identified and when under sampling exists. Alongside under and over-sampling, the HCFS uses additional methods to ensure the best possible coverage of households with the highest quality of data. However despite these advanced methods, a paper produced by the European Central Bank (ECB) in December 2016 noted that:

> "A key challenge for all wealth surveys is that wealth distribution is highly skewed: very large amounts of assets, especially financial assets, are owned by a small fraction of wealth households. Such households may be insufficiently represented in the survey, either because they are not easily accessible or because they refuse to participate. In this case, the survey will tend to *underestimate* the wealth of the wealthiest households (Bank, 2016, p. 8)."

Despite the high concentration of wealth being held within a particularly small subset of a countries' population the HFCS has high confidence that the data set is adequately weighted by using other reference sample data as well.

To apply for data from the European Central Bank one may visit their website under the economic research section. It can be found here: https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html

To then gain access to the data one must fill out the "Eurosystem household Finance and Consumption Survey Research Dataset Request Form" under the "Access to the Data" field. Once this form is downloaded it should then be submitted to the European Central bank via email. The research form asks questions of identification, research plans, use of research results, and identification of the research funding sources, security of the data, terms and conditions for the data usage of the data, additional required documentation and correctness of the information. Once this has been reviewed by the European Central Bank committee and the references have been checked, the user is then notified and asked to send a signed hard copy to the European Central Bank in Brussels to validate its legitimacy. All things considered, working with and obtaining the secure data from the European Central Bank is a process

which can take a lengthy period of time and is by no means given to all whom apply.

Where applicable, the values reported in the HFCS are in Euros and the information is provided solely by the respondent.

The data supplied from the HFCS survey is too large to manage within a modern spreadsheet format. For this reason the program *R x64 3.3.1* has been used to perform the database sculpting. This tool further allows for analysis of characteristics and variables with packages of statistical analysis which have been applied briefly in this thesis. The visual graphs have been largely produced by a program called *Tableau 10.1* aside from the flow graphs which have been produced by *Kumu*.

3.2. Analysing wealth distributions: a multifaceted approach

One of the key overarching methodologies of this thesis is the idea of a multifaceted approach to understanding wealth distributions. A multifaceted approach differs from the typical positivist approach in that there is not necessarily one source of truth or optimal answer for any given description. This is particularly relevant to wealth descriptions where there are multiple variables, contentious points of importance and questions such as “What is a given country’s distribution?” and “What are X’s levels of inequality?” which do not necessarily have a clear answer.

There is an underlying usage of summary statistics which Atkinson points out as well. He writes that the conventional approach to discussing wealth inequalities is to use such standards as the GINI, a relative index, Palma ratio, and richest one percent as effective means to describe what the reality of the entire spectrum is (Atkinson, 1970, p. 253). Needless to say, a complete description is neither: the one percent, the difference between the Lorenz curve or the relative difference between percentiles but rather all of these views, or their counterparts simultaneously which implies a multifaceted approach.

Ideally, a multifaceted approach would have several standard templates of analysis within it. The idea being that each country of interest would be effectively *parsed*[1] through these multiple methods of analysis and provide a rich, comparable, complete, description of relative and absolute understandings of any given country. This is used in the thesis by examining each of the fourteen countries across essentially three different templates, these templates include: population-based graphs, relative based graphs and relative increase graphs. Each of these graphs is then layered with additional analysis using common data analysis techniques in a comparative nature to then cross examine countries against one another. What this technique of inquiry does is:

1) Provide an objective base-line assessment through standardised templates of analysis;
2) Provide complementary views of analysis;
3) And describe the *entire* distribution of wealth with emphasis not obviously on any one given characteristic or sub-population.

The combination of these three primary attributes for the multifaceted approach is one of the core goals of this thesis. Developing this approach, the new methods of distribution analysis, and using them in a new environment of data will be a test of this concept and will hopefully show how viewpoints not only adds quantity to the description, but also enhances the quality of the description as well.

[1] Referring to computer programming usage of the word *parse*.

3.3. The population-based wealth distribution graph: aggregating past one million

The population-based wealth distribution graph is a staple throughout this thesis and it is used as the first '*go-to*' visualisation of the polarisation of wealth within a given country. The graph's main strength is the clarity and information scope it portrays, not only for the complete wealth distribution spectrum but also for polarisation too. As shown below in figure 5, the total count of the population falling within each wealth range is represented by the height of each column on the Y axis and the value of wealth range, which the count falls within, is represented on the X axis. The visual impact produced by this graph is just as important as its mathematical calculations. In a sense visualising and calculating do arguably describe the same picture however the visual format creates an easily interpretable and non-summarised view of wealth. Additionally, the marker indicating the median simply shows where the 50th percentile of the population resides.

Portugal's household population based wealth distribution of elderly population 65+

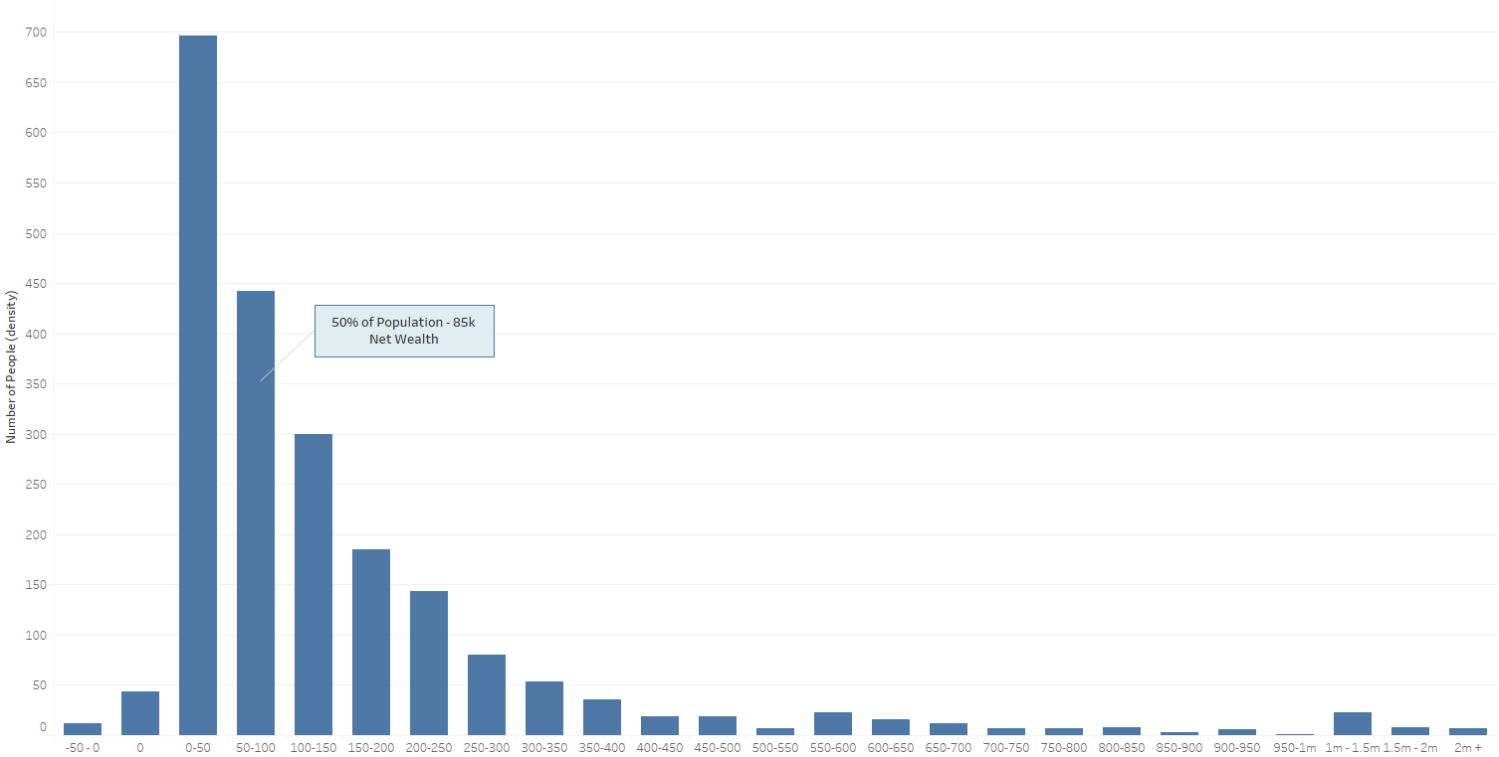


Figure 5 - Example of population-based wealth distribution graph: Portugal.

Some may rightly raise the point that the population-based wealth distribution graph is subjectively created to assess wealth distribution in a

particular manner. This is true, to an extent, however the multi-facetted approach encourages a diversity of views and emphasises the combination of these views for emergent points of analysis. Atkinson notes earlier in the literature review alongside Cobham & Sumner that all statistical measurements essentially emphasise one or more perspectives, however with the population-based wealth distribution graph the perspectives along the X axis are clear as opposed to many summary statistics which do not demonstrate their statistical micro data alongside their results (Atkinson, 1971; Cobham & Summer, 2013). However, the critique of the population-based approach is still of course a valid point but there are significant means for this decision which encompass aesthetical, sociological and epistemological pragmatisms.

The first important point to raise is one of pure aesthetical value. Wealth, as compared to income, encompasses a significantly larger range of possible values. To begin with, it can hold negative values but most importantly it is very common to have over 500,000 unique counts of data points spread across an extremely high maximum value and thus the counts of data points are equal to the unique count of data points. It becomes impossible to visually represent data with such high variance and unique counts because of the limited spaces when conveying information along the X axis. It goes without saying that the information and research must be conveyed in a reasonable format to actually be digestible. An extreme example of inappropriately displaying information would be a graph which only contains bin sizes of 1 (1 euro ranges instead of €50,000 used in this thesis) which would stretch the X axis the entire length of a building. In that example the information is portrayed in perhaps the highest granularity but is not interpretable. On the other hand, there is a possibility to increase the ranges in which people fall, to double them to €100,000, however this would deduct most of the detail and considering that the majority of the population falls under, in most circumstances, the €300,000 range, it would seem unacceptable to glaze over the majority of the population for the sake of a higher max range. Given these two positions it appeared that a €50,000 'bin'[2] size gave

[2] Tableau 10.1 uses the word 'bin' interchangeably with the word 'range' when constructing graphs.

enough detail and yet retained a large enough range to show density changes in the population in a digestible format.

3.4. Percentile-based wealth distribution and relative increases

The percentile-based wealth distribution graph is another staple element used throughout this thesis in parallel with the population-based graph as the baseline examination of each country. This graph contributes a relative description of wealth to the multifaceted approach and specialises in displaying the relative differences between each decile range. It is the best qualified graph for describing the total wealth within a system and how much of that total wealth is controlled by certain percentile groups. What this graph does not do is describe, in *absolute* values, the net wealth levels held at any given unit of measurement. In this sense, the percentile graph provides rich analysis into the relative differences of wealth concentration while the population graph excels at population density and *real* wealth levels.

As shown below in figure 6, there are percentile ranges each encompassing 10% of the total population. The height of each column represents the total net wealth accounted for its corresponding percentile of the population. The percentile approach is based upon sorting the population into its ascending net wealth values and effectively ranking. On the X axis are the percentile ranges from 0-100th with their respective aggregate wealth levels on top of each column.

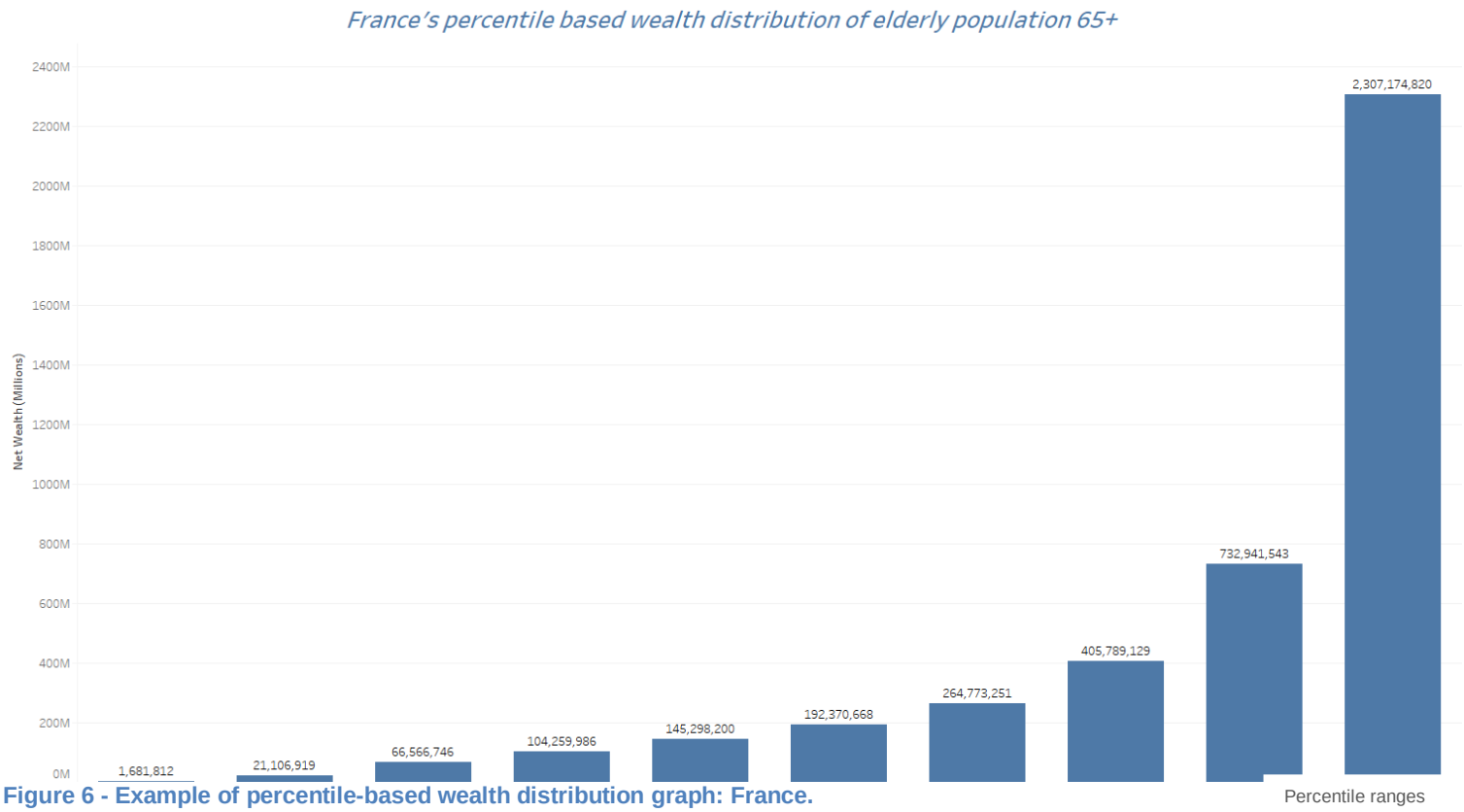


Figure 6 - Example of percentile-based wealth distribution graph: France.

As inequality is fundamentally intertwined with the relative differences between sub groups it is a natural course of inquiry to investigate the differences between the decile ranges. This is conducted by calculating the relative differences of net wealth held within each decile range. This method of calculating the relative increase begins by examining a percentile wealth distribution profile of any given country. The result can be seen in the calculations provided below:

Table 1 - Example of relative increases between decile ranges: France.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**1155%**
11th-20th -> 21st -30th	**215.38%**
21st-30th -> 31st -40th	**56.62%**
31st-40th -> 41st -50th	**39.36%**
41st-50th -> 51st -60th	**32.40%**
51st-60th -> 61st -70th	**37.63%**
61st-70th -> 71st -80th	**53.25%**
71st-80th -> 81st -90th	**80.62%**

81^{st}-90^{th} -> 91^{st} -100^{th}	**214.78%**

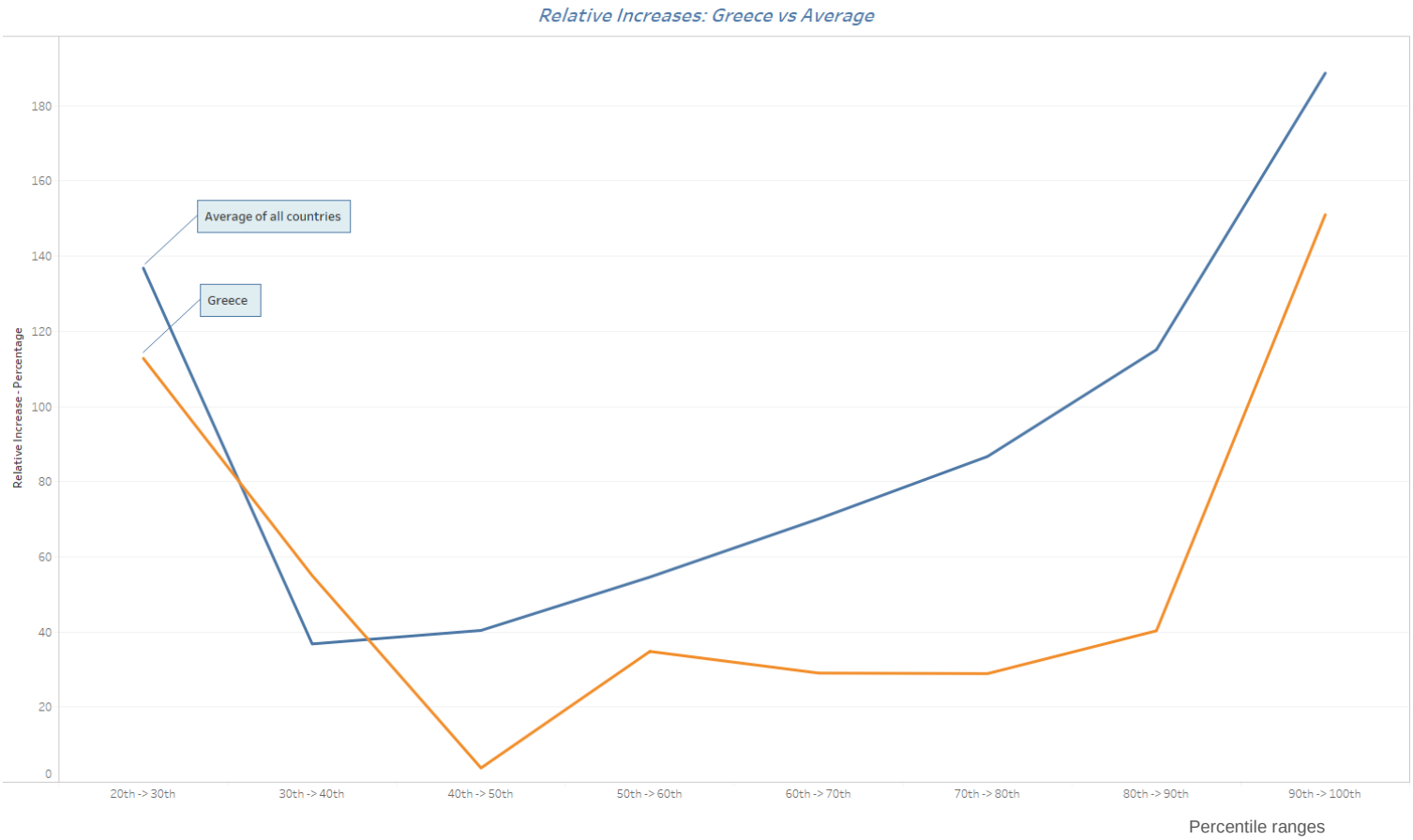


Figure 7 - Relative increases between decile ranges: Greece and average.

Figure 7 visualises the relative increases of Greece and the average of all 15 countries. Graphing the relative increases between decile brackets can prove to be a very interesting point of analysis as it effectively shows what the difference in aggregate levels of net wealth between any given deciles of the population are. However, the greatest strength of this graph is showing the comparative differences between countries percentile ranges. For this reason, the relative increases for each country have been shown alongside the percentile distributions graph to provide yet another element to the multifaceted approach to describing wealth distribution.

As shown above, both examples have very high initial relative increases. This is due to the lower wealth ranges being very low in total net wealth and having high volatility. For this reason, the comparison between the 0-10^{th} and 11^{th}-20^{th} decile ranges has been left out as it doesn't provide relevant information. After the early ranges, typically after

the 20th percentile, the increases between brackets begin their exponential increase from a relatively low base. Greece's relative increases are unusual as one may expect there to be a smooth exponential curve as the decile ranges increase however Greece appears to have sections of its deciles with very little difference (+/- 10% of the population). This demonstrates that there are sub-stratums of population with very little to no difference in net wealth to the preceding 10% of the population. This can be observed between Greece's 40th-50th percentiles and 50th-60th percentiles which only has 3.79% difference.

This method of comparative analysis provides one of the supplementary view points for a multifaceted approach. The relative increase graph has the ability of identifying sectors of the population with very little differences in net wealth while also being able to identify where the largest differences are. It is a tool which operates very much in contrast with the population-based distribution graph because it has the ability to show relative difference as opposed to absolute difference.

3.5. Calculating a Rate of Decline.

The concept of calculating a rate of decline is essentially a simple one. It involves taking the total decrease from the first initial peak of a distribution (usually on the median) until the flat line, or until the population density no longer increases[3]. Once total decrease in population density is established it is then divided into the sum of the elapsed or observed wealth spectrum. The Slope-shaped distrbuitons provide great test subjects due to their smooth curve and identifiable flatlinings (flatlinings here are taken to mean the negative Slope-shape from the first peak) however the U-shaped countries have often run into problems with identifying an appropriate flatline. The rate of decline is then calculated by taking the combination of X changing over Y peroid. This is to say that as net wealth decreases, it does so over a given population density

[3] With further work a threshold for the end point of capture would be established for the rate of decline. This may be on a percentile basis which would accommodate a distribution perfectly asymptotic to the X axis. It would enable one to definitely establish where the capture of the rate of decline would end by calculating whether or not the decrease was, for example, larger or not than one percent.

decreasing which provides a rate of population density falling as the wealth ranges increase.

The rate of decline could arguably represent a proxy representation of a the middle class (this representation depends on ones definition of the ‘middle-class’). If one were to concieve of the middle-class as the wealth ranges after the most densely populated range to the least populated range one would have an emperically workable definition. This argument has been accepted as an assumption, however one may also use the rate of decline as a means for measuring how ‘quickly’ the population density falls past a given point. This notion of how sharply any given country’s decrease is has the ability to yield some very interseting information. Assessing the different gradiants for different countries offers a comparative example of the relative inequality within systems. The three main points of analysis from this may include:

1) The ‘length’ of wealth needed to observed a decline from the most densly populated range to the least populated range;
2) The steepness of the gradiant, as shown by the rate;
3) The rate of decline which indicates the change in population density over wealth.

To emphasise this point further consider the following two examples which are abstractions of the population-based wealth distribution graph. In the first example shown by figure 8 in the graph below there are two countries, let these be country X and country Y. The hard filled lines are the *real* distribution of wealth ascending across the X axis and the count of the population, or could be considered as the density, is shown in the Y axis. The dashed lines are each respective countries rates of decline.

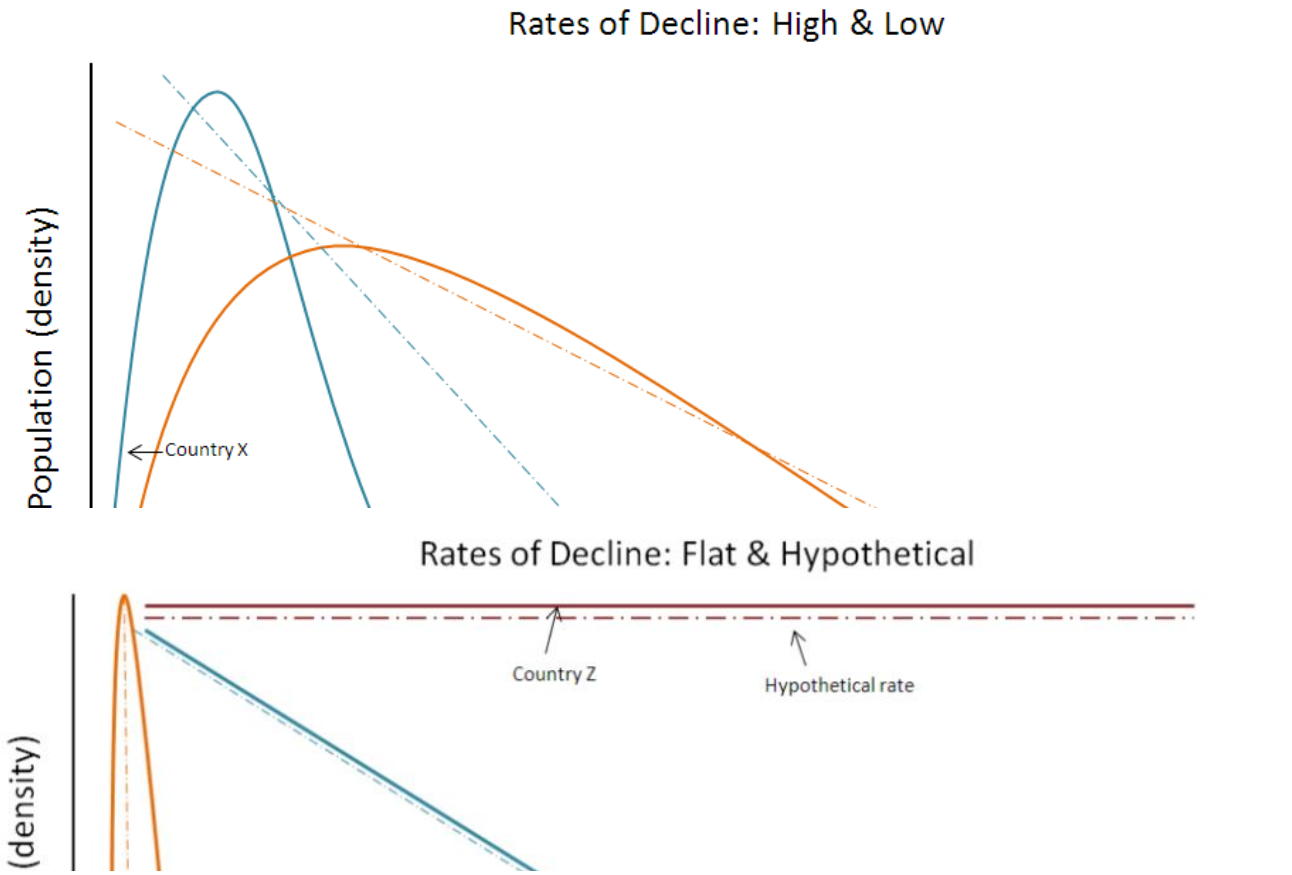


Figure 8 - Example of hypothetical rates of declines: high and low.

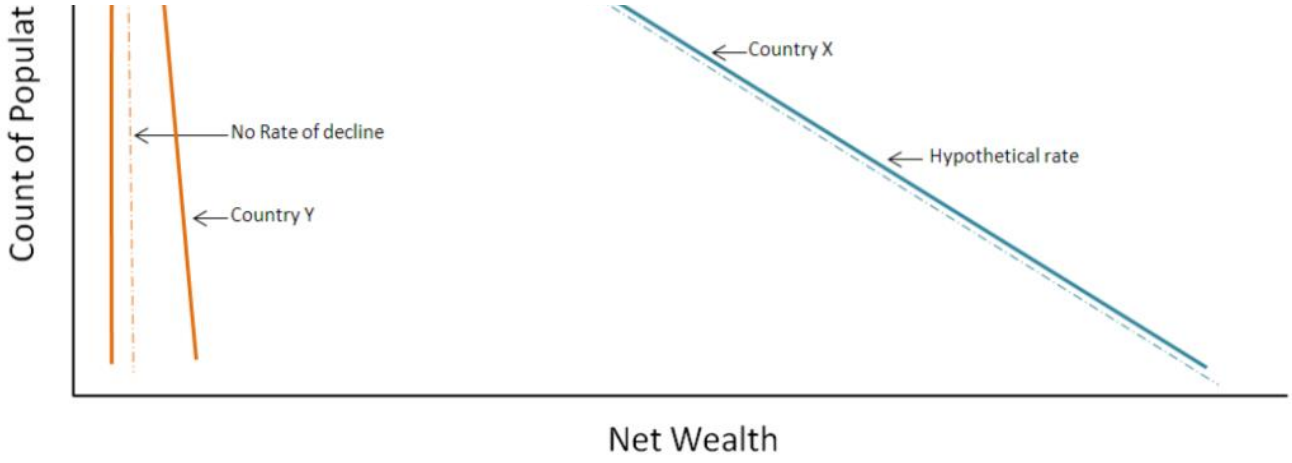


Figure 9 - Example of rates of declines: three hypothetical countries.

Country X, in the turquoise, is very similar to many Slope-shape countries. They typically begin with a high density peak which tails off into

the higher levels of wealth. Country X has a relatively high rate of decline of which the starting capture point is the top of the first peak and the point at which the tail end no longer increases. Compartively speaking, country Y has a more gradual rate of decline which is much lower than country X. This rate of decline means that for every additional €xx,xxx observed, x.x% of the total population will *not* have net wealth above the new threshold.

The next example in figure 9 instead uses three unusual hypothetical countries, called country X, Y and Z and for all intended purposes the graph uses the same X and Y axis labels. In this example, country Y has 100% of its population within one confined wealth range. For hypothetical purposes, propose that the range is €1,000 in which all the population resides with. It can then be seen by calculating the rate of decline that the country's rate is at the local maximum steepness and thus is a population of complete inequality. Country X may look similar to the Lorenz curve shown in the literature review section however it is not. The reason for this is that the Lorenz curve is percentage based whereas this graph is absolutely based. For hypothetical reasons, if one wanted to make a similar comparison to the GINI coefficient one could compare the difference between country Y and country X as one is of perfect equality and the other not. Country Z is similar to country Y in that it has no rate of decline as the density of its population does not change as wealth increases. Country Z has a perfectly equal relative distribution of its population *across* the wealth spectrum whereas country Y has a perfectly equal distribution of wealth across its *population*. These three hypothetical examples are interesting cases of some of the possibilities of wealth distributions and how a rate of decline could describe them.

A real example shown shown below will examines Portugal's distribution of wealth and the calculations for creating a rate of decline over a certain range of wealth. As it is highlighted, the calculation is concerned with the range of data beginning with the median peak and ending when a flatline has been observed. A flatline in this context is observed when the population density of any single bracket no longer increases. The concerned brackets for Portugal are highlighed in pink.

As described previously, calculating the rate of decline requires measuring the percentage decrease from the central peak to the flatline. In figure 10 below the columns highlighted in pink show the selected wealth range that observes the decline. This wealth range is from €0 -> €450,000 and across this range the population declines from 696 to 19.The total change within these wealth ranges is 97.27% - table 2.

Table 2 - Portugal's rate of decline.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€0	€450,000	€450,000	97.27%	0.216% per €1,000

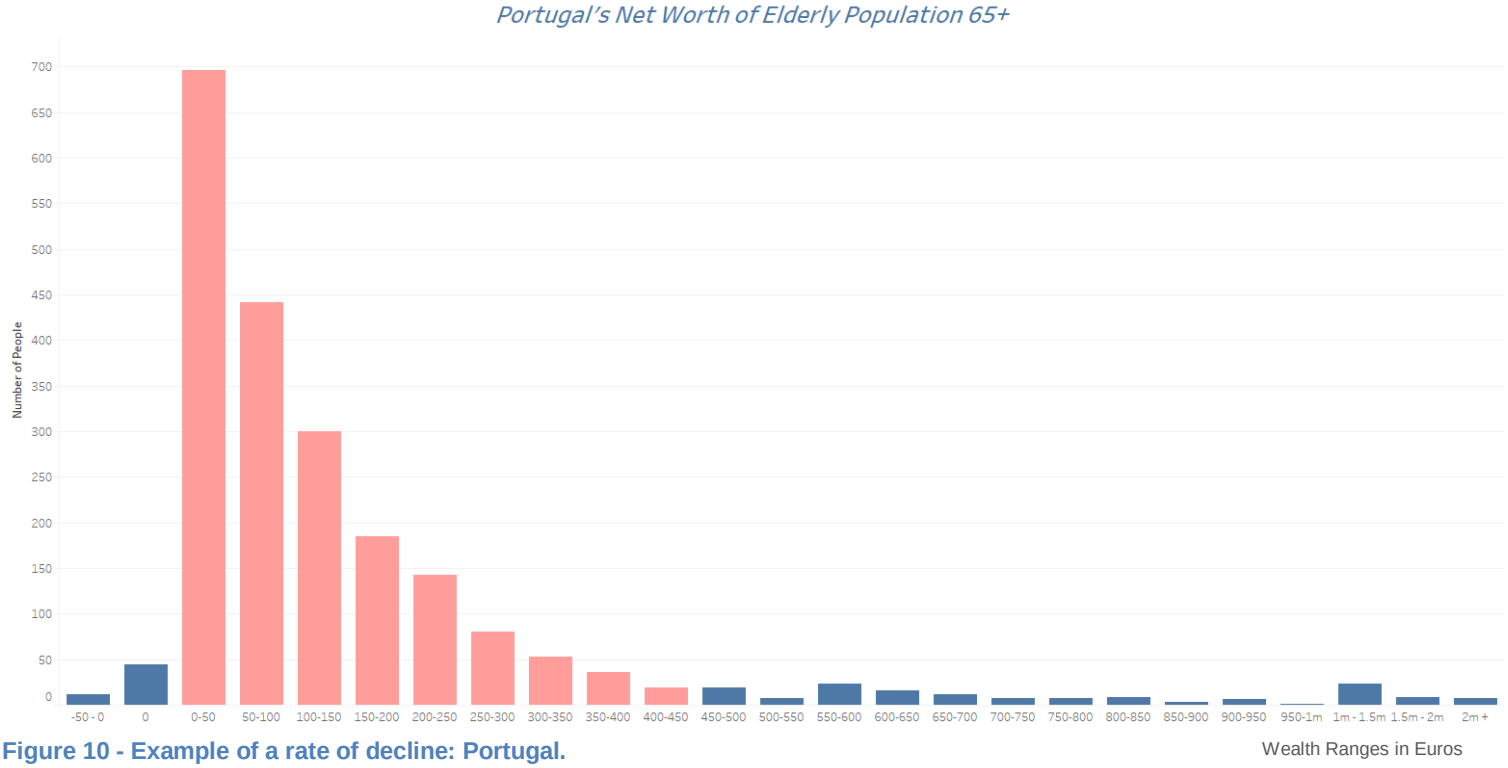


Figure 10 - Example of a rate of decline: Portugal.

As shown in table 2, Portugal's rate of decline per €1,000 is 0.216%. This may also be calculated another way by swapping the denominator with the numerator. This would provide a figure of €4,626 per 1% which means that it takes €4,626 to decrease the population density by 1%.

This measurement of a rate of decline easily shows how powerful a calculation like this is. It has the potential to mathematically say how much of an impact differences in wealth would have on any given population and how wealth is distributed after the median peak.

4. Analysis & Results

The following chapter is purposed to outline both the overall and singular wealth distributions across Europe in the available countries. The datasets covered in this chapter comprise of 15 countries which participated in the HCFS survey conducted in 2014. Slovakia has been omitted from the population-based wealth distribution analysis because of its small sample size.

The following chapter establishes a two type wealth distribution categorisation called the Slope-shaped and U-shaped distributions. The chapter is broken into three primary sections which contain within them the 15 observed countries. The first primary section is the U-shaped distribution countries and the second section covers the Slope-shaped distributions. Lastly, the analysis section ends with its key findings that provide a normalised comparative graph to compare the countries of the same distribution types and also an overarching graph to show the relative median and mean differences.

Each country in this chapter is introduced with its sample size, median age and median wealth. After this, there are no standardised description templates but rather the most interesting characteristics are described first and are then followed by general analysis.

Given this, this chapter is intentioned to be purely descriptive. This aims to provide the reader with an overall understanding of how the multifaceted approach works and the complementary nature of its design.

4.1. U-Shaped Distributions

The following section begins by examining France's elderly population's wealth distribution as the most concrete example of what is meant by a 'U' shaped distribution. In this thesis, the U-shape distribution is defined by having two distinct sections of distribution most commonly separated by a 'gap' in the middle. This describes a dichotomous wealth distribution between two sub groups of the population, those who have large quantities of wealth and those who do not.

The categorisation process involves assessing countries' overall shapes and also by the proportion of the latter aggregated brackets starting at one million and over. Of the U-shaped countries, the country with the lowest percentage of its population within the latter aggregated ranges is Cyprus at 12.61% of its population. In contrast, Italy which displays a distribution with only 3.8% of its population over one million euros net worth.

Drawing a line between one country and another does have subjective elements. This is because there really is no simple answer or solution to point where the line of relativity should be drawn, however, taking the first step is the beginning to establishing either a standardised or objective value. For the purposes of this thesis, there is a rough boarder of 10% in which a country must have at least 10% of its population in the over one million ranges to classify as U-shaped. This decision is being made in retrospect of generating the two classifications and is used to supplement the end decision which also takes into account the interpretation of the overall Slope-shape.

The raw count of the population and how it falls into each bracket is important, however so is the overall 'slope' or shape of distribution as well. The importance of any given country's slope of distribution becomes increasingly important when conducting research from a transnational perspective. When viewing from a macro perspective it is necessary to generalise the data to the same degree and analysing the different overall shapes allow fast and detailed visualisations of any given country's distributions.

4.1.1. France

France's household population based wealth distribution of elderly population 65+

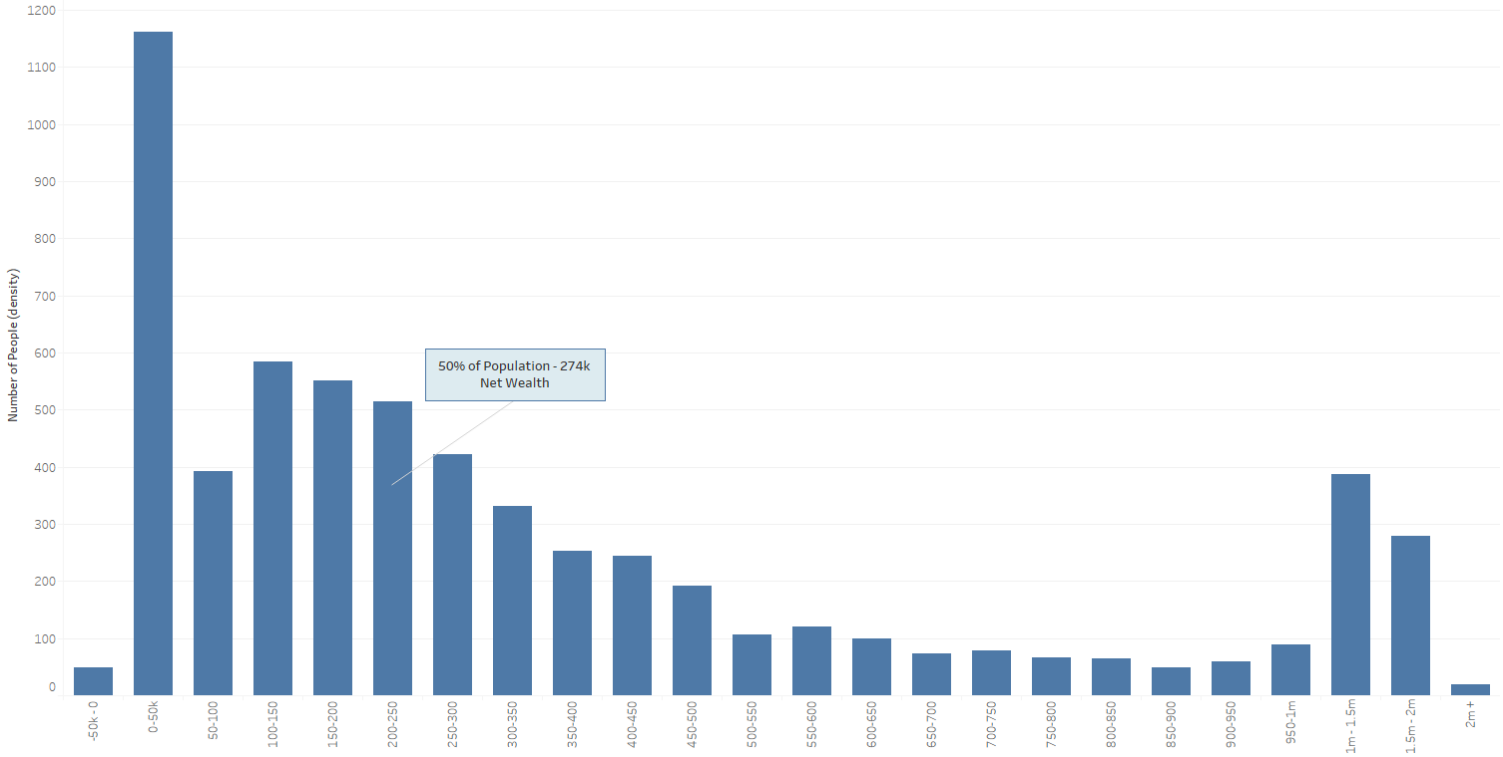


Figure 11 - France's household population-based wealth distribution graph. €270,000 median net wealth.

Figure 11 observes the net wealth of the elderly population at ages of 65 and over containing 6,188 data points.

Figure 11 has an average age of 74.23 with a lowest point of 65 and the highest of 102 years of age. France has a relatively old elderly population in relation to the rest of the observed countries and ranks as the 4th oldest. France here has an observed median net wealth of €274,000 and an average net wealth of €628,000.

The highest point of household density falls into the €0-50k category which represents a total of 18.7% of the population. The lowest density point in the graph is within the €2 million and over bracket at 0.31% of the population closely followed by the €850-900k range at 9.53%. The median household holds €274k in net worth and below this falls 50% of the total population. Of that 50% of the population, 25.1% have a net wealth between €0-100k and 0.31% of the population have negative net wealth of which the lowest net wealth is €-257,000. Compared to the median net wealth observed of €274,000, the average

household in comparison has a net wealth of €628,000 which represents a 129.2% increase.

This difference in net wealth is not as extreme as some other countries observed however ranks 4th when comparing the median vs mean distributions. One notable feature of figure 11 is the spike beginning at the €1 million and over bracket. The population observed in France with net wealth higher than €1 million is responsible for 11.06% of the population. Of this 11.06% of the population, the majority of it is contained between the €1 million and €2 million categories with only 19 data points observed over the two million bracket.

Supplementary to Frances raw net wealth distribution is the net wealth held by individuals in the dataset at each decile. Figure 12 is calculated by arranging the unique identifiers and their levels of net wealth from highest to lowest and subsequently selecting the bottom ten percent followed to the top ten percent and summing their total net wealth. This graph effectively displays how the different stratums of net wealth holders relate to each other – it's important to note that the total sums are not necessarily important however how they relate compared to others are the notable points of comparisons.

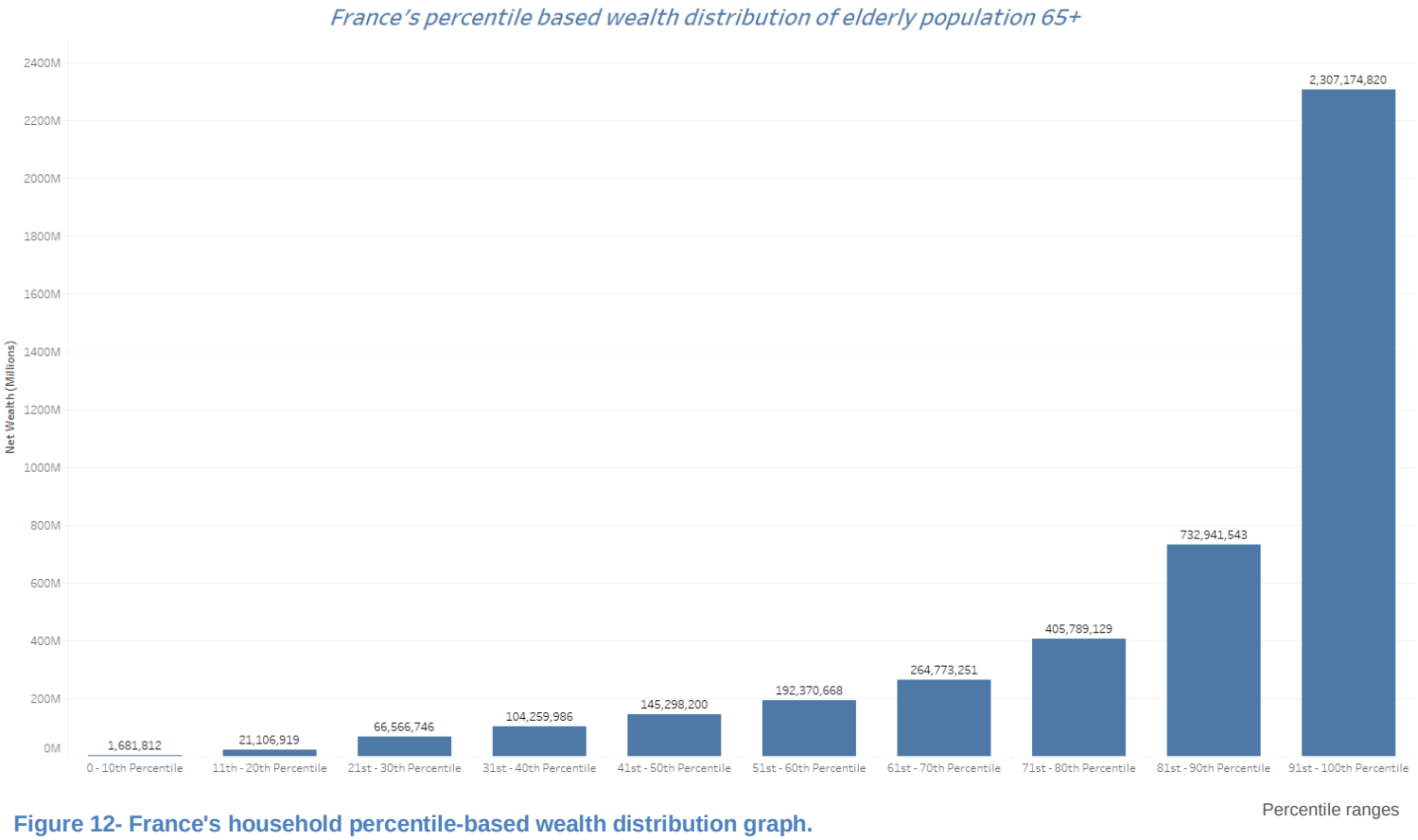


Figure 12- France's household percentile-based wealth distribution graph.

Figure 12 shows an exponentially increasing accumulation of wealth from the bottom ten percent to the highest ten percent. While the first 60 percent of the population's increases appear relatively stable and flat there are marginal differences between each group's increases. From 31st – 80th percentile the average increase between brackets is 43.78% while the increases beyond the 80th percentile begin over 55% and work towards 215%. This tail end of increase is the defining point between the mid and upper brackets.

Within the observed population in Figure 12 a total of €4,241,963,074 (4.2 trillion) euros are observed. Of that 4.2 trillion, the bottom ten percent account for just under four tenths of one percent (0.00396) of the total population. Compared to their size they are under represented by roughly 2,500 times (if the distribution of wealth were spread equally).

It becomes clear that when examining the wealth captured by the top ten percent in France that the group's total net worth is considerably larger than the preceding bracket. It does in fact increase by over 214.78%

which resembles the largest increase throughout the country[4]. If one were to compare the two preceding brackets to each other, the 7th and 8th deciles, an increase of only 80.62% separates the two. On top of this, when comparing the top ten percent to the proceeding bracket, the absolute increase in net wealth is almost €1.6 trillion euros, which is 38% of the total net wealth observed. With such large increases in net wealth, the top ten percent is able to encompass all of the preceding brackets combined. In France, the bottom 90 percent of households observed only accounts for €1.935 trillion euros leaving an excess of roughly €400 billion when compared to the top ten percent which is enough to over count the bottom 50 percent of the population over again.

Figure 12 provides a different perspective of wealth within the elderly compared to the previous graph. This is primarily because it is focused on aggregated amounts of net wealth as opposed to population counts which shifts the focus towards how households compare relatively between each other. It would be disingenuous to only represent either one of the graphs but combined they are able to tell a much fuller story with emergent details which are only revealed when both area viewed in relation with one another.

Table 3 - France's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th-21st	**1155%**
11th-20th -> 21st-30th	**215.3%**
21st-30th -> 31st-40th	**56.62%**
31st-40th -> 41st-50th	**39.36%**
41st-50th -> 51st-60th	**32.40%**
51st-60th -> 61st-70th	**37.63%**
61st-70th -> 71st-80th	**53.25%**
71st-80th -> 81st-90th	**80.62%**
81st-90th -> 91st-100th	**214.78%**

[4] Mathematically the bottom 20 percent has the largest increase but due to over counting and respondent bias (over responding of zero sums) combined with a relatively low absolute increase it isn't considered as statistically relevant.

Table 3 shows France's relative increases between its decile ranges. As it has been observed across all countries in this thesis, the first 20% of increases have extremely high values. This is typically because the 0-10th percentile and 11th-20th percentiles have very low absolute net wealth levels as they encompass households with €0 or negative total net wealth levels. However, from the 3rd decile and onwards there is a smooth exponential curve of relative increases. This is to say that as relatively higher deciles are compared that the difference between them grows faster. The difference between the 9th and 10th deciles is 214.78% or just over three times the net worth.

Figure 13 below visualises these relative increases against the average of relative increases across all countries observed. France's relative increases from the 30th percentile onward have lower increases than the average; however France has a higher difference when comparing the 9th and 10th deciles.

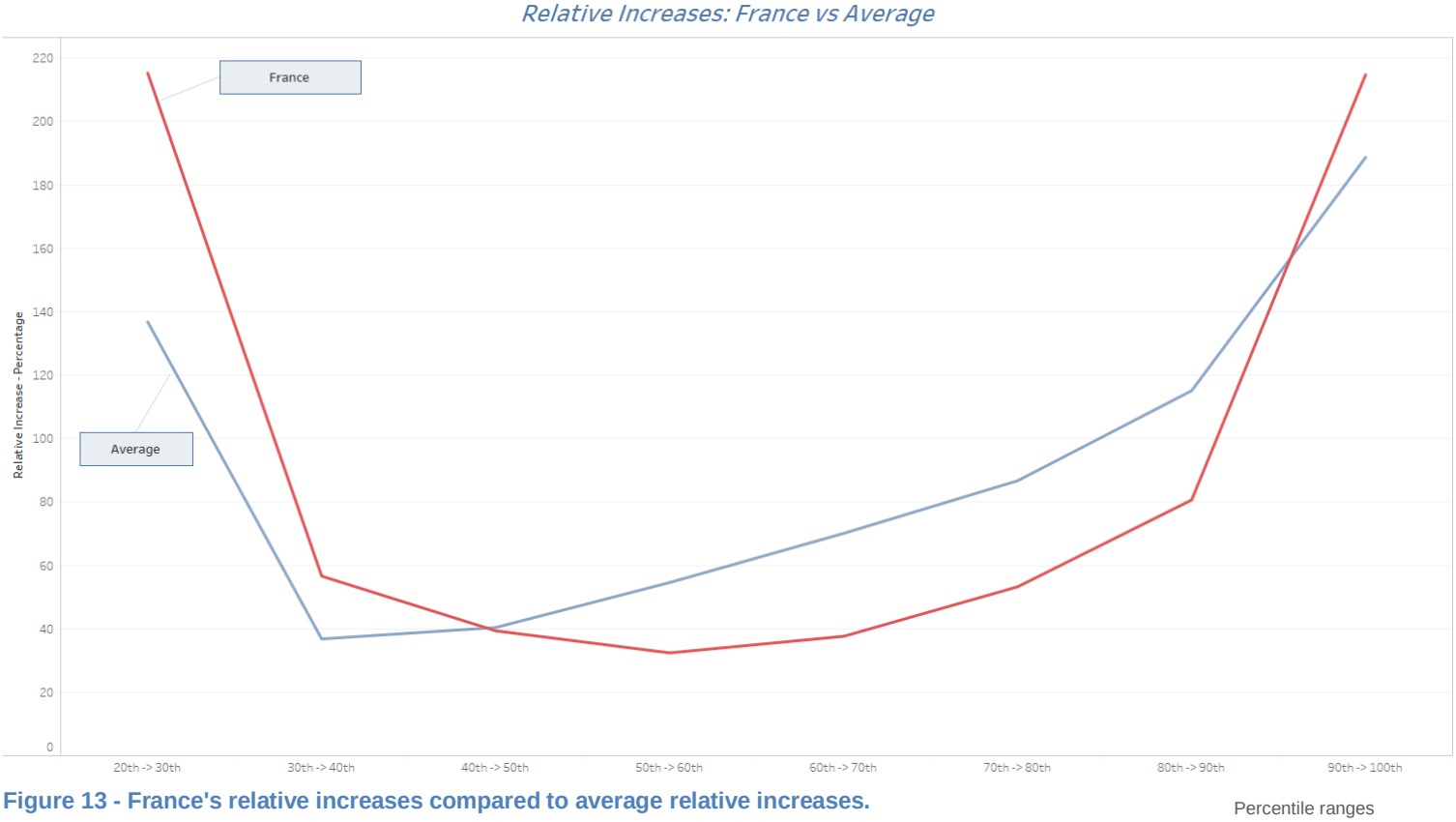


Figure 13 - France's relative increases compared to average relative increases.

4.1.2. Estonia

Estonia's household population based wealth distribution of elderly population 65+

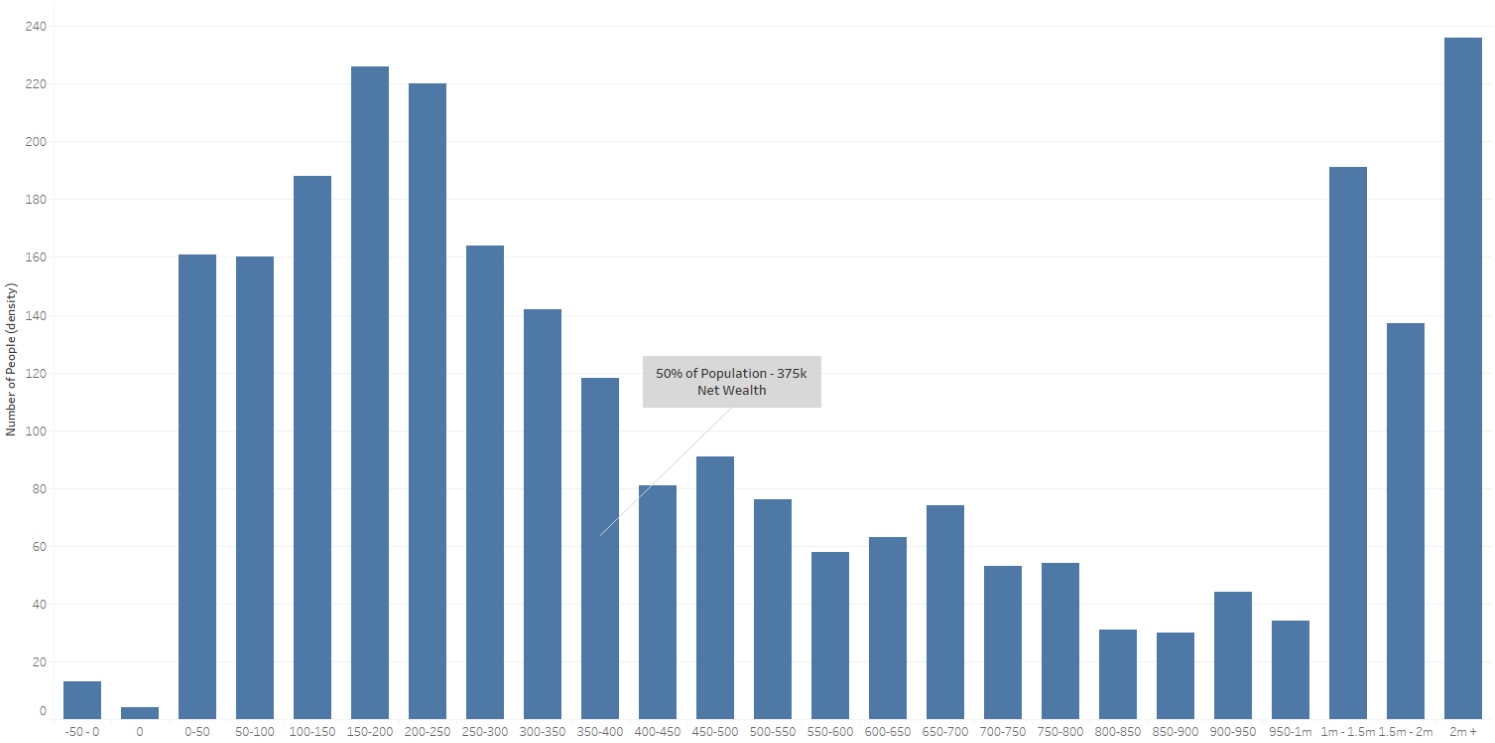


Figure 14 – Estonia's household population-based wealth distribution graph. €375,000 median net wealth.

Figure 14 displays Estonia's distribution of net worth amongst its elderly population. It contains 2649 data points with an average age of 75.4 which ranks as the second oldest population observed. Estonia has a median net wealth of €375,000 which is the second highest country observed, behind Luxembourg, and has an average wealth of €1,118,000.

The lowest point within figure 14 is the €0 bracket with only 4 counts which represents only 0.015% of the population aged 65 and over. The highest bracket within Estonia is the 2 million and over bracket which comprises 236 data points of the total 2649 – 8.909%. Estonia has the second largest percentage of population within the €2 million and over bracket behind of Luxembourg which comparatively has 15.4% of its population above €2 million euros net wealth.

Estonia has a high percentage of its population with net wealth over the €1M+ range as well. Of the total 2649 data points, there are 564 contained within the latter aggregated brackets. This represents a large percentage of the population at 21.3% - the second largest of the 15 countries examined. One notable characteristic of the €1 million and over

population is the difference between the €1-1.5million and the €1.5-2million as there is a decrease of 29.83% between the two points which is then followed by an increase to the €2 million and over bracket of 72.26%.

Estonia's rate of decline can been observed in table 4 below. As shown, the total wealth range observed for this rate is €650,000 and the decrease from the highest range to the €650,000 range is 86.28%. Of this, Estonia's rate of decline shows that per €1,000 an expected 0.132% of the population would not be above the new wealth range.

Table 4 - Estonia's rate of decline

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€150,000	€800,000	€650,000	86.28%	0.132% per €1,000

When considering the full spectrum of wealth distribution Estonia must be categorised under the U-shaped distribution. It has a clearly defined dual peak distribution with a specific and identifiable hollowing out between these two peaks. Even though Estonia appears to have a relatively wealthy population its distribution is still dichotomous and as the following graph will demonstrate, Estonia shares many distributions characteristics with other countries with much lower median net wealth.

Figure 15 displays Estonia's percentile-based wealth distribution and contains 2649 data points with an average age of 75.4 and a sum total value of €2,877,472,722.

Estonia's percentile based wealth distribution of elderly population 65+

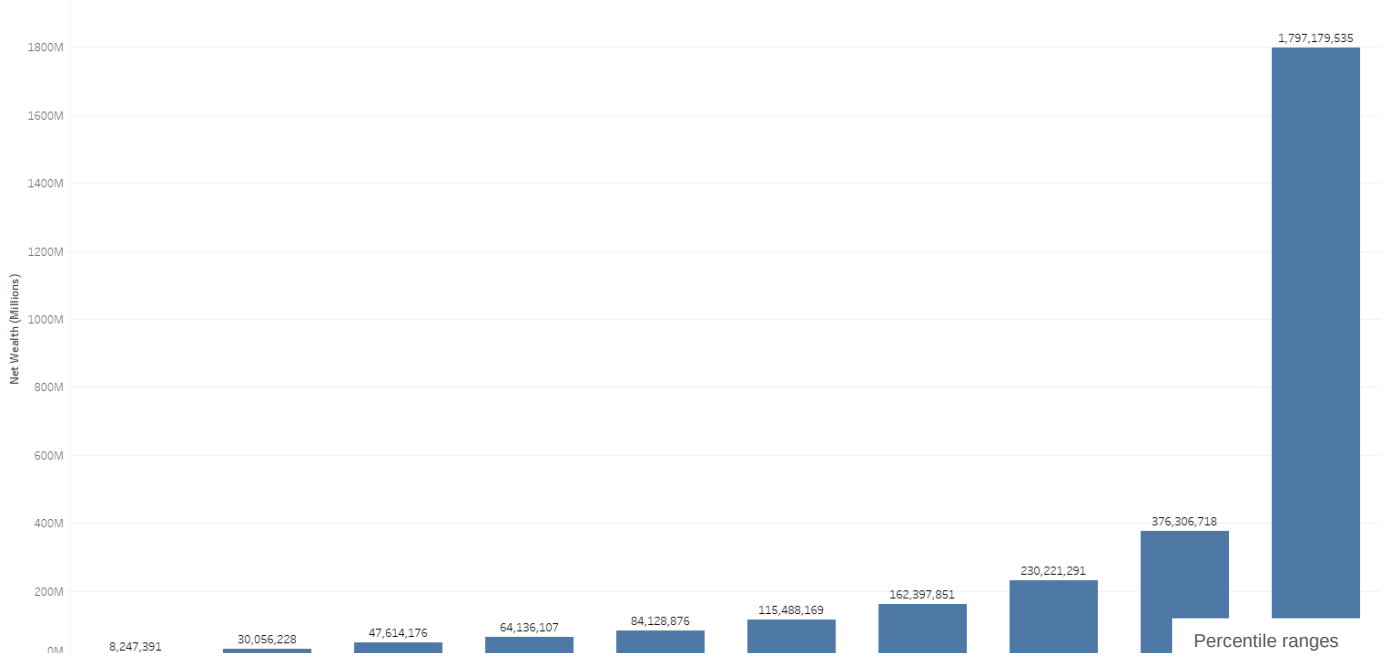


Figure 15 - Estonia's household percentile-based wealth distribution graph.

The most immediate and striking aspect to figure 15 is the total wealth encompassed by the top ten percentile. Of the roughly €2.9 trillion euros observed, the top 10 percentile accounts for €1.8 trillion of that. The top 10 percentile of wealthiest households in Estonia control the same amount of wealth as the bottom 90 percent combined - €1,118,905,807 vs €1,797,179,535. If one were to over count the population again to make up for the difference between the two figures starting from the lowest percentile the top 10 percent would account for the same amount of wealth as the bottom 90 percent plus roughly an additional 75% of the bottom population. This level of difference between the top 10 percent and the bottom 90 percent is the highest in all of the countries observed and with a total accumulation equal to 165% of the bottom population – excluding the top 10 percent itself. The top 10 percentile for Estonia would have to redistribute €1,505,571,000 of its net wealth to be proportionally representative of its size and the 81st – 90th percentile would also have to redistribute €84,698,184 to be left with €291,608,524.

Across all the brackets the average increase is 111.31% however if the two outliers at the low and high end of the wealth spectrum are subtracted the average relative increase becomes 40.675% which is consistent with the other countries observed. A common trend with other countries observed also is displayed here and that is a hollowing out of the

middle range relative increases. Estonia follows many other countries in that it displays has high relative increases in the lower decile ranges followed by a significant fall and then a steady climb until the highest percentile.

The largest absolute difference between deciles occurs between the 9th and 10th decile ranges with €1,420,872,817 separating the two. In addition, the largest relative increase occurs between the 9th and 10th deciles with an absolute increase of €1.4b and relatively increasing by a factor of 4.7 times. Estonia's bottom 90 percent is relatively similar to the rest of the other 15 countries observed, the largest relative difference is from the very poorest to the next bracket and the largest absolute difference is once again between the wealthiest and the proceeding percentiles. This could largely speak to the extremely wide maximums and minimums observed at both ends of the wealth spectrum which either negatively or positively skew the brackets which represents the wealthiest and the poorest.

For the bottom 90 percentile there is an exponentially trending pattern of wealth accumulation. Aside from the stark increase with the top 20 percent of the population there is a steady relative increase of wealth accumulation which correlates with the percentile increase. The overall relative increases can be seen in table 5 below.

Table 5 - Estonia's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th-21st	**264%**
11th-20th -> 21st-30th	**58.4%**
21st-30th -> 31st-40th	**34.6%**
31st-40th -> 41st-50th	**31.2%**
41st-50th -> 51st-60th	**37.2%**
51st-60th -> 61st-70th	**40.6%**
61st-70th -> 71st-80th	**41.7%**
71st-80th -> 81st-90th	**63.45%**
81st-90th -> 91st-100th	**377.5%**

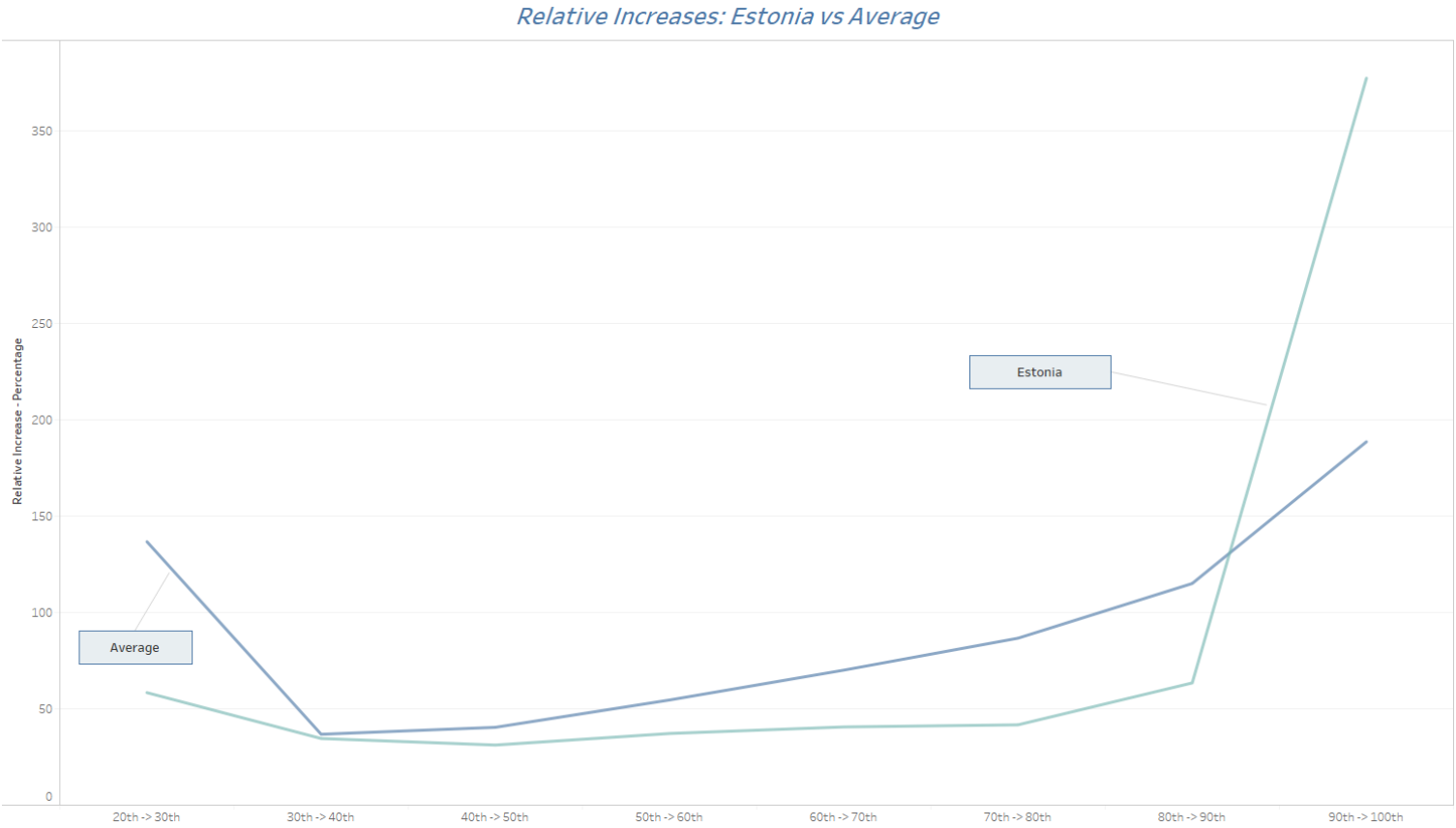


Figure 16 - Estonia's relative increases compared to average relative increases.

Figure 16 shows Estonia's relative increases against the average increases. Estonia has an interesting relative increase curve as it sits under the average for the majority of its decile ranges. However this is shifted when comparing within the top 20 percent as there is a very large relative increase measuring 377.5%. Another interesting point is the steady increases throughout the 30th-70th percentiles which all have a relatively low increase of only 34%->41%.

As discussed in the main wealth distribution graph, Estonia represents a U-shaped wealth distribution in its entirety. Estonia not only has a text book definition of the U-shaped distribution but it also has an extreme percentile distribution. Estonia arguably has the most extreme differences within both its population-based and relative-based distribution graphs out of all 15 countries observed in this thesis.

4.1.3. Austria

Austria's household population based wealth distribution of elderly population 65+

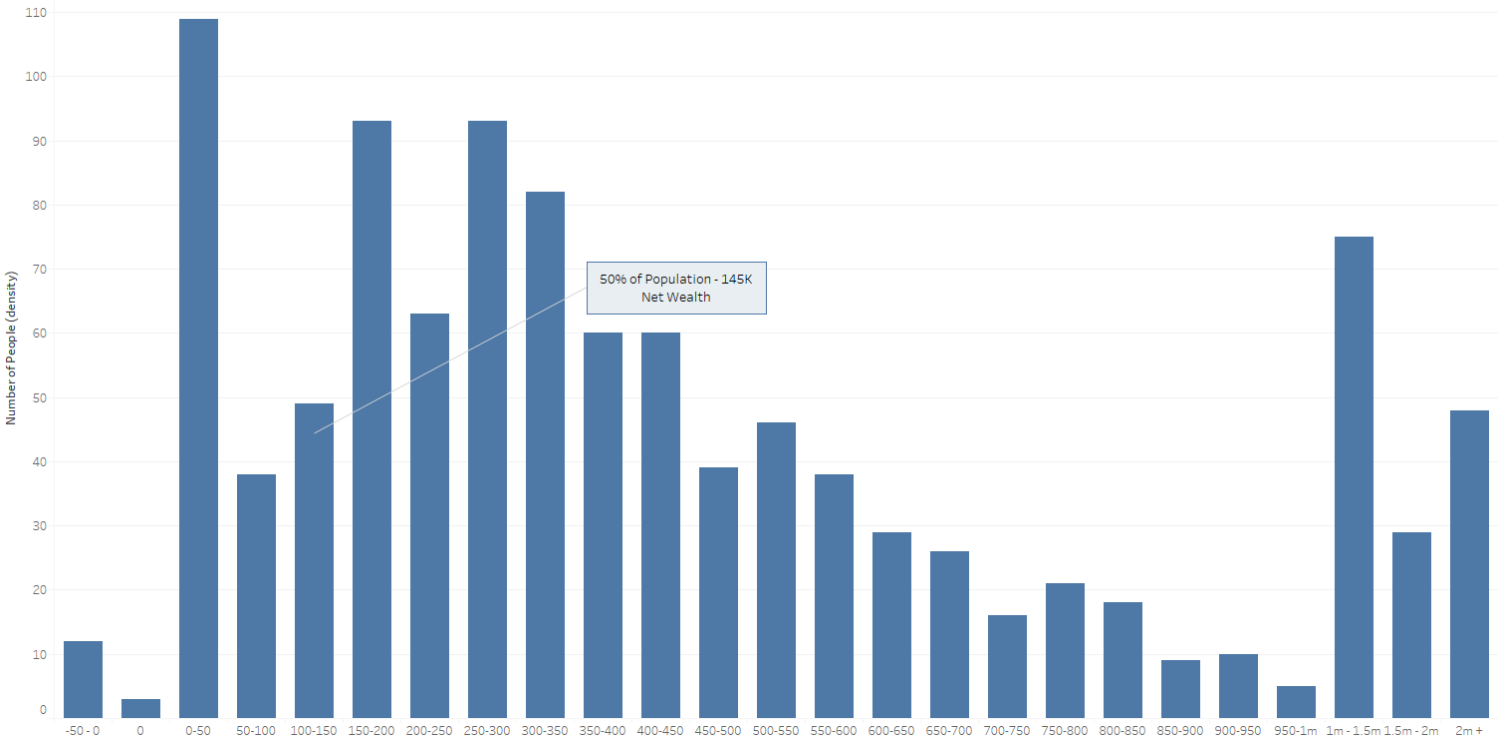


Figure 17 – Austria's household population-based wealth distribution graph. €145,000 median net wealth.

Figure 17 displays the net worth of the observed elderly population within Austria. Within figure 17 there are a total of 1,071 data points and the average age of the surveyed population is 73.92 which is the 10th eldest population within the 15 observed countries. Austria has a median net wealth of €145,000 and an average net wealth of €331,338.

Austria has been categorised as a U-shaped distribution type due to its significant population density falling within the aggregated ranges. This is also coupled with a hollowing out between the median peak and the aggregated peak.

The highest bracket within Austria's data set is the €0-50k range which holds 109 data points or 10.18% of its population. In contrast, the lowest point within Austria's data set is the €0 net wealth bracket which accounts for 3 data points or 0.081% of the total population. Austria is the only examined country within the 15 observed to have such a large discrepancy between two bracketed groups so close to one another. The difference between those who have registered €0 net wealth and those between €0-50k is 106 data points, 9.89% or an increase of 36.3 times.

Austria shares many of the same qualities that Netherlands does with respect to a multi-peak or staggered peak distribution. Just like in Netherlands, Austria has many peaks with one being distinctly different from the median peak, this being the €0-50K bracket which has the highest population density across all brackets of 109 or 10.2%.

Austria has a relatively large percentage of its population within the aggregated ranges totalling 152 data points. These 152 data points represent 14.19% of the population. Of this 14.19% of the population 49.34% of it fall within the first aggregated range of €1M-1.5M. A surprising part of Austria's wealth distribution is also that the €2M+ bracket actually accounts for a higher percentage of the population compared to the €1.5M-2M bracket, this is an uncommon occurrence compared to the rest of the countries studied as the €2M+ bracket accounts for 31.58% of the total aggregated ranges.

Austria's rate of decline can be seen below in table 6. This table of relative increases provides a good example of how U-shaped countries can be difficult to judge as they often do not have smooth declining slopes. However despite this the ranges selected begin at €250,000 and end at €950,000 which is one of the largest ranges examined. The rate of decline per €1,000 observed is 0.135%. This is quite low and should be reflected in Austria's distribution graph in figure 17 which has multiple peaks before the €950,000 range.

Table 6 - Austria's rate of decline.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€250,000	€950,000	€700,000	94.62%	0.135% per €1,000

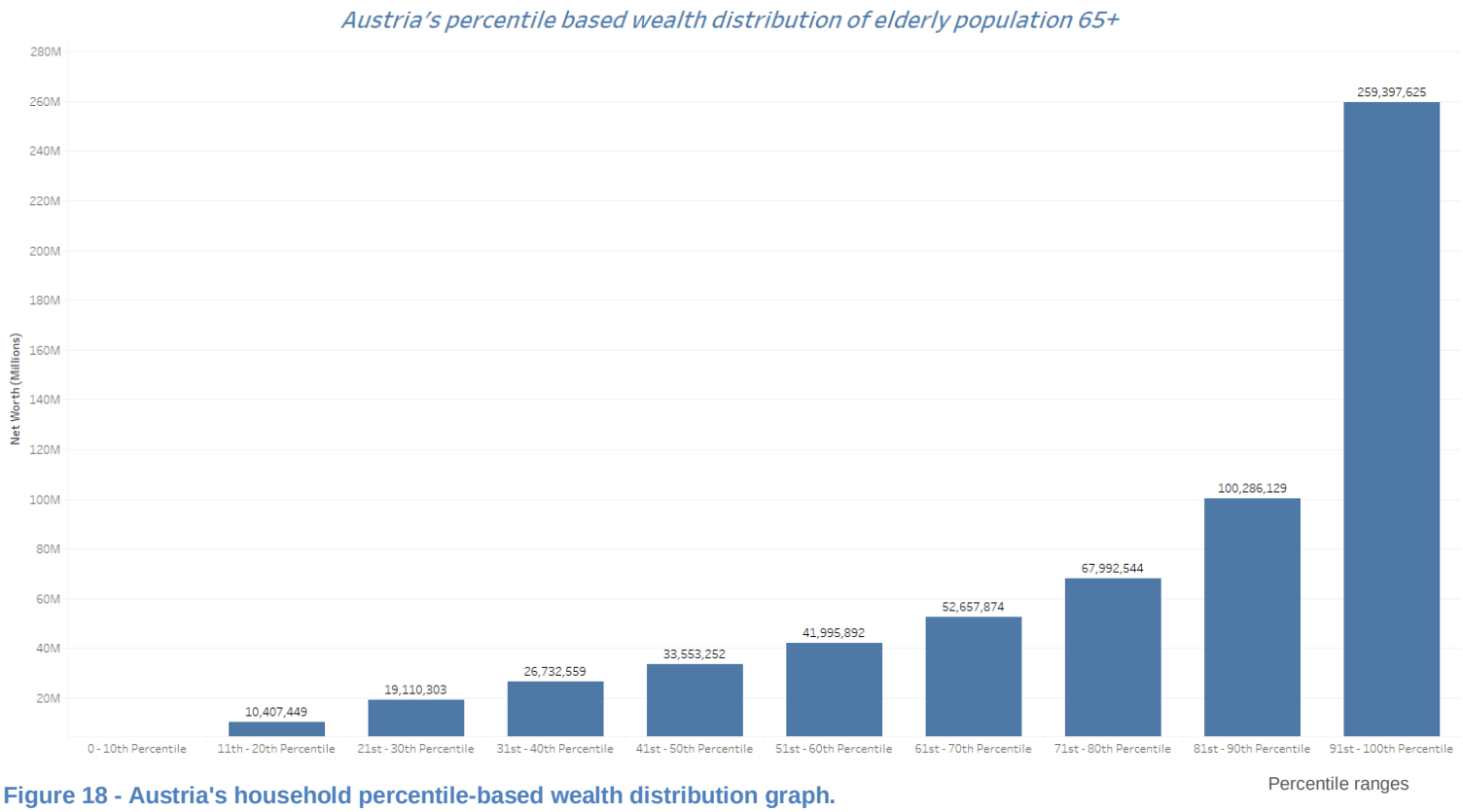


Figure 18 - Austria's household percentile-based wealth distribution graph.

Figure 18 displays Austria's percentile-based wealth distribution graph and contains 1,071 data points with €612,750,992 total net wealth observed.

Austria has a typical exponential relative increase between the decile brackets with the largest relative increases being at the start and the highest secondary spike occurring at the very end of the wealth spectrum. Austria shares many of the same qualities as other countries percentile distributions as the top 10% accounts for the same amount of wealth as almost the bottom 90%. However in Austria's case the top 10% accounts for roughly the bottom 73%.

The biggest relative difference within Austria's percentile distribution is once again observed between the 0-10th vs 11th-20th brackets. This difference is a relative increase of 1585.78% or a factor of almost 16 times. This vast relative difference is the highest observed over any bracket and any country out of the 15 observed. A large contributing factor to this is the relatively high net wealth of the 11th-20th percentiles being €10,407,449 (It's important to note that the deciles, in an absolute sense, are influenced by the same size of the country involved). The largest

absolute increase is once again observed between the 9th and 10th deciles with a difference of €159,111,496 which is similarly one tenth of the increase between the lowest brackets. All of Austria's relative increases can be seen below in table 7.

Table 7 - Austria's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**1585%**
11th-20th -> 21st -30th	**83.62%**
21st-30th -> 31st -40th	**39.88%**
31st-40th -> 41st -50th	**25.51%**
41st-50th -> 51st -60th	**25.16%**
51st-60th -> 61st -70th	**25.38%**
61st-70th -> 71st -80th	**29.12%**
71st-80th -> 81st -90th	**47.49%**
81st-90th -> 91st -100th	**158.6%**

Figure 19 below visualises the relative increases of Austria against the average increases. Similar to Estonia, Austria tracks under the average increases throughout the majority of its percentiles. However, where Estonia had higher increases in between the 9th and 10th deciles, Austria has below average increases. Austria also has quite a flat level of increases from its 40th – 70th percentiles with it spiking in the typical areas around the top 20th percentiles.

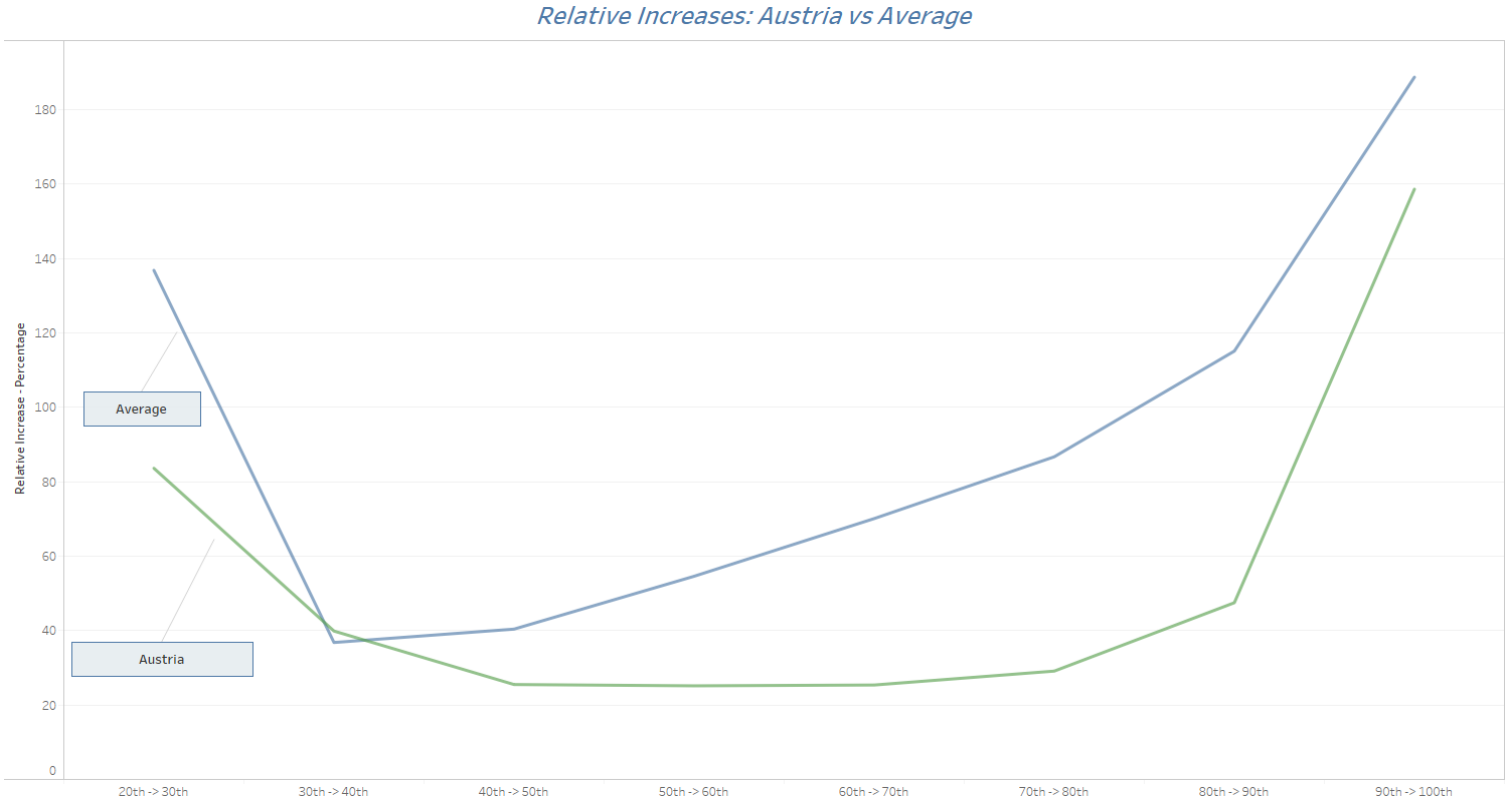


Figure 19 – Austria's relative increases compared to average relative increases.

4.1.4. Luxembourg

Luxembourg's household population based wealth distribution of elderly population 65+

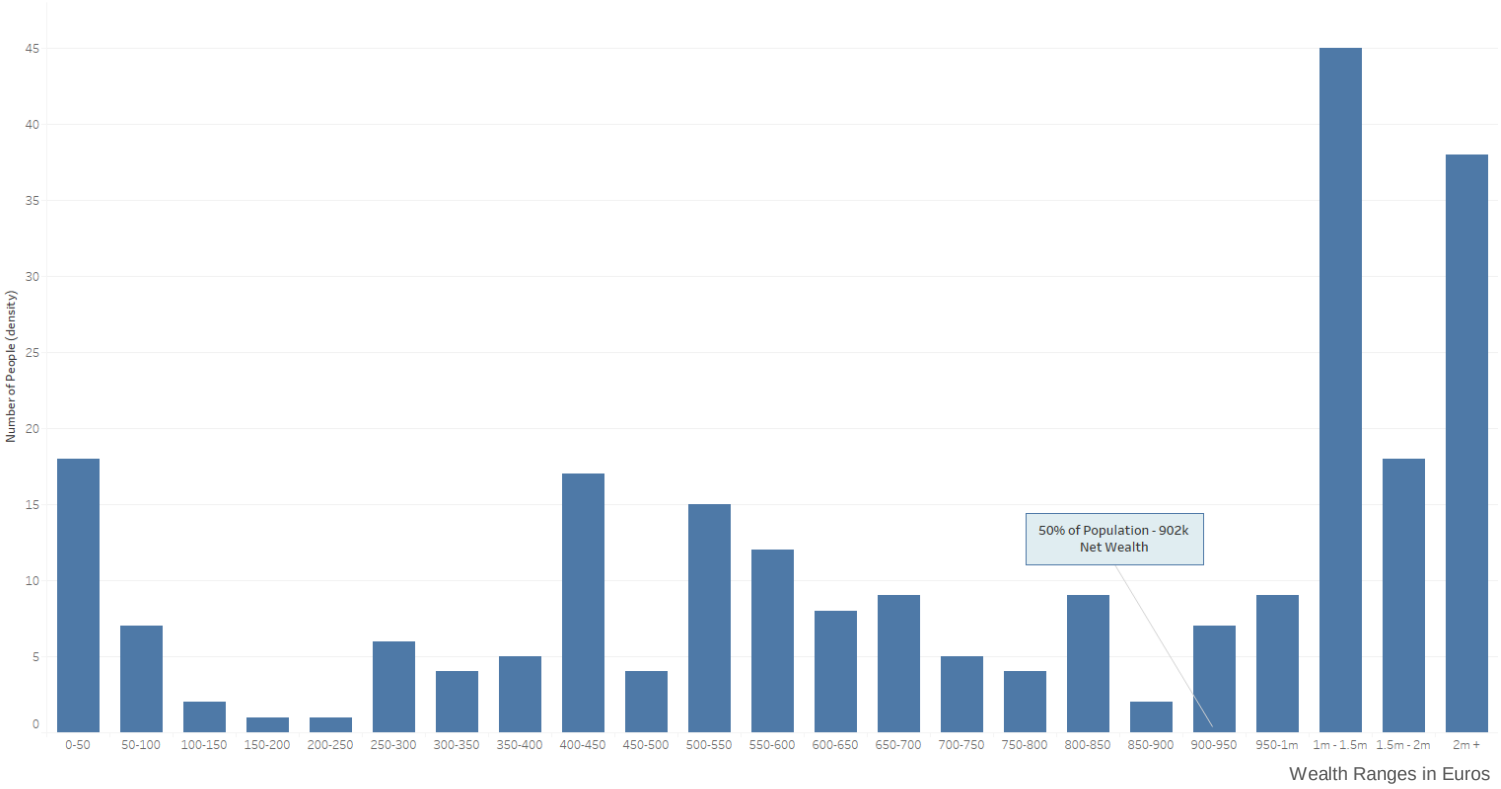


Figure 20 - Luxembourg's household population-based wealth distribution graph. €902,000 median net wealth.

Figure 20 displays the population-based net wealth distribution for Luxembourg. Within figure 20 there are 246 data points observed and the average age of these participants is 72.2 which places Luxembourg as the 2nd youngest population sampled. Luxembourg has an median wealth value of €902,100 and an average of €1,414,000 which is the highest of all countries observed.

The highest density range within the Luxembourg distribution is the €1M-1.5M section which accounts for 18.23% of the population or 45 data points. The second highest is also observed within the aggregated brackets at €2M+ with 38 data points or 15.44% of the population. This is highly unusual as the €2M+ bracket as shown in this chapter has typically been one of the lower population brackets due to its high threshold. Comparing these two later peaks to the initial peak, one would find a difference of 30 data points or 12.21% (this is comparing the €1M-1.5M bracket with the €450-500k).

The lowest density within figure 20 is both the €100k-150k and €150k-200k ranges with only one data point each accounting for 0.04% of the population. This exemplifies just how unique Luxembourg is compared to the other countries observed which typically have 10-15% of their population within the median bracket or within these ranges.

As shown, Luxembourg has been categorised as a U-shape distribution. Clearly from the first appearance, Luxembourg has a unique distribution which is not clearly U-shapes or Slope-shapes that have been defined in this thesis. This may be the combination of Luxembourg having the highest median and average net wealth across all observed countries at €902k which is 150% than Estonia with €368k median net wealth. Luxembourg also has the highest proportion of its population with net wealth in the upper aggregated range of €1M+ encompassing 41.05% which is by far the highest across the observed countries, the closest being Austria with 18.2%.

However while Luxembourg has a large amount of its elderly population within the upper aggregate ranges it still has a median point which lays outside of these ranges. There is in fact an initial peak starting at the €400k or possibly the €500k range which falls upon the median. This is unique because most countries observed in this study have median net wealth values much lower and thus the usual initial peak is much closer to the €150-200k range. Given that a U-shaped distribution as described in this paper relies on a percentage threshold it is fair to classify Luxembourg as a U-shaped distribution however it is far from the best example and thus requires further attention.

A rate of decline has not been calculated for Luxembourg as its wealth distribution is highly unusual and there would be no place for selected a starting and ending range.

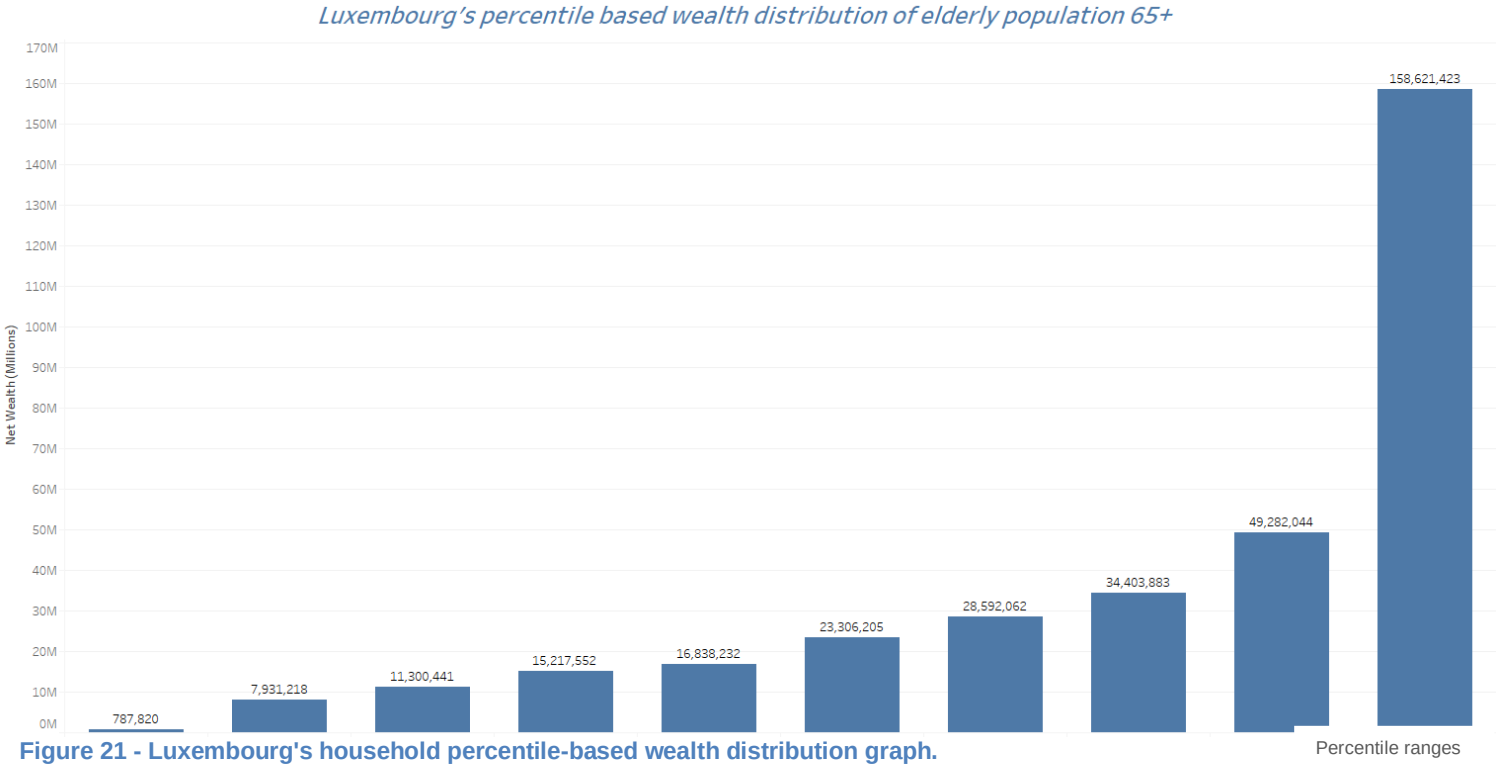


Figure 21 - Luxembourg's household percentile-based wealth distribution graph.

Figure 21 displays the percentile distribution for Luxembourg and contains 246 data points with a total net wealth of €346,280,880.

Luxembourg has an unusually high number of its surveyed population residing in the upper aggreagted wealth ranges. The wealthiest data point observed has registered €33,377,488 net wealth followed by the second highest registered at €19,745,379. While these numbers are not the highest of the total 15 countries observed they are reasonably close to what others have registered in the two million and over bracket. Luxembourg has the wealthiest two million and over bracket with an average of €4,937423 of net wealth.

Luxembourg's percentile distribution has one of the lowest relative growth averages throughout the 20th-90th percentiles with an average of 30.34% relative increase across the first 70% of the population. Luxembourg's relative increase spikes between the 9th and 10th decilesiles with an increase of 221.87% whereas the lowest relative increase is observed between the 31st-40th vs 41st-50th percentiles with only 10.65%. This shows how Luxembourg does not display a perfectly exponential curve given despite that the average increase is 30.34%, not including the highest and lowest ranges.

The highest relative increase within the Luxembourg percentile distribution once again is registered between the 1st and 2nd deciles with an increase of 900.67% however there is only an absolute increase of €7,143,398. In contrast, the highest absolute increase is observed within the last brackets with an increase of €109,339,419 or 221.87%. All of Luxembourg's relative increases can be seen in table 8 below.

Table 8 – Luxembourg's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**906.72%**
11th-20th -> 21st -30th	**42.48%**
21st-30th -> 31st -40th	**34.66%**
31st-40th -> 41st -50th	**10.65%**
41st-50th -> 51st -60th	**38.41%**
51st-60th -> 61st -70th	**22.68%**
61st-70th -> 71st -80th	**20.32%**
71st-80th -> 81st -90th	**43.24%**
81st-90th -> 91st -100th	**221.86%**

Figure 22 below visualises the relative increases of Luxembourg against the average increases. Luxembourg has several interesting points when it comes to relative increases, the first being that it has two decreases after the 20th -> 30th range. This is unusual because the average has a smooth exponentially increasing curve. This potentially indicates that Luxembourg has very little difference between the 3rd and 4th deciles with only 10% net wealth variance. The increases between the 5th and 8th deciles are also relatively even, this is perhaps explained by the relatively flat population distribution graph and very high median net wealth Luxembourg has. The primary increase is once again observed between the 9th and 10th deciles with an increase of 221.86%.

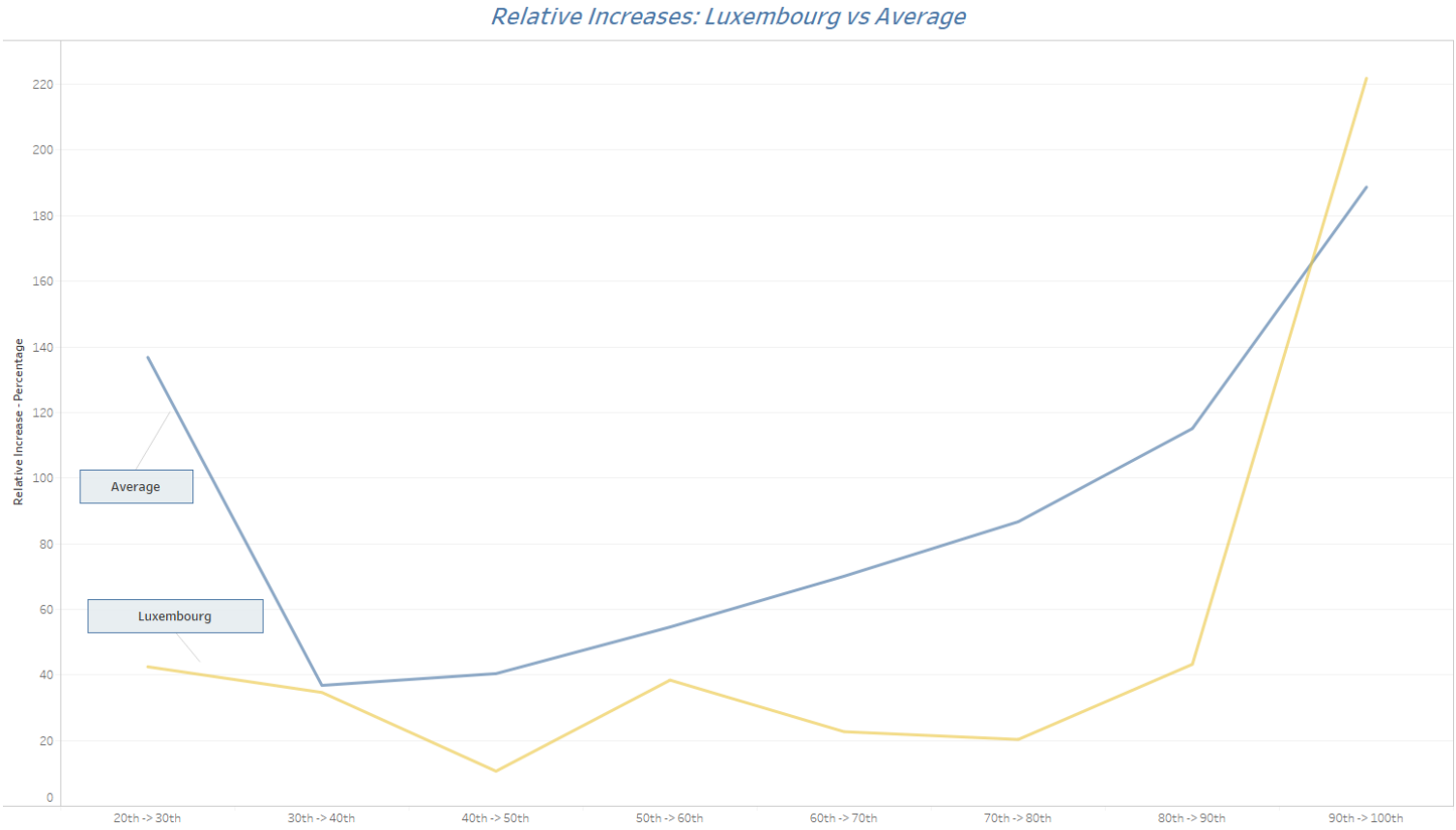


Figure 22 - Luxembourg's relative increases compared to average relative increases.

4.1.5. Germany

Germany's household population based wealth distribution of elderly population 65+

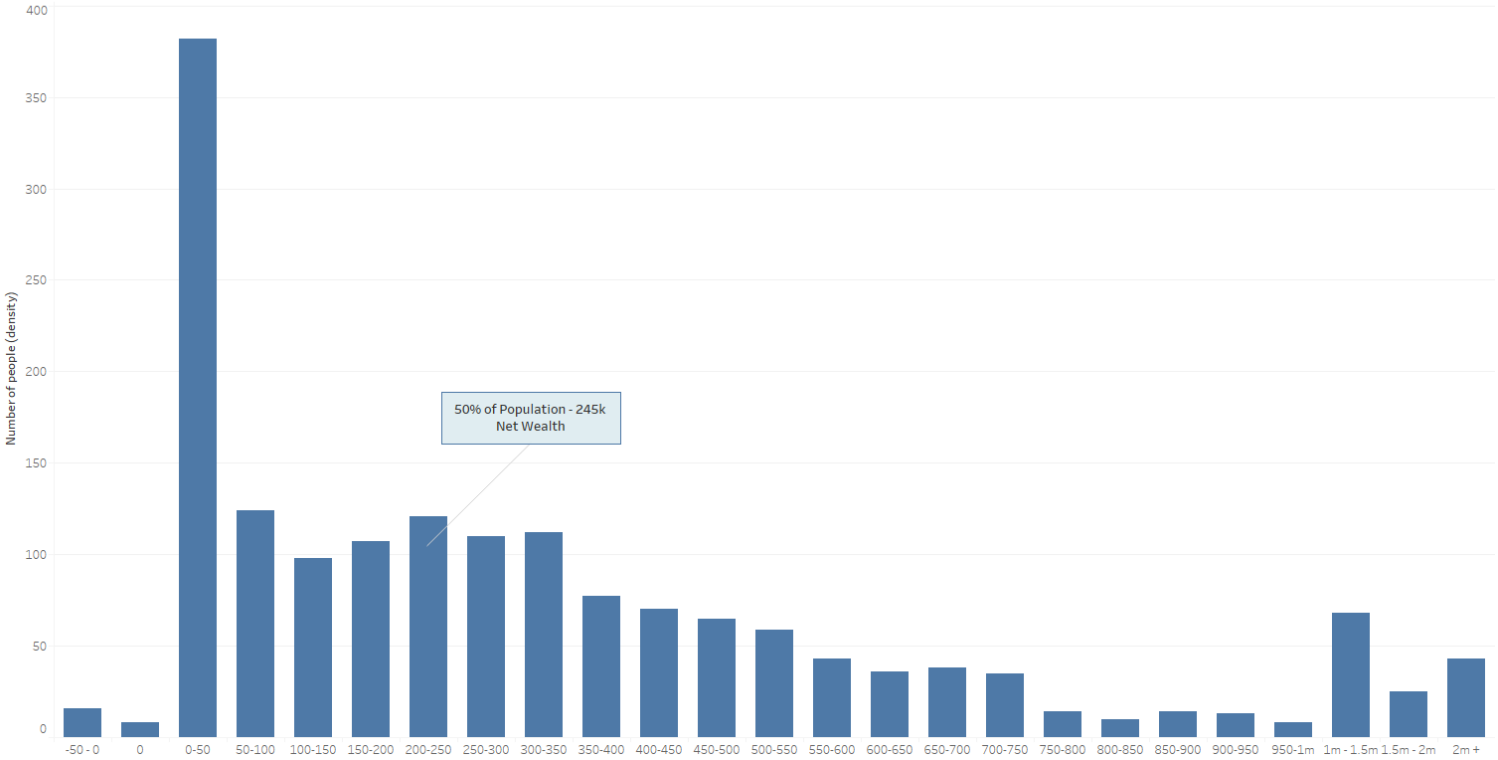


Figure 23 - Germany's household population-based wealth distribution graph. €245,000 median net wealth.

Figure 23 displays Germany's population-based wealth distribution. The total amount of data points contained within this set is 1,696 with an average age of 73.16 years which is the 5th youngest population studied. Germany's median net wealth is €245,000 and has an average net wealth of €413,000.

Germany displays multiple interesting points of examination. The first notable point is the highly populated €0-50K bracket which encompasses 380 data points accounting for 22.4% of the total observed population. This level of density within one of the lowest brackets is uncommon for a country whose median net wealth is €245,000 – 9th highest. Typically within the upper half, and the U-shaped distribution countries there is not such a large difference between any singular wealth bracket and its proceeding brackets.

While Germany has been classified as a U-shaped distribution it could be argued that a Slope-shaped distribution would be appropriate due to the size of the aggregated levels. This is a valid point, while the size of the latter aggregated levels is not as high as the other examined U-

shaped distributions it is still significantly large when compared to the middle and even lower ranges of the wealth distribution spectrum. It is because the size of the €0-50K bracket that the deception of a small aggregated range exists. When one compares the latter aggregated ranges to the majority of the population, excluding the €0-50K range, one finds that the average population count of 45.33 is comparable to the middle ranges with an average population count of 66.34.

Table 9 - Germany's rate of decline. Includes two different wealth ranges.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€200,000	€800,000	€600,000	91.73%	0.152% per €1,000
€0	€800,000	€800,000	97.38%	0.122% per €1,000

Germany's rate of decline can be seen above in table 9. There are two different calculations made for Germany's rate of decline due to it having an individual peak which occurs before the median peak. The top calculation shows a rate of 0.152% per €1,000 which is observed across €600,000 whereas the bottom calculation is taken from the €0-€50,000 range until the same €800,000 but has a lower rate of decline of only 0.122% per €1,000. One may expect that the rate of decline would be lower given that it is taken from a starting range with much smaller population density, however because the total wealth observed is significantly smaller the rate of decline is larger.

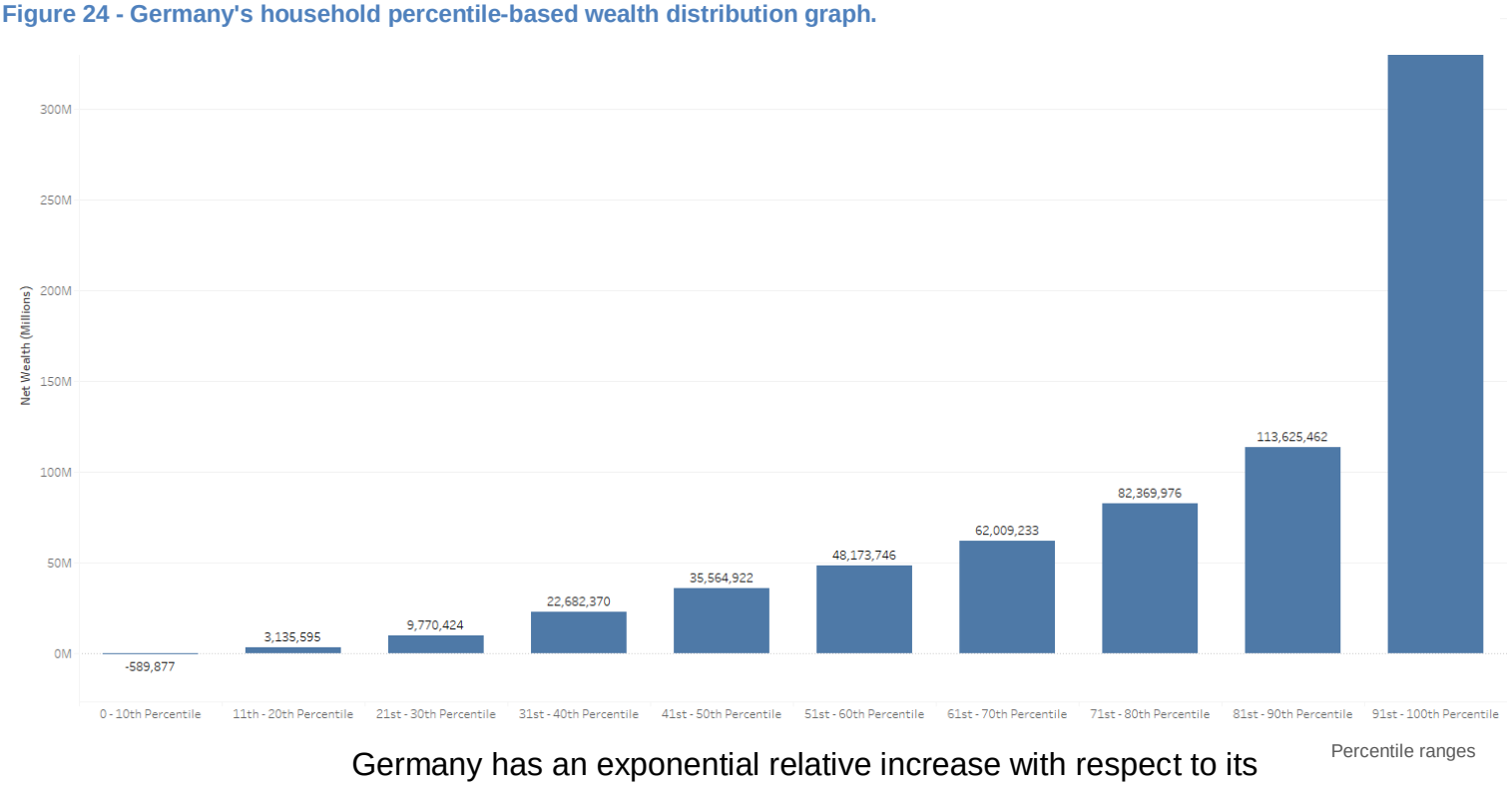
Figure 24 displays the Percentile-based wealth distribution for Germany. Within figure 24 there are 1,696 data points and a sum total of €714,708,750.

Germany has an interesting wealth distribution when it is displays on a percentile basis. Perhaps one of the first impressionable attributes of this graph is the lowest ten percent of the population which actually carries a negative wealth value of €-589,877. This negative wealth sum is only found in one other country, that of Portugal which registered at €-19,100,

however there is a stark difference between these two figures. Portugal with €-19,100 is almost breaking even whereas the bottom ten percent of Germany are significantly poorer.

Germany's percentile based wealth distribution of elderly population 65+

Figure 24 - Germany's household percentile-based wealth distribution graph.



Germany has an exponential relative increase with respect to its percentile distribution. The relative increases made within the middle ground of the population, notable the 11th-90th percentiles, are relatively stable and increase linearly, however when the upper range is taken into account it clearly accelerates at a rapid pace compared to the remaining population. This percentile-based wealth distribution graph serves as a good example as to the power of combining both the population and percentile distribution because Germany would appear to have a less pronounced dichotomous distribution than France however the percentile-based wealth distributions are rather comparable.

All of Germany's relative increases can be seen in table 10 below and figure 25 shows the relative increase graph with Germany being compared to the average increases.

Table 10 - Germany's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**N/A**
11th-20th -> 21st -30th	**211.6%**
21st-30th -> 31st -40th	**132.1%**
31st-40th -> 41st -50th	**56.79%**
41st-50th -> 51st -60th	**35.45%**
51st-60th -> 61st -70th	**28.71%**
61st-70th -> 71st -80th	**32.83%**
71st-80th -> 81st -90th	**37.94%**
81st-90th -> 91st -100th	**197.2%**

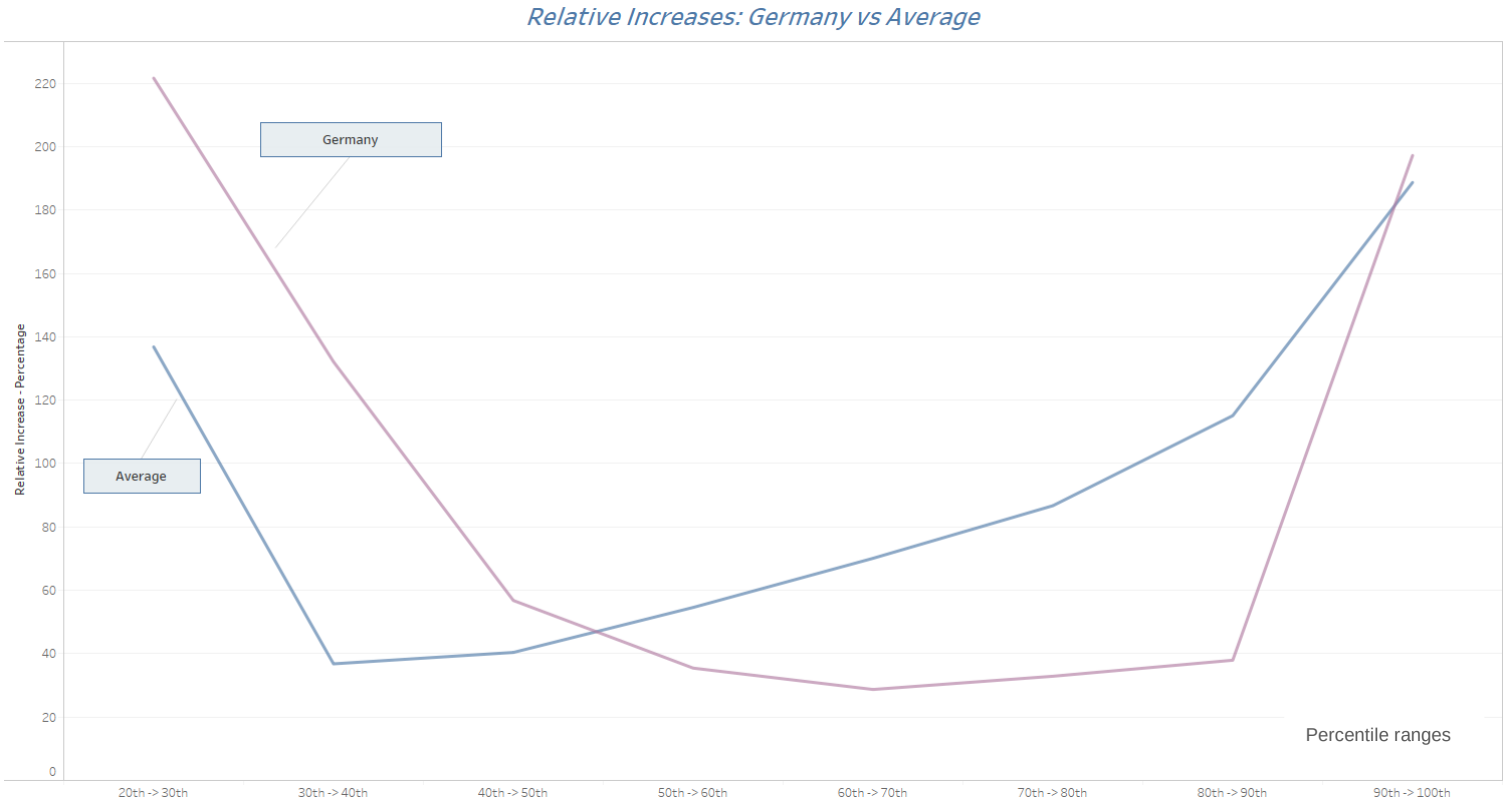


Figure 25 - Germany's relative increases compared to average relative increases.

Germany beings with much higher relative increases as shown by figure 25 showing a much larger relative difference between the 1st, 2nd and 3rd deciles. After this, the relative increases fall below the average until the 9th and 10th deciles are compared. This last 20 percent comparison yields only a slightly smaller increase than the average at 197.2 as the average increase between 9th and 10th deciles is 188.7%.

4.1.6. Cyprus

Cyprus' household population based wealth distribution of elderly population 65+

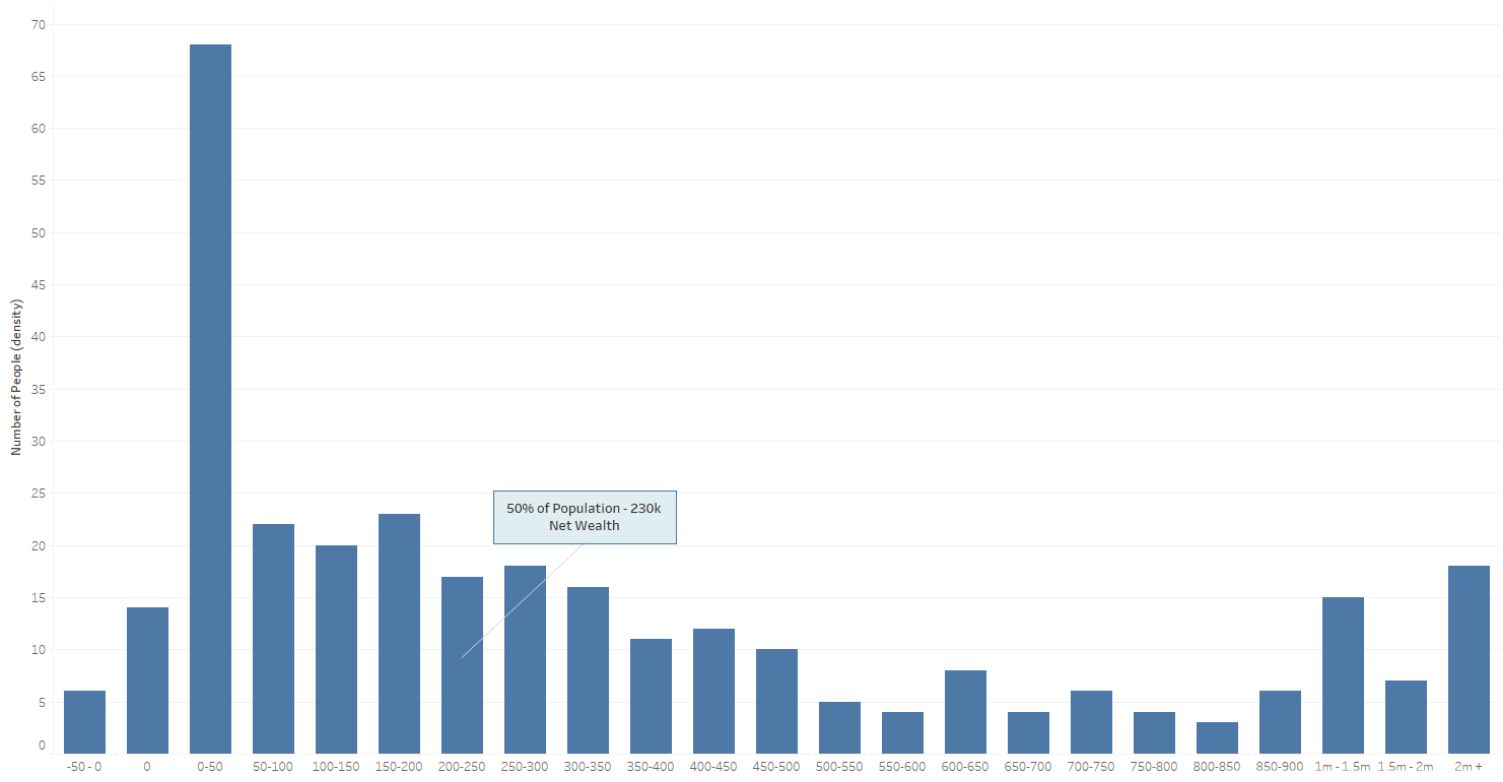


Figure 26 - Cyprus' household population-based wealth distribution graph. €230,000 median net wealth.

Figure 26 displays the population-based wealth distribution for Cyprus. Within figure 26 there are 317 data points contained with an average age of 73.07 which is the 4th youngest population observed in this thesis. Cyprus has a median net wealth of €230,000 and an average wealth of €643,000.

Cyprus has a strikingly similarity to Germany with respect to many of its notable distribution characteristics. The first characteristic being the spike within the €0-50K bracket which too was observed within the Germany's population-graphs. Within the Cyprus distribution the €0-50K range contains 68 data points or 21.45% of the total population which is slightly lower than Germany's which contained 22.4%. Aside from the initial peak within Cyprus' distribution there is a relatively flat spread of population throughout the entire range of brackets.

Cyprus' rate of decline can be seen below in table 11. There are two different calculations made for Cyprus again because the rate of

decline may be taken from two different positions. The first position is taken from €0-€550,000 which has a rate of decline calculated at 0.171% per €1,000. The second position is taken from €150,000-€550,000 and has a larger rate of decline calculated at 0.206%. It is interesting to note the difference between these two rates and while the percentage decrease of density is larger for the first rate, it does not have a steeper rate of decline.

Table 11 – Cyprus' rate of decline. Includes two different wealth ranges.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€0	€550,000	€550,000	94.11%	0.171% per €1,000
€150,000	€550,000	€400,000	82.61%	0.206% per €1,000

Figure 27 displays Cyprus' percentile-based wealth distribution and contains 317 data points spread across an observed sum wealth of €179,760,629.

Cyprus has perhaps one of the most extreme styles of percentile-based wealth distribution when compared against the other 15 countries observed. This is because Cyprus' distribution has many unusual characteristics which are not seen in the other studied countries. The first unusual characteristic is the negative sum total of wealth within the bottom ten percent of the population. With a total net wealth of €-143,066 the bottom ten percent mirrors that closely again of Germany's percentile-based wealth distribution.

However, more unusual is the lack of 'real' growth seen within the bottom 30% of the observed population. Cyprus' bottom 30 percent has strikingly low levels of net wealth with respect to the remaining population. The relative increase between the 11^{th}-20^{th} vs 21^{st}-30^{th} ranges is only 368% - this may seem high however there are typically very large relative increases seen within the very bottom ranges. The absolute wealth increase between these ranges is only €3-4 million however because of the low absolute values within the lower percentile ranges these actually

represents a relatively large increases within the bottom 40-50% of the population.

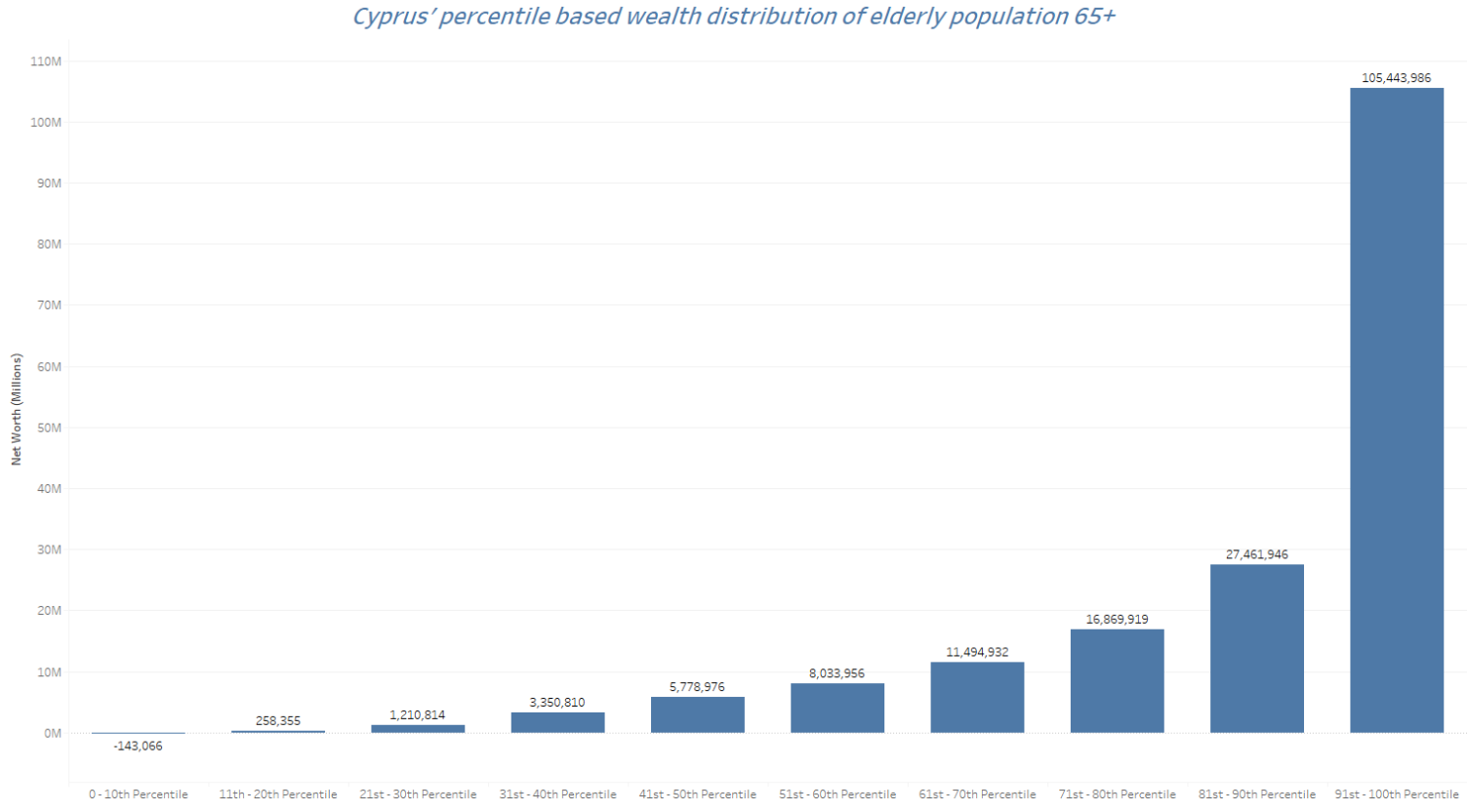


Figure 27 - Cyprus' household percentile-based wealth distribution graph.

Cyprus' distribution further displays a very heavy 'top end', this being that the top ten percent of the population account for an exceedingly large share of the total sum wealth within the population. Of the €179,760,629 contained, the top ten percent accounts for €105,443,986 or 58.65%. When counted starting from the lowest ends of the population, the top ten percent accounts for the same amount of wealth as held by the bottom 160% of the population – this is excluding the top ten percent itself.

Table 12 – Cyprus' relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**N/A**
11th-20th -> 21st -30th	**368.6%**
21st-30th -> 31st -40th	**176.7%**
31st-40th -> 41st -50th	**72.46%**
41st-50th -> 51st -60th	**39.02%**

51st-60th -> 61st -70th	**43.07%**
61st-70th -> 71st -80th	**46.75%**
71st-80th -> 81st -90th	**62.78%**
81st-90th -> 91st -100th	**283.9%**

Table 12 shows the complete relative increases of Cyprus. As shown, Cyprus has very high relative increases at the beginning and end points with the highest relative increase between the 2st and 3nd deciles. This is surprising as most countries only have relative increases this high between their 1st and 2nd deciles however Cyprus has negative sums of net wealth within the 1st decile and thus cannot be compared.

Figure 28 visualises these relative increases against the average relative increases across the 15 countries observed. The high relative increases can be seen as being well above the average and this lasts until the 4th decile. Cyprus only has lower than average relative increases throughout the middle percentile ranges and once again has much higher relative increase between the 9th and 10th decile ranges peaking at 283%.

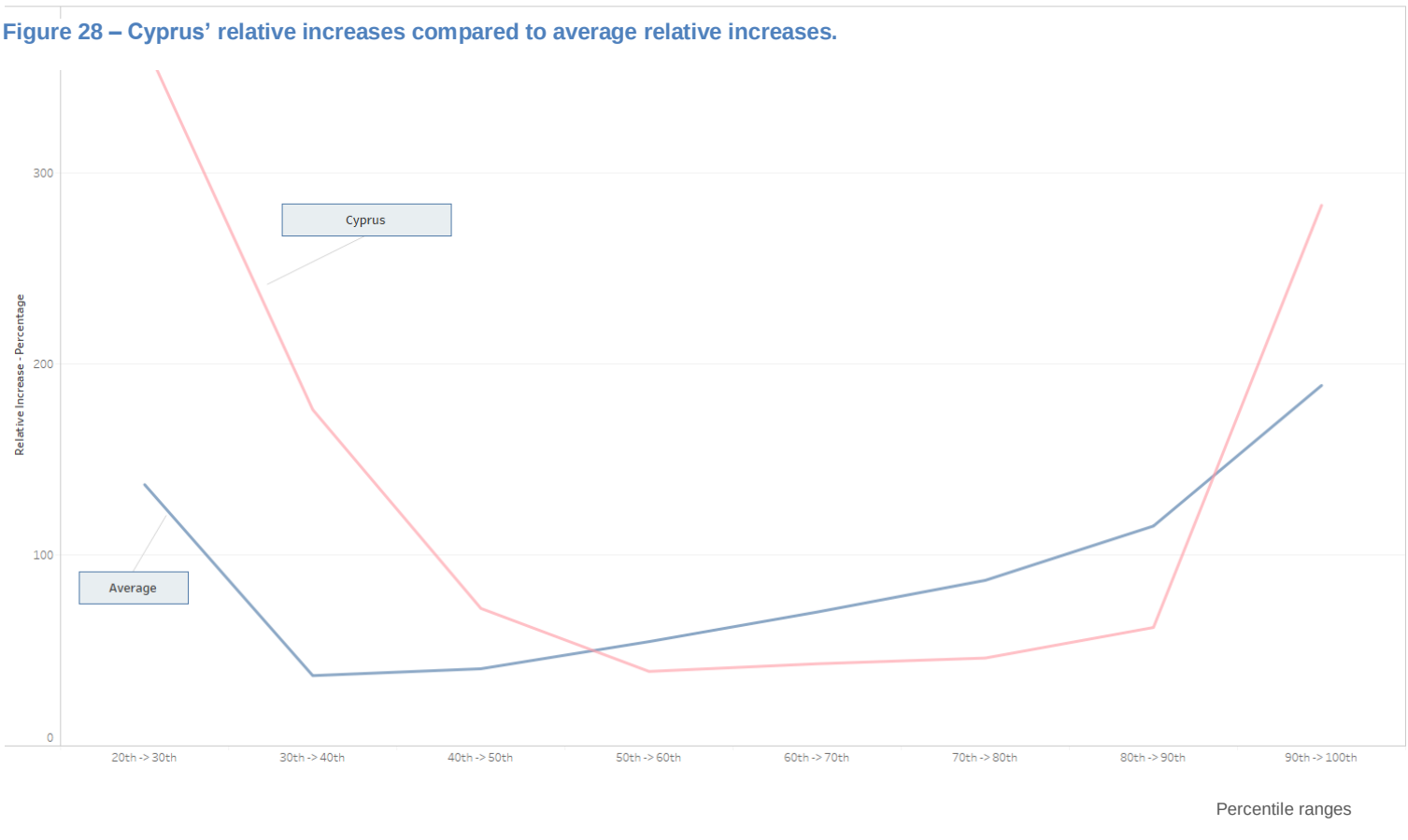


Figure 28 – Cyprus' relative increases compared to average relative increases.

4.1.7. Belgium

Belgium's household population based wealth distribution of elderly population 65+

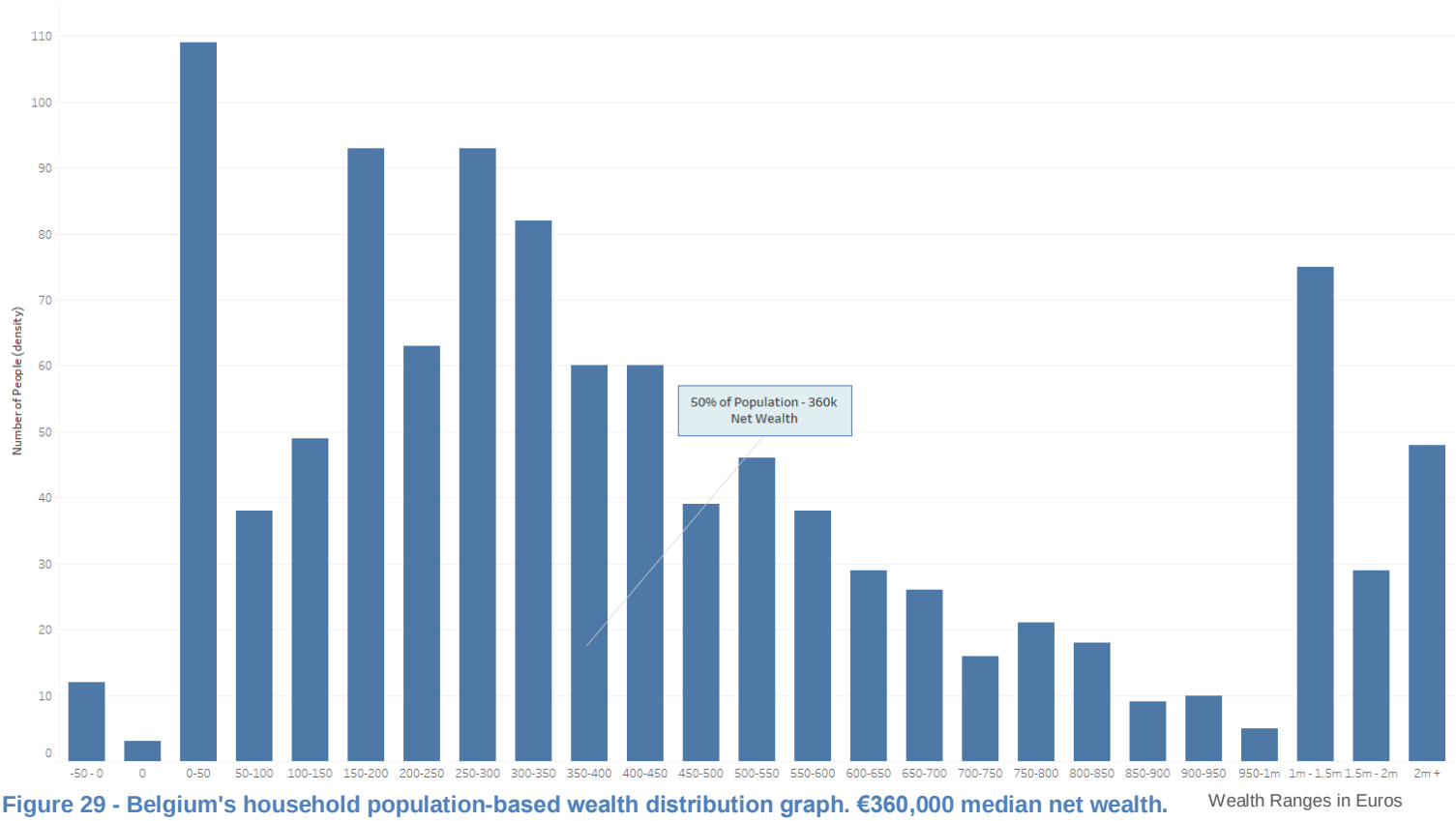


Figure 29 - Belgium's household population-based wealth distribution graph. €360,000 median net wealth.

Figure 29 displays Belgium's populating based wealth distribution and contains 1,071 data points with an average age of 74.3 which is the (8th) eldest population observed. Belgium a median net wealth of €360,000 and an average net wealth of €581,000

Belgium is another good example of a U-shaped distribution in full blossom; it has two distinct overarching peaks and also contains many singular spikes within and around the median peak. As Belgium has many different individual peaks, there has not been a calculated rate of decline.

The most populated bracket within the Belgium data set is the €0-50K bracket with a total of 109 data points which represents 10.18% of the total population. The wealth bracket with the lowest density is the 0 net wealth bracket which only has 3 data points within it. This low count within the €0 value is unsurprising because of Belgium's high level of median net wealth measured at €360,000 ranking the 3rd highest within the observed countries.

Belgium has a surprisingly high population density within the latter aggregated wealth ranges with 152 of the total data points being contained after the one million markers. These 152 data points represent 14.19% of the total population with the highest point containing 75 data points.

Belgium has multiple single peaks and shares a quality that only a few other countries have displayed such as the Netherlands and Austria. This phenomenon is unknown in its origin however as multiple countries seem to displays it there may be a legitimate underlying cause.

Figure 30 - Belgium's household percentile-based wealth distribution graph.

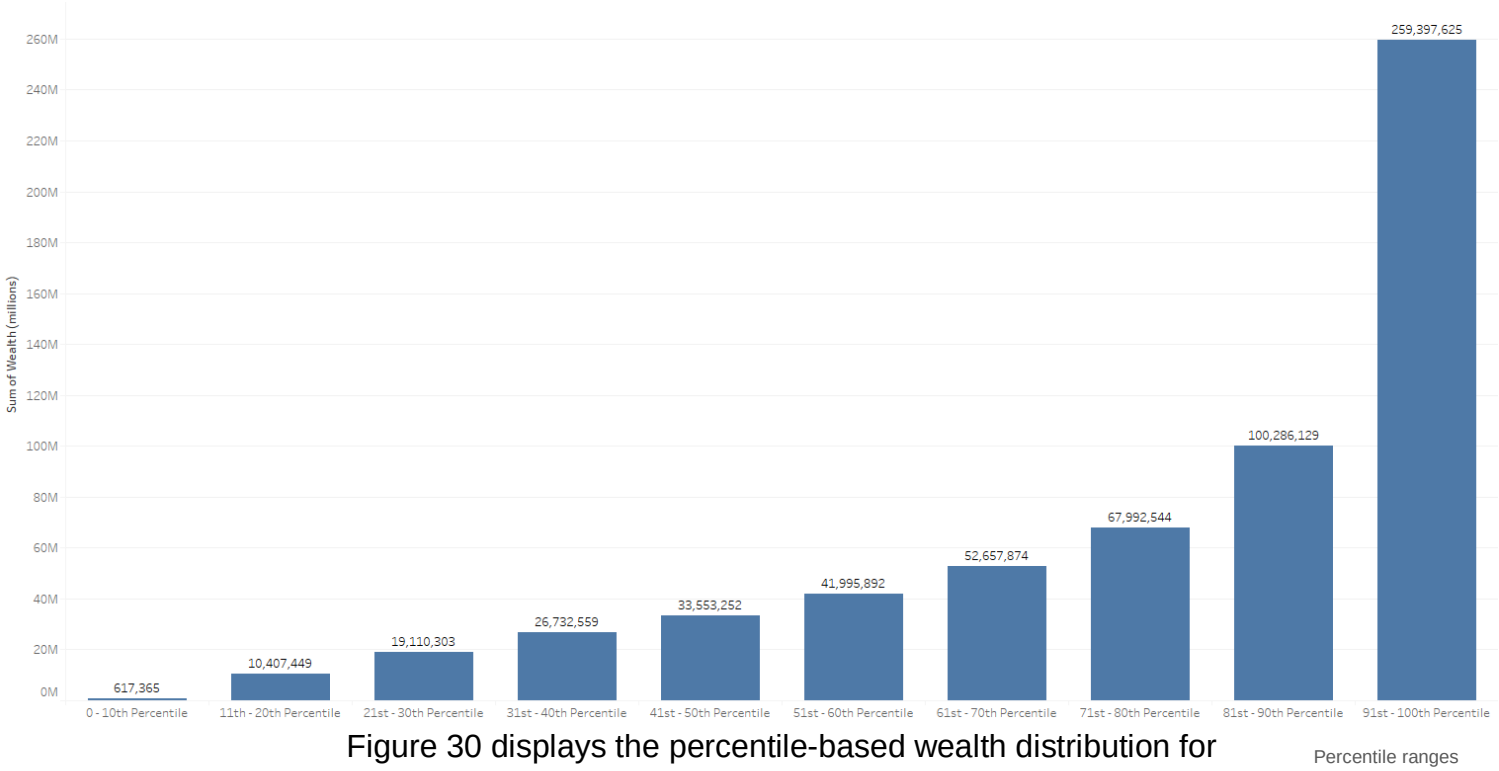


Figure 30 displays the percentile-based wealth distribution for Belgium and contains 1,071 data points with a sum total net worth observed of €259,397,625.

Belgium displays a linear progression of relative increase throughout the majority of its percentiles – 31st–80th. It follows similar patterns from other countries with large relative increase spikes at the beginning and end of its spectrum. The total relative increases for Belgium are shown below in table 13.

Table 13 – Belgium's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**1585%**
11th-20th -> 21st -30th	**83.6%**
21st-30th -> 31st -40th	**25.1%**
31st-40th -> 41st -50th	**25.5%**
41st-50th -> 51st -60th	**25.1**
51st-60th -> 61st -70th	**25.4%**
61st-70th -> 71st -80th	**29.12%**
71st-80th -> 81st -90th	**47.49%**
81st-90th -> 91st -100th	**283.9%**

As shown above, Belgium's linear increases throughout the middle ranges with a remarkably similar relative increase stabilising at 25% through almost 50% of the population. This is partially reflected within the population-based wealth distribution graph which displays the low decline rate and a relatively dense population within the middle ranges of the wealth spectrums.

The largest relative increase for Belgium is within the 0-10th vs 11th-20th percentiles with a total increase of 1585% which is the largest from any of the 15 countries observed. This increase is backed by an absolute increase of €9,790,084 which is also one of the largest absolute increases in net wealth between the lowest two brackets. This large absolute increase pairs well with the data shown in the population-based wealth distribution which shows Belgium's spike within the €0-50k range encompassing 10.18% of the population.

Figure 31 visually shows Belgium's relative increases against the average increases across the 15 European countries observed in the thesis. Figure 31 shows how Belgium has below average increases when comparing almost all of its decile ranges. This can be shown by table 13 as ranges between 21st percentiles and 70th percentiles have very stable and linear increases between 25% and 29%. Belgium is the only country

to have such stable and linear increases across such as large part of its population. After these stable increases Belgium has very high increases, once again seen between the 9th and 10th deciles, of 283% which is well above the average.

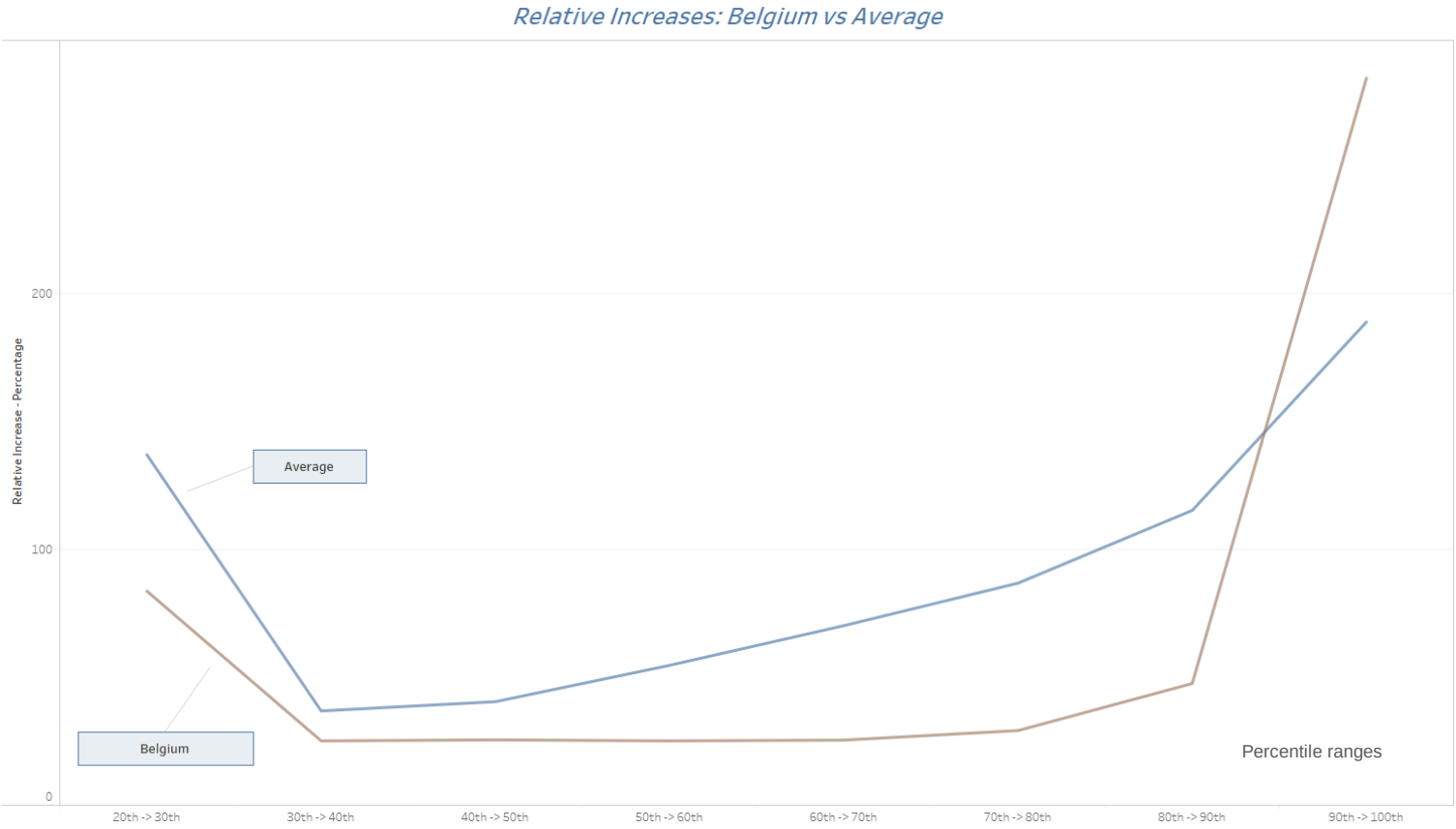


Figure 31 – Belgium's relative increases compared to average relative increases.

4.2. Slope-Shaped Distributions

This section aims to define and describe Slope-shaped distributions within the observed countries. Slope-shape distributions are primarily categorised by having only one peak and a continually declining count of population after said peak. Within the peak of distribution the majority of the population should theoretically be encompassed. Slope-shaped distributions here do not speak to the distribution of wealth in relation to sum aggregates or wealth held by certain percentages but instead to where the majority of the population resides in relation to the wealth spectrum.

As will be displayed, there can often be a large difference within Slope-shaped distributions where a very few number of individuals clearly control extremely large amounts of wealth which evidently skew the sum wealth distributions. This is an example of how the population-based distributions combine with the percentile-based distributions to provide emergent details about the distribution as a whole.

Within the U shape distribution definition there contained a mathematical methodology for classifying the distribution type which capped at a threshold of 10% population as one qualifier. The Slope-shape distribution comparatively uses this same threshold as a point of difference between the Slope-shaped and U-shaped distributions.

While this 10% population threshold is important it is often visually much clearer to define a Slope-shape compared to a U shape distribution. This is primarily because Slope-shape distributions have very similar characteristics and lack the large variances within the distribution curves which many U Shapes have proven. In this sense, solidifying and clarifying Slope-shapes is easier and have less ambiguity than U-shaped distributions.

4.2.1. Portugal

Portugal's household population based wealth distribution of elderly population 65+

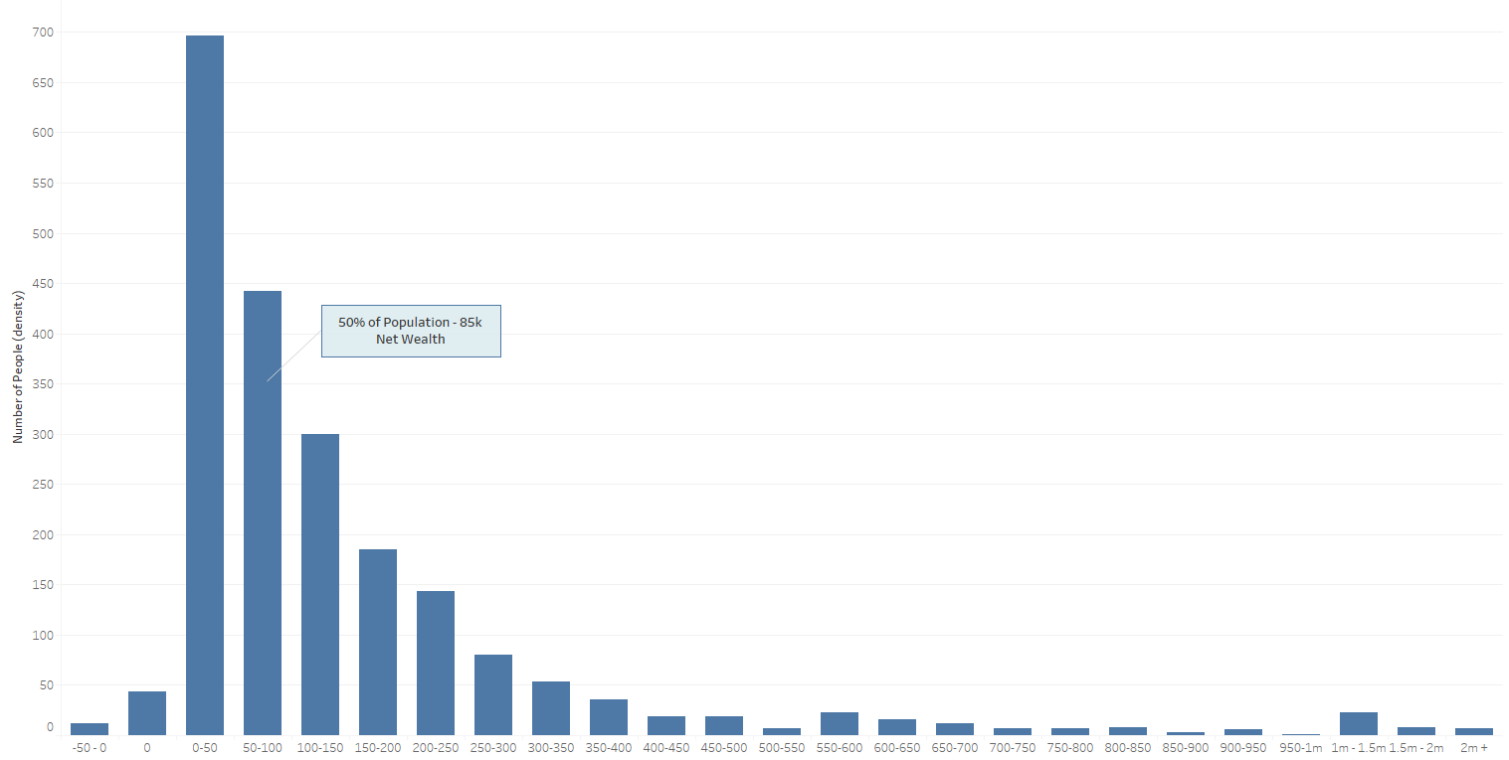


Figure 32 – Portugal's household population-based wealth distribution graph. €85,000 median net wealth.

Just as France was first observed as the 'best' example of both the U-shaped distributions, Portugal serves as the best example of a Slope-shaped distribution.

Figure 32 displays the net wealth of the elderly population at ages 65 and over. It contains just over 2,100 data points and uses data from the ECB's HFCS. This graph is generated in the same way as all the population wealth distribution graphs in this paper. Figure 32 has an average age of 74.5 years and the minimum age is 65 years. Portugal has a relatively old population and has already transitioned into the main phase of population aging and ranks 32nd in the world in terms of population age, 11th in Europe and 3rd within the 15 countries observed in this paper. Portugal has a median net wealth of €85,000 and an average net wealth of €160,000.

Within figure 32 the highest point is the €0 – 50k range this holds 696 data points and compared to the lowest bracket €950k – 1M it represents a difference of 693 points. This section of the population in the €0 – 50k range represents 32.26% of the total population sampled (2157),

the following bracket €50 – 100k also contains 442 data points and combined with the €0 -50k bracket accounts for 52.75% of the population. Alongside this data it is noteworthy to add that the median net wealth levels in Portugal are just over €68,000 per household and the average household wealth value is €160,100 which represents a median to average ratio of 1.875.

Portugal has the second lowest median net wealth levels within the 15 countries observed – Slovakia being the lowest. However while Portugal ranks second in the lowest median wealth levels it has a smaller amount of its population with negative net wealth levels compared to France. Of France's population, 0.7% are indebted or have negative net wealth values however in Portugal, only 0.55% of people have negative net wealth values and of these values Portugal has a significantly lower observed minimum of €-27,600 and a median of €-2,700.

After the €0 – 50k bracket Portugal's distributions steadily decreases. It does so at an average of 36.1 %per bracket until the €450K bracket at which point the values fluctuate from anywhere between 6% of the total population to the lowest of just 0.001% of the population.

Portugal's rate of decline can be seen in table 14. As it shows, Portugal's range 1 begins at the €0-€50,000 bracket and ends at the €400,000 bracket. Portugal is the first Slope-shaped country to have its rate of decline calculated and serves as an exemplar because it has clear range of wealth observed and does not have multiple peaks within its smooth slope. Portugal has a relatively high rate of decline with 0.243% of its population density declining per €1,000 or 1% decline in population for every €4,115 increased.

Table 14 - Portugal's rate of decline. Includes two different wealth ranges.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€0	€400,000	€400,000	97.2%	0.243% per €1,000

As Portugal has been classified as a slope type distribution it is important to observe that even though the later brackets starting at €1M+ have been aggregated there is still only a very small percentage of the population who reside there. There is a slight peak in the €1M – 1.5M bracket, however it instantly tails off. A closer look at these brackets revel that while there are fewer very wealthy people relative to the population there are still households with extremely large amounts of capital and one specific example would be 'ID82932' which reported a net wealth value of €34,235,951.

Portugal's percentile based wealth distribution of elderly population 65+

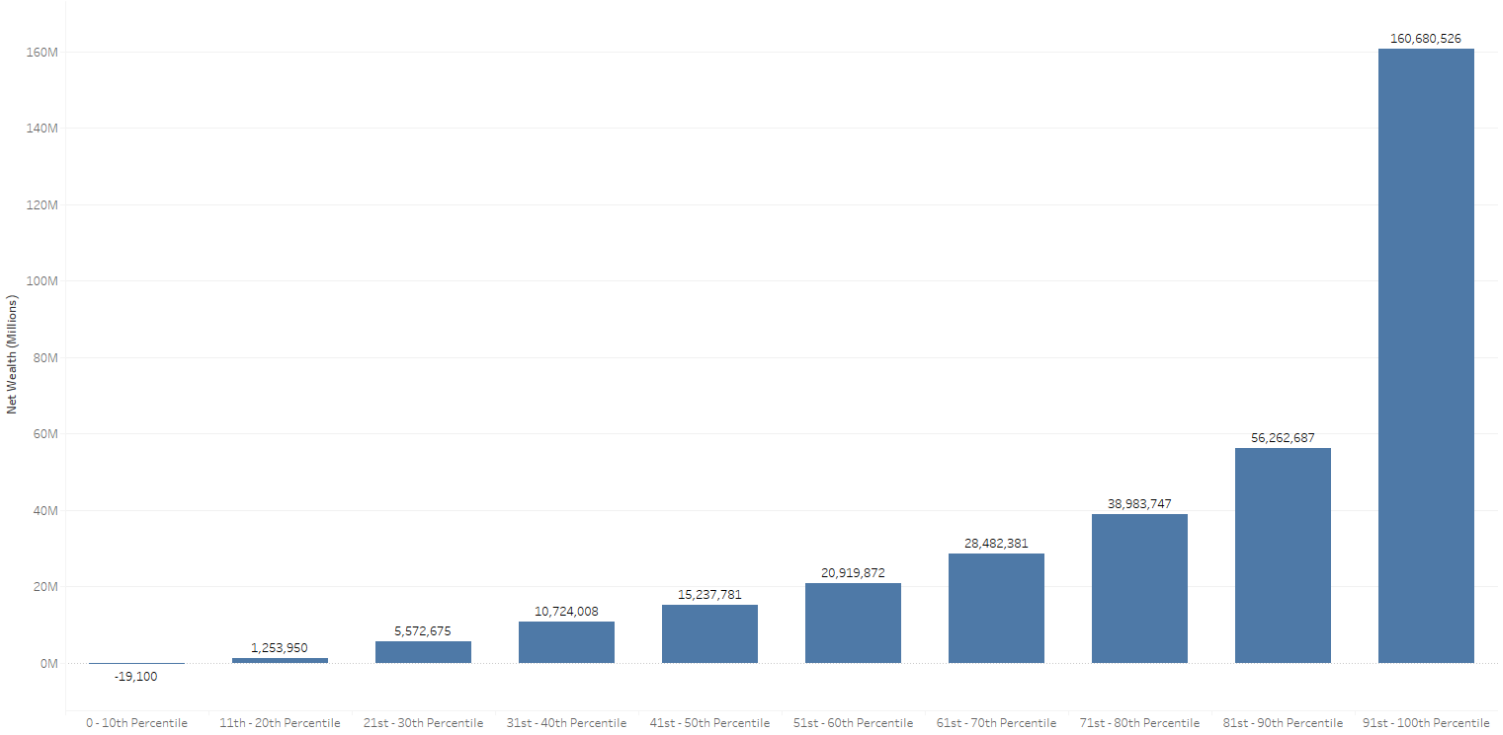


Figure 33 - Portugal's household percentile-based wealth distribution graph.

Portugal is a fascinating example for not only why Slope-shaped distributions can be deceiving but also as to why when studying wealth one must consider all the different descriptive approaches.

Portugal's wealth distribution when viewed through the percentile brackets yields an interesting discovery. The country is the only within the 15 countries observed to have a bracket with a negative aggregate net wealth value. As displayed in the 0-10th percentile the total value of this group of the population comes to €-19,100. This number actually becomes difficult to compare to the previous brackets as in the previous section there has been analysis based on the percentage increase, however it

becomes impossible to create a percentage increase when comparing negative values. The same calculation for France's bottom 10th percentile cannot be calculated for Portugal for this reason however it is clear that the bottom 10 percent is not only minimally represented, but heavily under represented due to their indebted nature relative to its size of the whole population. As a total of €338,053,527 is represented in the graph, the bottom 10% of the population's aggregate net wealth would have to increase by €33,824,452 to be proportionally represented.

Much like France, Portugal displays an exponentially trending growth of aggregate net wealth. While there is very little difference within the bottom 50 percentile each succession still increases more than the difference between the two proceeding percentile brackets with the exception of the 21-30th bracket. Much like the countries observed within the U-shaped distributions there are large relative increases between the lower brackets, however these differences are often small when viewed as absolute aggregate amounts. Take for example the 11th – 20th bracket and the 21-30th brackets, the relative difference between the two is 344.4% however the actual difference in aggregate net wealth is only €4,318,725 so whilst this is the largest increase relatively through the whole graph it is actually the second smallest increase. An increase in aggregate net wealth between these two brackets represents only 4.135% of the increase when compared to the increase observed between the two highest brackets. Table 15 shows the complete rate of relative increases for Portugal.

Table 15 - Portugal's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th-21st	**N/A**
11th-20th -> 21st-30th	**344.4%**
21st-30th -> 31st-40th	**92.43%**
31st-40th -> 41st-50th	**42.09%**
41st-50th -> 51st-60th	**37.28%**
51st-60th -> 61st-70th	**36.14%**
61st-70th -> 71st-80th	**36.86%**

71st-80th -> 81st -90th	**44.46%**
81st-90th -> 91st -100th	**185.5%**

The average increase across all of the brackets is 102.39%. If only the middle brackets are observed, dropping the highest and lowest brackets, one observed an average increase of 48.24%.

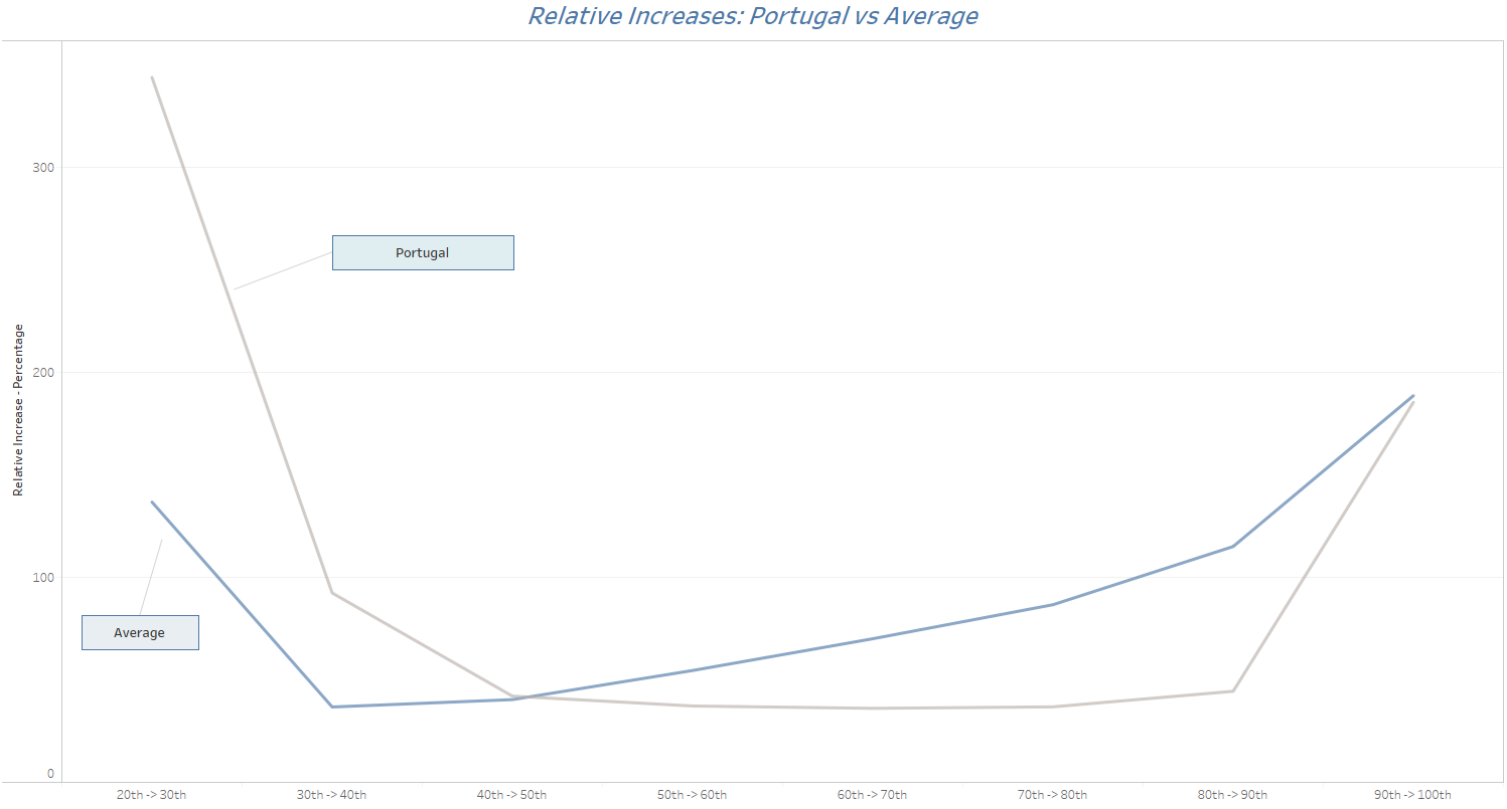


Figure 34 – Portugal's relative increases compared to average relative increases.

Figure 34 visualises table 15 to show Portugal's relative increases against the average relative increases observed across the 15 countries studied. As shown, Portugal begins with very high relative increases within the lower ranges however drops below the average through the middle to late percentiles. Interestingly though, Portugal has the same relative increase as the average when comparing the 9th to 10th deciles. This is surprising because when comparing the 8th and 9th deciles Portugal has a much lower relative increase which shows the large difference between these two trends. As Portugal has one of the lowest amounts of population within the €1M+ ranges it is expected that the relative increases would be

lower than the average because of its high population density across a small initial wealth range.

Portugal seems to display an unequal distribution of wealth when viewed through the percentile break down. Not only is Portugal the only observed country to display an extremely poor and indebted bottom 10% of the population but also a very wealth top 10% as well which controls more wealth than the bottom 90% combined. When comparing Portugal to previous countries within the U-shaped distributions one would logically deduce that Portugal does not have a large population base which resides above the one million and over category however it is still heavily skewed towards the wealth members in its society. It must follow that Portugal has a relatively small number of individuals who have extremely large amounts of net wealth. Deductions such as these are emergent details which can only be observed when combining both the percentile break down and the population break downs of net wealth as they yield distinct features which would appear to contradict themselves when compared with other typical European countries. If a piece of research were to only display the percentile distribution of wealth it could very well miss the contradiction between a typically conceived ‘equal’ population however when this percentile analysis is combined with other visualisations many emergent details come through.

4.2.2. Netherlands

Netherlands's household population based wealth distribution of elderly population 65+

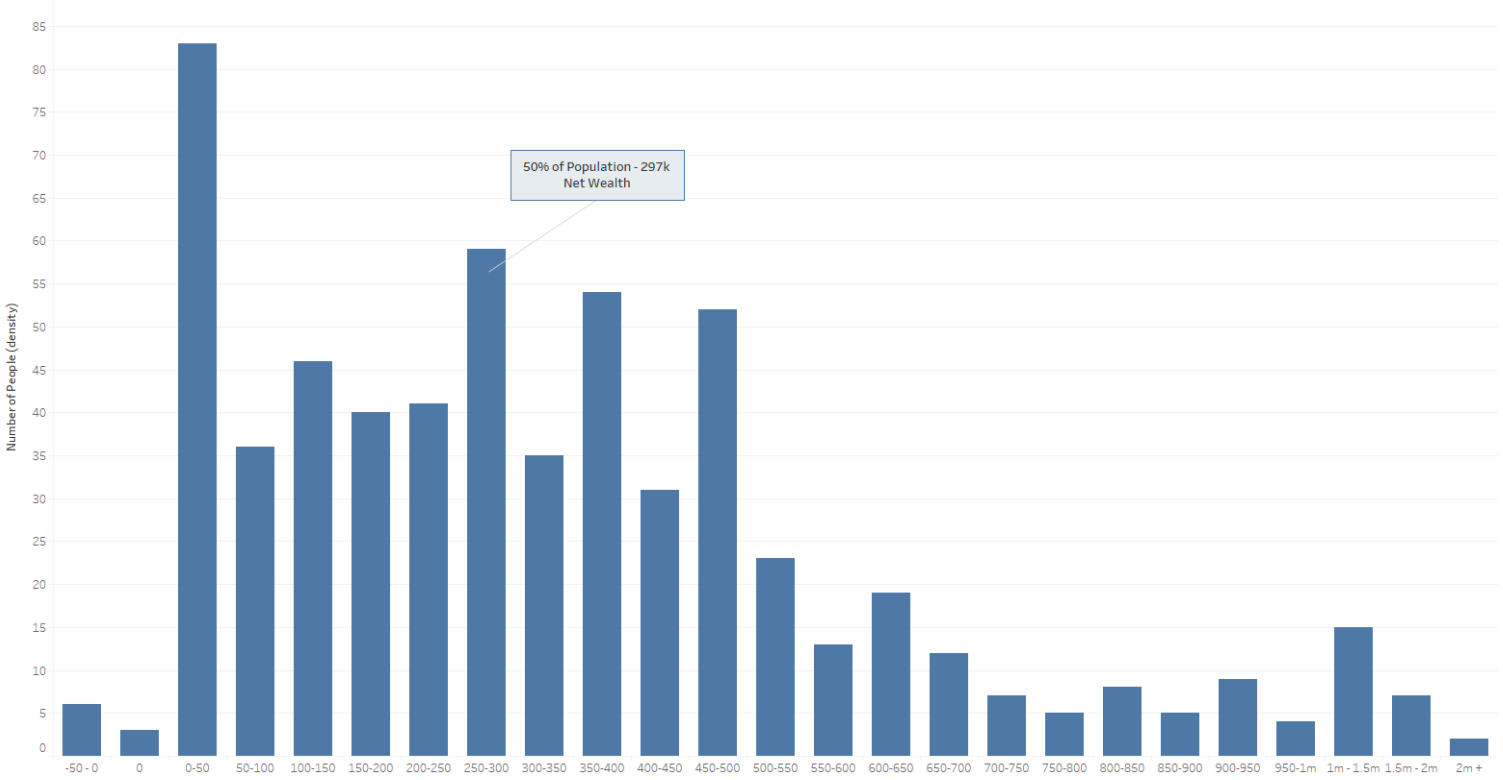


Figure 35 – Netherland's household population-based wealth distribution graph. €297,000 median net wealth.

Figure 35 displays the elderly wealth distributions of Netherlands. The total number of data points observed in figure 35 is 615 and the median age of the population is 71.86 years of age which ranks as the 2nd youngest population of the 15 countries included. The Netherland's has a median net wealth of €297,000 and an average net wealth of €358,000.

The highest point of density within Netherlands is the €0-50k bracket which includes 83 data points or 13.5% of the total population. The lowest point of the distribution is the €2M + bracket which has only 2 data points or 0.0325% of the population and is closely followed by the 0 bracket which has 3 data points. The difference between these two is bracket is 13.01%.

The median wealth for the observed population in Netherlands is €297k and ranks 4th out of the 15 observed countries. Of the top 5 highest median net wealth countries including: Luxembourg, Estonia, Belgium, Netherlands and France, Netherlands is the only Slope-shaped distribution and also has one of the lowest differences between the observed median

and the observed average levels of net wealth – 5th / 15th. Netherlands Slope-shaped distribution and its high median net wealth make it a unique country

As Netherlands appears to have a unique Slope-shaped distribution one could argue where exactly the middle section of the distribution actually lies. Because of this, a rate of decline has not been calculated for Netherlands. Typically the mid-section would start after the initial peak which is usually just after or at the median point of the distribution; however there is another smaller peak of distribution which occurs at the beginning of the distribution and peaks at the €100k-150k range. Because of these two peaks calculating the average decline throughout the middle section will be done from two points, first from the initial peak and secondly from the median peak. The decrease in population from the €100k-150k range is as follows:

13.1% , 2.5%+, -43.9%+, 41.3%, 54.2%+, 57.4%, 67.7%+, 44.2%, 44.5%+, 46.15%, 37.95%, 42.77%, 29.6%, 60%, 80%+, 44.44%.

The average decrease from the first peak is only -0.77% per bracket, however when taken from the second peak the average decrease until the aggregated wealth brackets is 16%.

Netherlands is another interesting case when dividing the 15 countries observed into two different slope categories. Netherlands could arguably be a U-shaped distribution as well as a slope distribution; if the aggregated wealth brackets towards the end were to be denser then it would definitely be categorised as a U-shaped distribution. However given that the aggregated wealth values are not high enough it Netherlands falls into a Slope-shaped distribution. Netherlands distribution also displays the characteristics of Slope-shaped distributions by having a steady decrease through the mid ranges of the wealth distribution. There are of course peaks within Netherlands mid wealth distribution and it then becomes arguable exactly where the middle wealth distribution for Netherlands falls however since there is such a prominent peak in the €0-50k bracket it would seem that from there begins the initial peak.

Another possibility is that Netherlands represents the midpoint for a country whose elderly population is progressing through the transition to a U-shaped distribution.

Of the 15 countries observed in this study Netherlands is the only country to display a staggered or multi single peak distribution throughout any part of its wealth spectrum. There are several possibilities for this anomaly the first of which could be a survey error. It is possible that during the survey there was some kind of cultural influence which may have influenced participant responses towards more ‘rounder’ numbers such as the €300,000 €400,000 and €500,000 observed. This possibility would accept the difficulties of studying wealth and argue that respondents when asked to sum their net wealth in whatever manner are likely to choose larger and simpler numbers rather than distinct ones. This could be proven by analysing the exact values of the micro data to see if rounder numbers are more prominent however when a bracketing method is used like such it generalises purposefully over such details. The second line of reasoning could argue that there is some financial benefit to the elderly population in the Netherlands to those who state a certain level of wealth or under a certain level to receive additional financial aid. The third possibility is that the Netherlands, being a separate country, has a completely unique elderly wealth distribution independent of surveying errors.

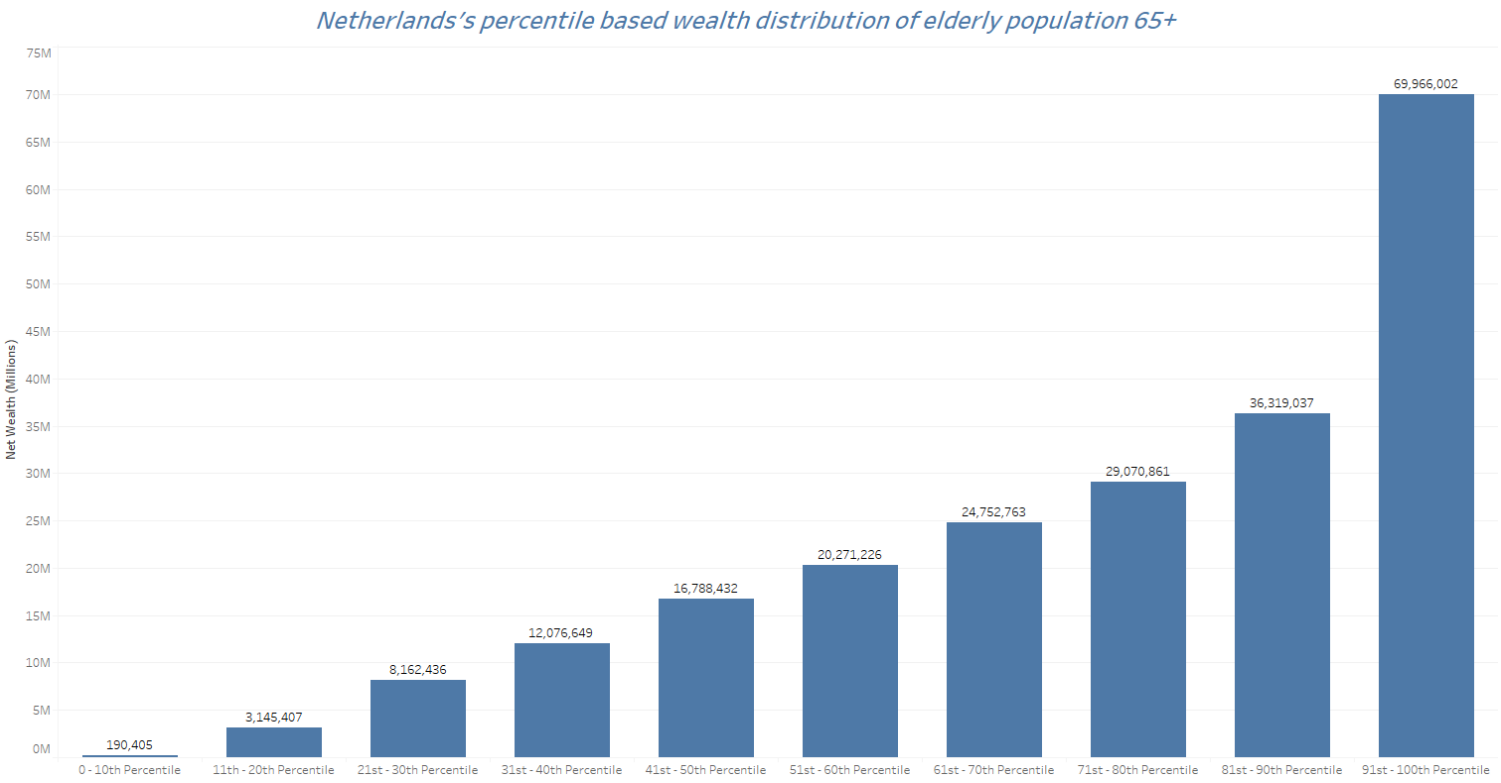


Figure 36 - Netherlands's household percentile-based wealth distribution graph.

Figure 36 displays Netherlands percentile-based wealth distribution. The total observed data points is 615 and represents one of the most equal percentile distributions of all countries examined.

Within the Netherlands dataset there is a sum total of €180,379,889 observed. Of this sum, the highest 10 percent of the population accounts for 38.79% of the total net wealth including itself. Without including itself the top 10 percent of the elderly population accounts for 63.37% of the wealth outside of its own. Compared to every other country observed in this study the top 10 percent of the elderly population in the Netherlands accounts for on average 18% less than the other 14 countries. Beginning with the lowest percentile and ascending the top 10 percent has the same amount of wealth as approximately the bottom 65% of the population surveyed.

There are several reasons why the Netherlands has been given the title of the most equal percentile distributions and the primary reason is because of its almost linear increase from the lowest to the highest percentiles. Beginning with the bottom percentiles, the relative difference between the percentile brackets can be seen below in table 16:

Table 16 – Netherland's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**1552%**
11th-20th -> 21st -30th	**159.5%**
21st-30th -> 31st -40th	**47.96%**
31st-40th -> 41st -50th	**39.01%**
41st-50th -> 51st -60th	**20.74%**
51st-60th -> 61st -70th	**22.10%**
61st-70th -> 71st -80th	**17.44%**
71st-80th -> 81st -90th	**24.93%**
81st-90th -> 91st -100th	**92.64%**

The average increase across all the percentiles is 144.385%. However, this relative increase is heavily skewered – like most countries, by the enormous difference between the 0-10th and the 11th-20th groups. When this figure is subtracted, the relative and more visually accurate average is 57.65%. If this is then further focused on the middle to top distribution by subtracting again the lowest relative increases the new average then becomes 40.59%.

Figure 37 across the page visualises Netherland's relative increases against the average relative increases across all 15 countries. The Netherlands shares very similar increases between the earlier deciles however it takes a different turn when comparing the 4th and 5th deciles. After the 5th decile, the Netherlands drops significantly below the average and continues to call until the 8th,9th and 10th deciles. This is highly unusual because most of the 15 countries show a steady increase or at least a flat lining of increases throughout these ranges whereas the Netherlands continues to decline. Along with this unusual decline, the Netherlands also has an unusually small relative increase between the 9th and 10th deciles.

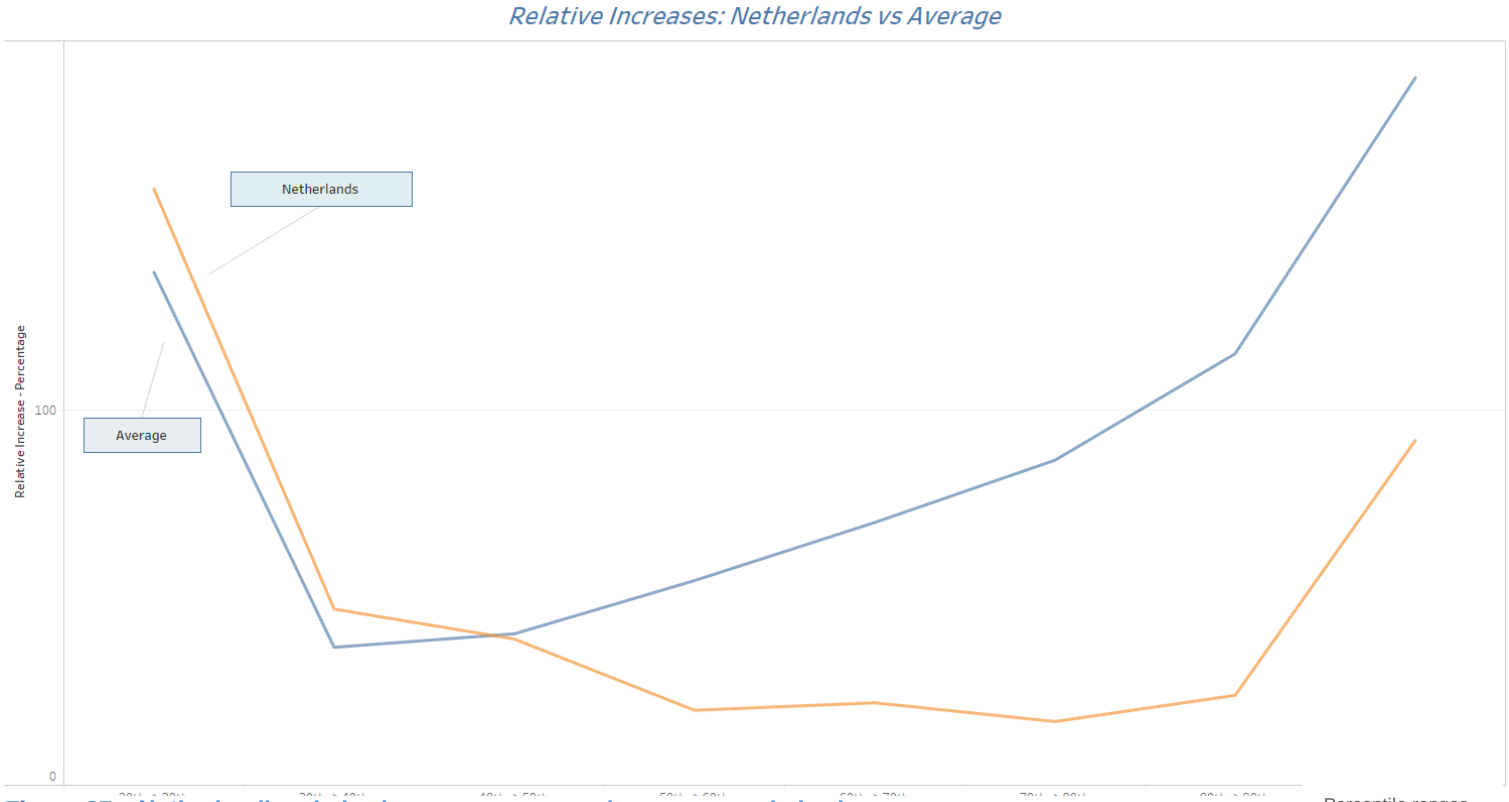


Figure 37 – Netherland's relative increases compared to average relative increases.

4.2.3. Italy

Italy's household population based wealth distribution of elderly population 65+

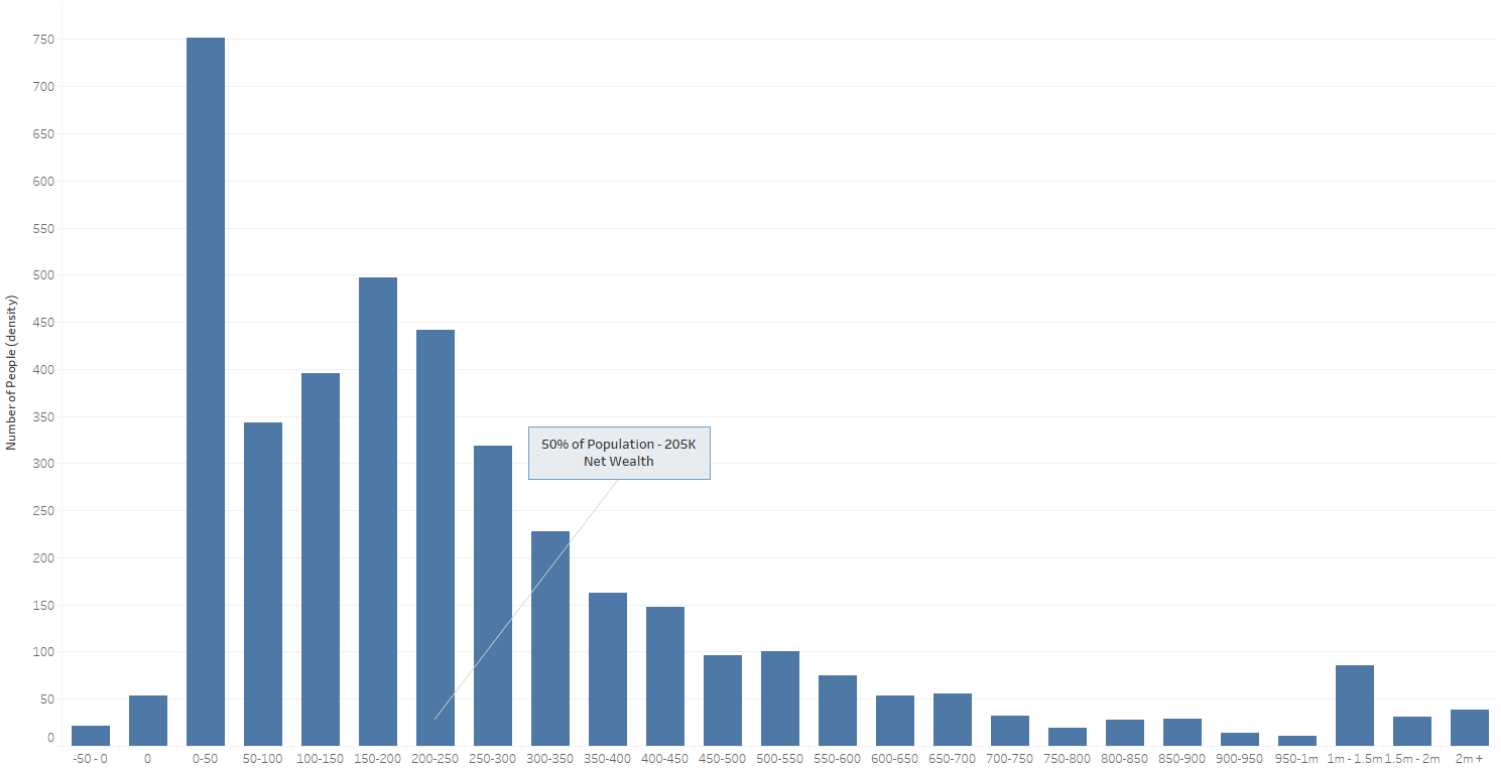


Figure 38 – Italy's household population-based wealth distribution graph. €205,000 median net wealth.

Figure 38 displays Italy's net worth distribution across the surveyed elderly population. This graph includes a total sample size population of 3,801 people with an average age of 67 which is the 7th oldest elderly population of the 15 countries observed. Italy has a median net wealth of €205,000 and an average net wealth of €299,000.

Italy is one of the only countries to show significant stratification within the area before the first peak. It is unusually, when considering the countries examined to have such a prominent singular peak in the €0-50k because of its independence to the median peak. The €0-50k peak encompasses a total of 752 data points or 19.8% of the total population and compared to the median peak, considered here to be the €150k-200k bracket, it is 51.3% bigger or contains 255 more data points.

Italy's rate of decline can be seen in table 17. As it shows, Italy's range 1 begins at the €150,000-€200,000 bracket and ends at the €750,000-€800,000 bracket. Italy has a rate of decline at 0.160% population density per €1,000 or 1% population density decrease per €6,238 increased.

Table 17 – Italy's rate of decline.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€150,000	€750,000	€600,000	96.17%	0.160% per €1,000

Previously, France and Netherland's distributions also contained singular peaks at the €0-50k bracket however neither of which were as prominent as Italy's when measured relative to the population.

Italy could almost be described as a U-shaped distribution because of the peak within the €1M-1.5M category however because of the shear difference between the two sizes of the first and second peak it has been categorised as a Slope-shaped distribution instead. Italy may be a good example of how a country begins along the distribution trend to transform from a Slope-shaped distribution into a U-shaped distribution.

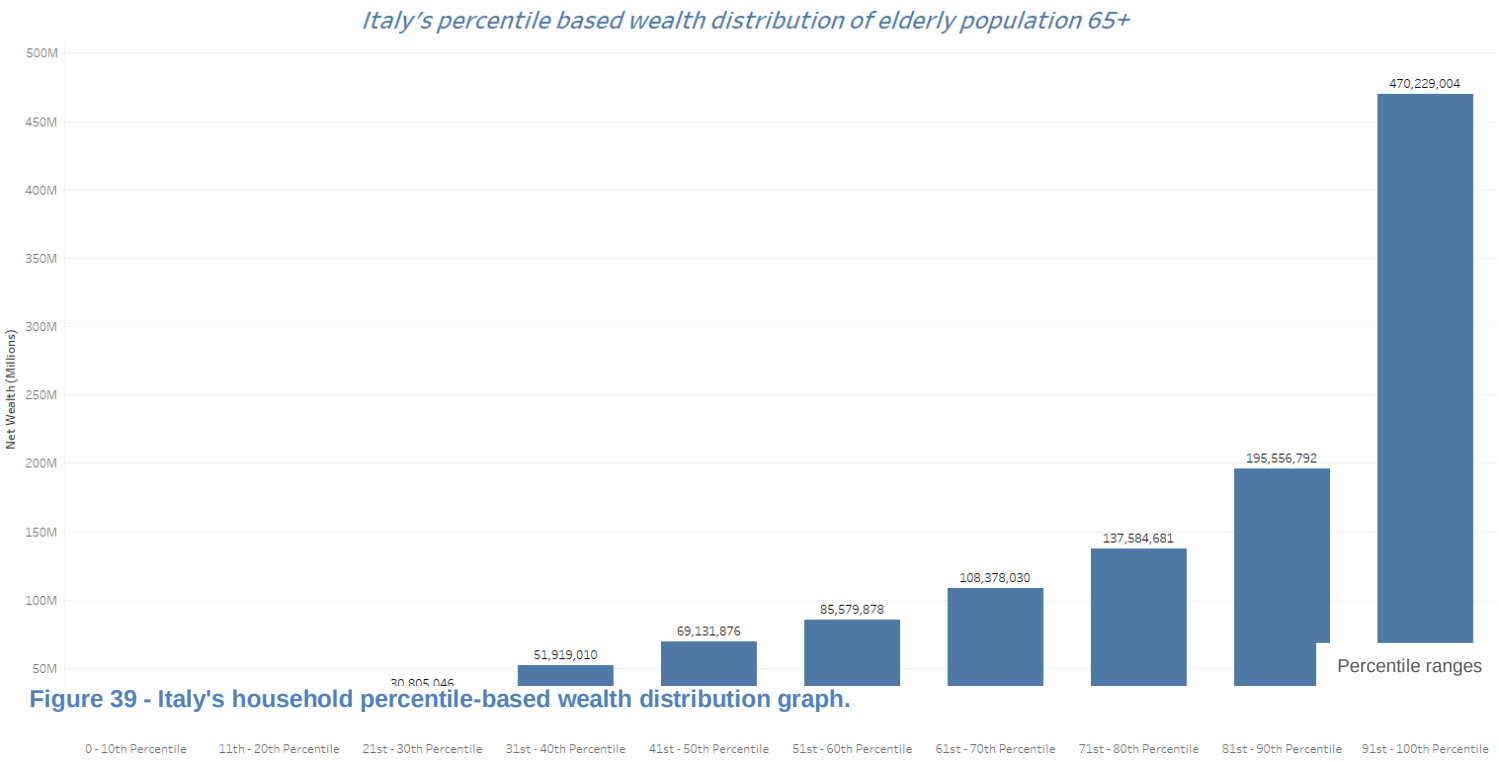


Figure 39 - Italy's household percentile-based wealth distribution graph.

Figure 39 displays Italy's net wealth percentile distribution. When Italy is considered amongst the other 15 observed countries it displays a similar mid-range percentile distribution. It shares the same characteristics as many other countries from the 0-90th percentiles as an almost linear increase between the decile ranges followed by a significantly larger increase within the 91st – 100th percentile.

The largest absolute increase is once again observed between the 81st-90th and the 91st-100th percentile ranges with an overall difference of €274,672,212. This represents a relative increase of 140.45% and is commonly behind the relative increase of the 0-10th percentile and the 11th-20th percentile which has a relative increase of 717.82% however this is only contained within 8 million euros.

The wealthiest 10% of the Italian population observed accounts for ~78.5% of the total population's wealth beginning from the lowest and ascending. In contrast, when compared to their proportion of the population the 0-10th percentile only comprises 0.088% of the total net wealth leaving them 113x smaller than if the wealth within the system were to be split equally. Compared to other countries, Italy's wealthiest 10% of the population has a relatively small grasp of the total wealth in the

observed population and ranks 6th of 15 within the observed countries. All of Italy's relative increases can be seen below in table 18.

Table 18 – Italy's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**717.8%**
11th-20th -> 21st -30th	**267.6%**
21st-30th -> 31st -40th	**68.54%**
31st-40th -> 41st -50th	**33.15%**
41st-50th -> 51st -60th	**23.79%**
51st-60th -> 61st -70th	**26.63%**
61st-70th -> 71st -80th	**26.69%**
71st-80th -> 81st -90th	**42.1%**
81st-90th -> 91st -100th	**140.4%**

Figure 40 visualises Italy's relative increases against the average increases observed across the 15 countries studied in this thesis. As shown, Italy follows a similar trend to Portugal which is unsurprising given that the two have very similar population-based distribution graphs and the

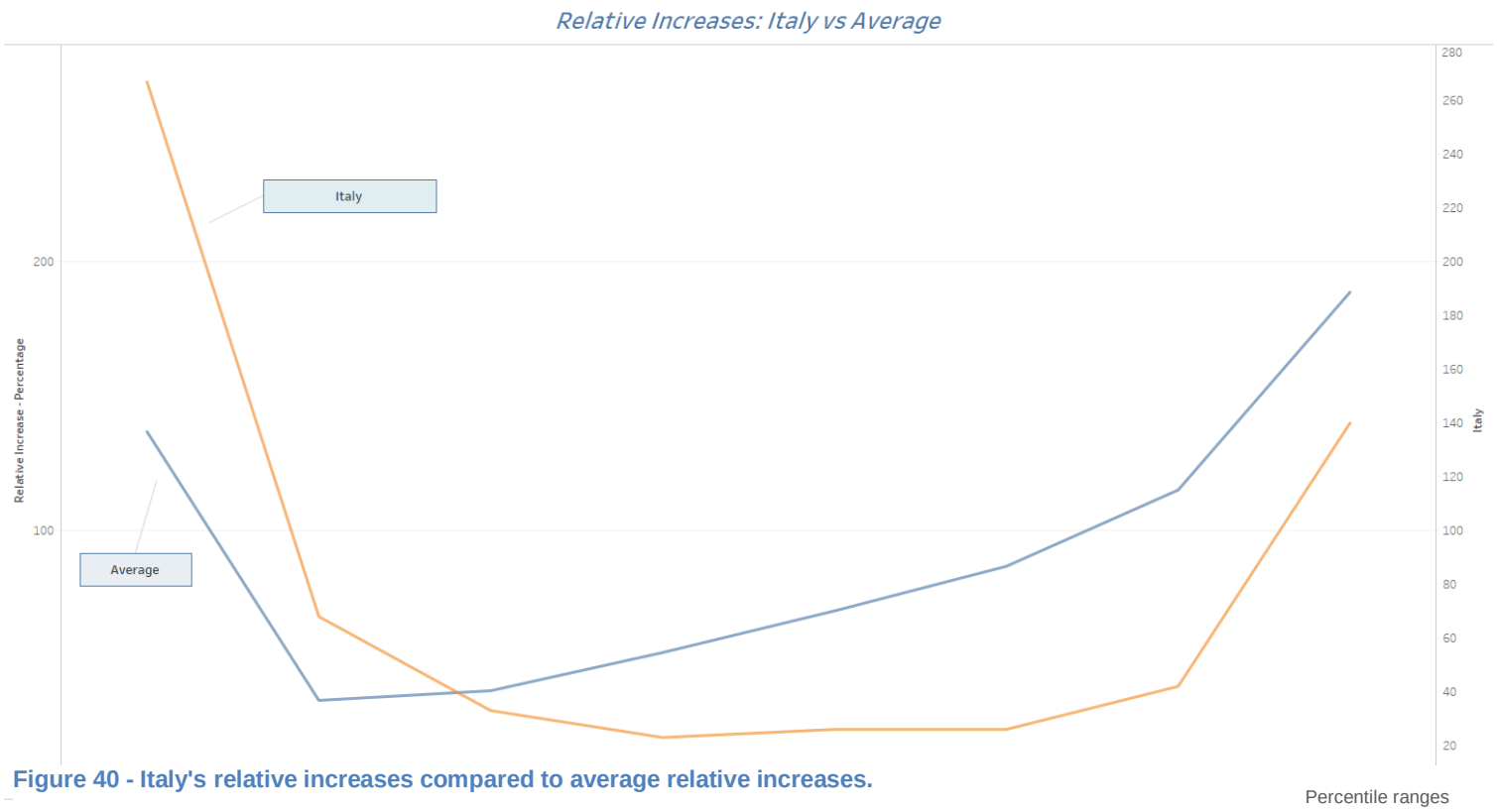


Figure 40 - Italy's relative increases compared to average relative increases.

complementary nature between these two views provides stability between them both.

4.2.4. Slovenia

Slovenia's household population based wealth distribution of elderly population 65+

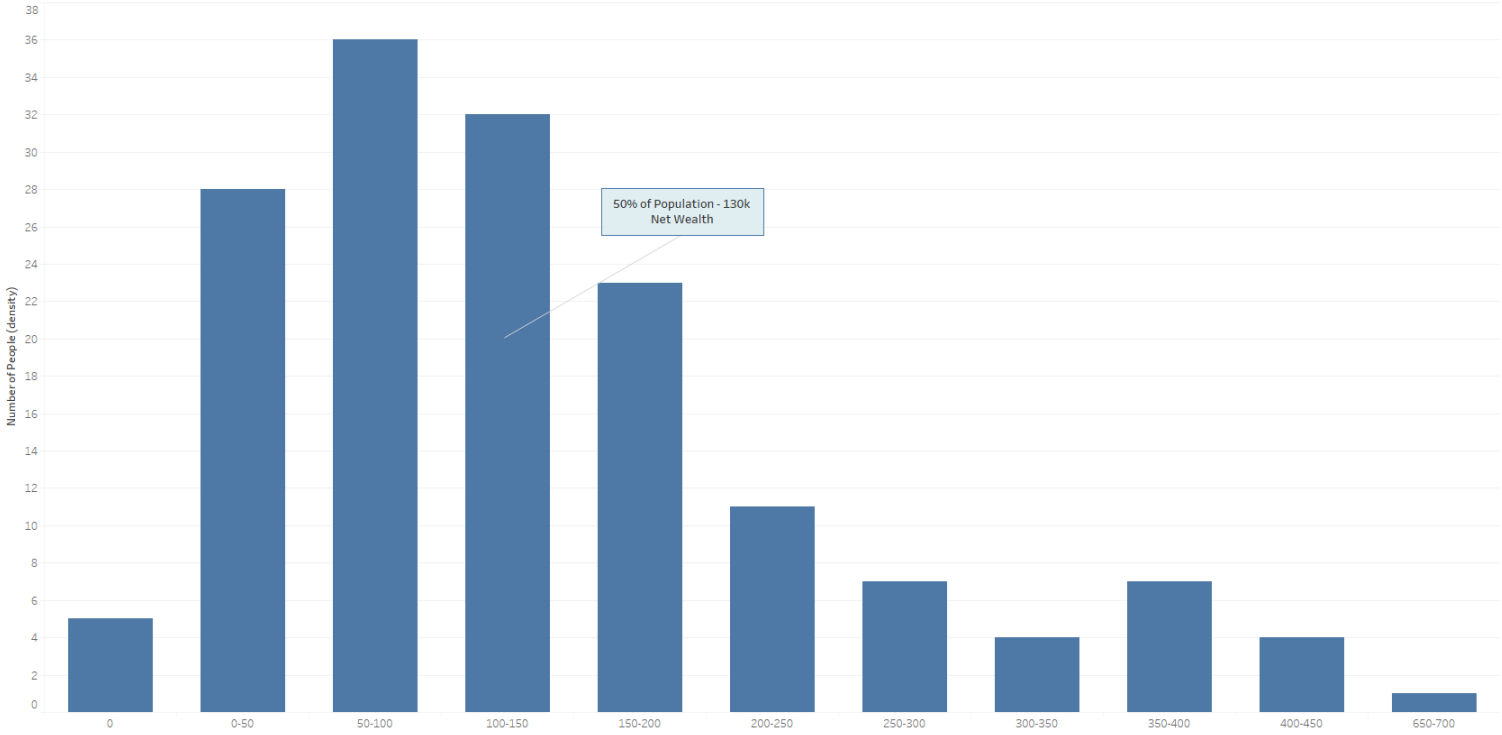


Figure 41 – Slovenia's household population-based wealth distribution graph. €130,000 median net wealth.

Figure 41 depicts Slovenia's net worth within the surveyed elderly population. The average age of the sampled population is 65.7 which is the lowest within the 15 observed countries.

The most notable part of Slovenia's wealth distribution within this graph is the lack of available data points. Within figure 41 there are only 158 data points shown. Within the HCFS Slovenia only contains 956 data points across all ages which is significantly less than almost every other country surveyed as all but Slovakia have complete and abundant data points to work with. For this reason a rate of decline has not been calculated for Slovenia.

Nevertheless despite the lack of data there are still interesting points of analysis contained within the limited information provided. Perhaps the most interesting is the complete lack of any surveyed population in the upper limits of the wealth spectrum. Even within other countries which have been classified as Slope-shaped distributions there are still indicators that the maximum levels of wealth are still prevalent

however within Slovenia's elderly population this appears to be absent. Accompanying this lack of wealthy population is the low median and average levels of wealth of only €130K which is the 4th lowest of the 15 observed countries.

Slovenia's highest percentage of the elderly population resides within the €50-100k range with 36 data points and encompassing 22.78% of the population. This is closely followed by the €100-150k range which encompasses 22.25% of the population.

Slovenia's percentile based wealth distribution of elderly population 65+

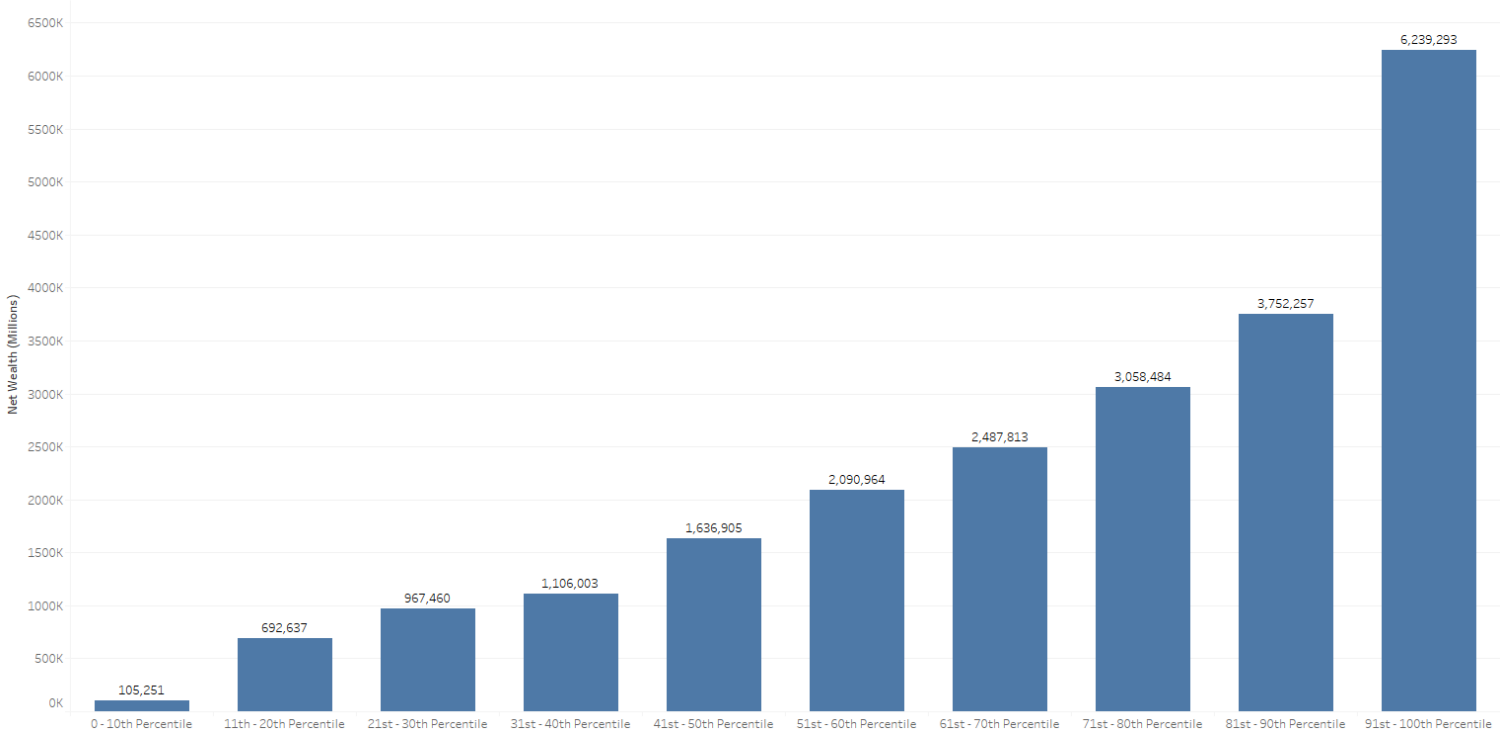


Figure 42 - Slovenia's household percentile-based wealth distribution graph.

Figure 42 provides further insight into the wealth distribution of Slovenia. Slovenia's wealth percentile break down is remarkably similar in shape to that of Italy's however it has a less pronounced difference between the top 10% and the proceeding bracket. As mentioned before, the aggregate levels of wealth here are heavily influenced by the small data set availability which is reflected in the low levels of aggregated wealth within each percentile bracket. Having said this, the percentile distribution graph for Slovenia provides more information due to this limitation. Slovenia's percentile distribution has an almost linear relative increase trend. This is rare and within the observed countries and

Slovenia has a relative increase trend which is the closest to a linear increase.

Table 19 - Slovenia's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**558.08%**
11th-20th -> 21st -30th	**39.67%**
21st-30th -> 31st -40th	**14.32%**
31st-40th -> 41st -50th	**48.00%**
41st-50th -> 51st -60th	**27.73%**
51st-60th -> 61st -70th	**18.97%**
61st-70th -> 71st -80th	**22.93%**
71st-80th -> 81st -90th	**22.68%**
81st-90th -> 91st -100th	**66.28%**

Table 19 details all of Slovenia's relative increases and Figure 43 further visualises these increases. As shown below, Slovenia has a rather unusual relative increase curve as, for the majority; it falls below the

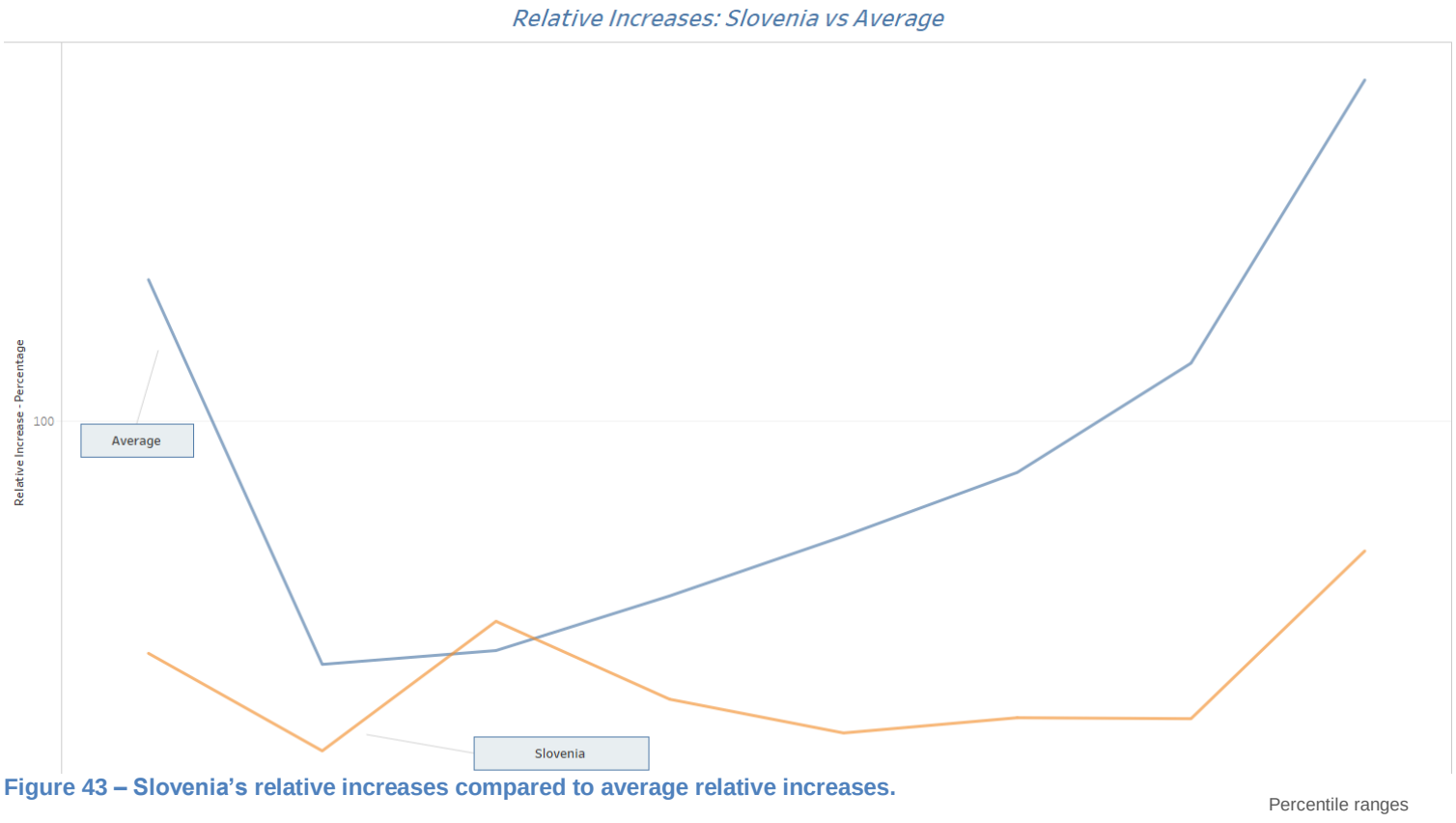


Figure 43 – Slovenia's relative increases compared to average relative increases.

increases of the average. Slovenia, aside from the Netherlands, has the lowest relative increases with only 32.5% across the total dataset.

4.2.5. Greece

Greece's household population based wealth distribution of elderly population 65+

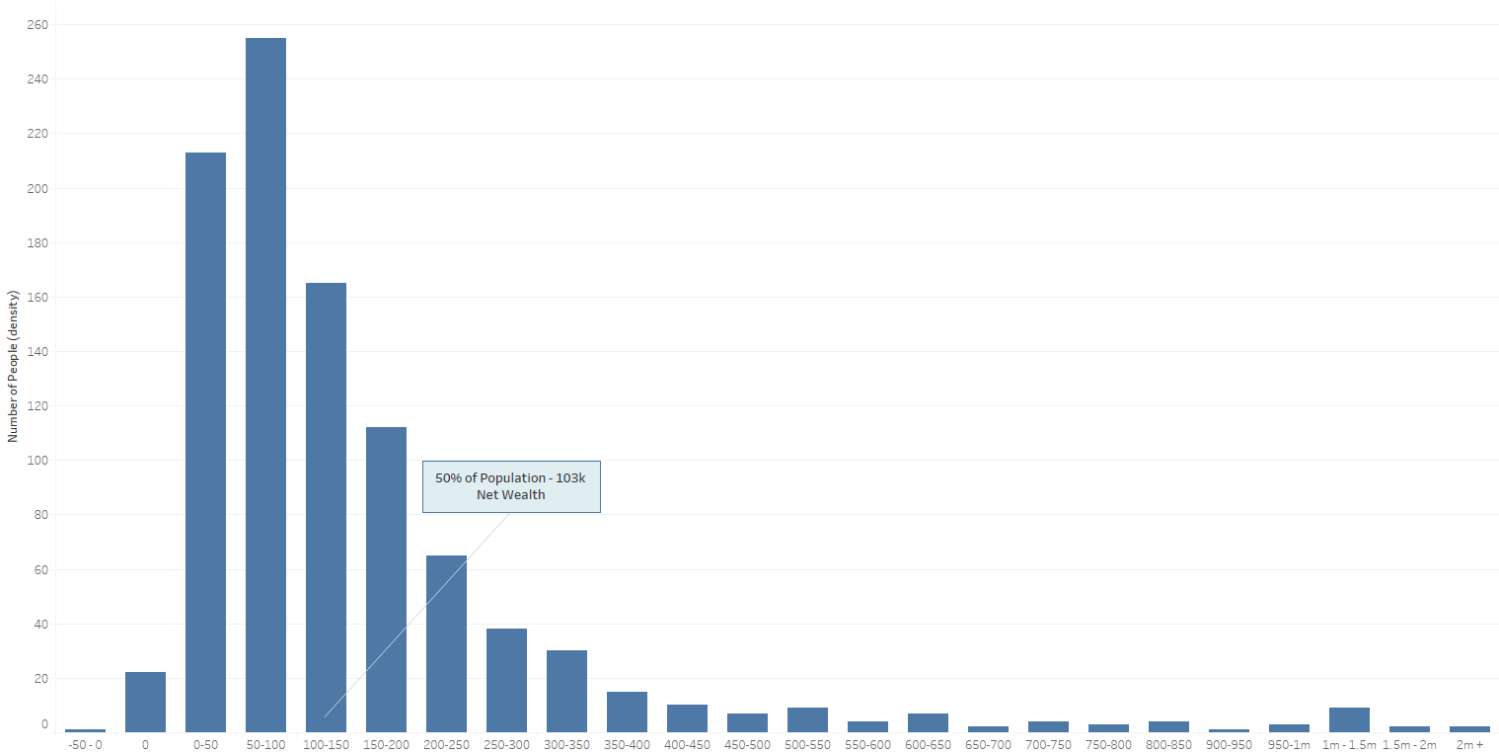


Figure 44 - Greece's household population-based wealth distribution graph. €103,000 median net wealth.

Figure 44 displays the net wealth distribution of Greece. Within the dataset the average age is 73.92 years which is one of the older elderly populations examined and ranks as the 9th eldest from the 15 observed countries. The Greece dataset used contains 983 data points. Greece has a median net wealth value of €107,000 and an average net wealth of €165,000.

Greece appears to be one of the more extreme examples of a Slope-shaped distribution. It has a very high relative peak which is concentrated around relatively low levels of net wealth – as noted the median net wealth for Greece is €107,000. Greece's distribution has a sharp decline after the highest peak in the €50-100K range combined with a low and flat decline through the middle and upper wealth ranges.

The lowest point of Greece's distributions falls within both the €-50k-0 bracket and the €900-950K bracket both with only one data point. This is surprising to the extent that Greece has one of the lowest observed median levels of wealth within the 15 countries that usually have a higher number of the population in the lowest or negative wealth levels.

Greece has been determined as one of the Slope-shaped distribution curves because it methodologically fits the definition constructed in this thesis. Greece is perhaps one of the better Slope-shaped countries because of its low levels of wealthy population especially among the aggregated population where the U-shaped distribution countries have a second peak.

Table 20 – Slovenia's rate of decline.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€50,000	€450,000	€400,000	97.25%	0.243% per €1,000

Greece's rate of decline can be seen in table 20. As it shows, Greece's first range begins at the €50,000-€100,000 bracket and range 2 ends at the €450,000-€500,000 bracket. Greece has a rate of decline measured at 0.243% per €1,000 or additionally for ever €1,646 increased the population density will fall by 1%.

Figure 45 displays Greece's percentile-based wealth distribution. The total observed data points is 983 and represents a percentile distribution with some unique characteristics.

The total observed wealth within the Greece dataset is €154,998,031. Of the total sum wealth observed, the top 10% of the population accounts for 40.1% a factor 4 times its size. Of this 40.1% share the top 10% of the richest population have the equivalent wealth of the bottom 78% of the population. In this regard Greece's richest 10% captures a relatively similar percentage of wealth to the rest of the observed countries. The bottom 10% on the other hand only account for 0.3% of the accountable wealth which, when compared the top 10%'s share is 133.66 times smaller. This bottom 10% also holds the largest relative increase of 402% between itself and the proceeding bracket (11^{th}-20^{th}). However while it holds the highest relative increase the greatest absolute increase is seen within the 81^{st}-90^{th} vs the 91^{st}-100^{th} brackets which shows a difference of €38,146,518.

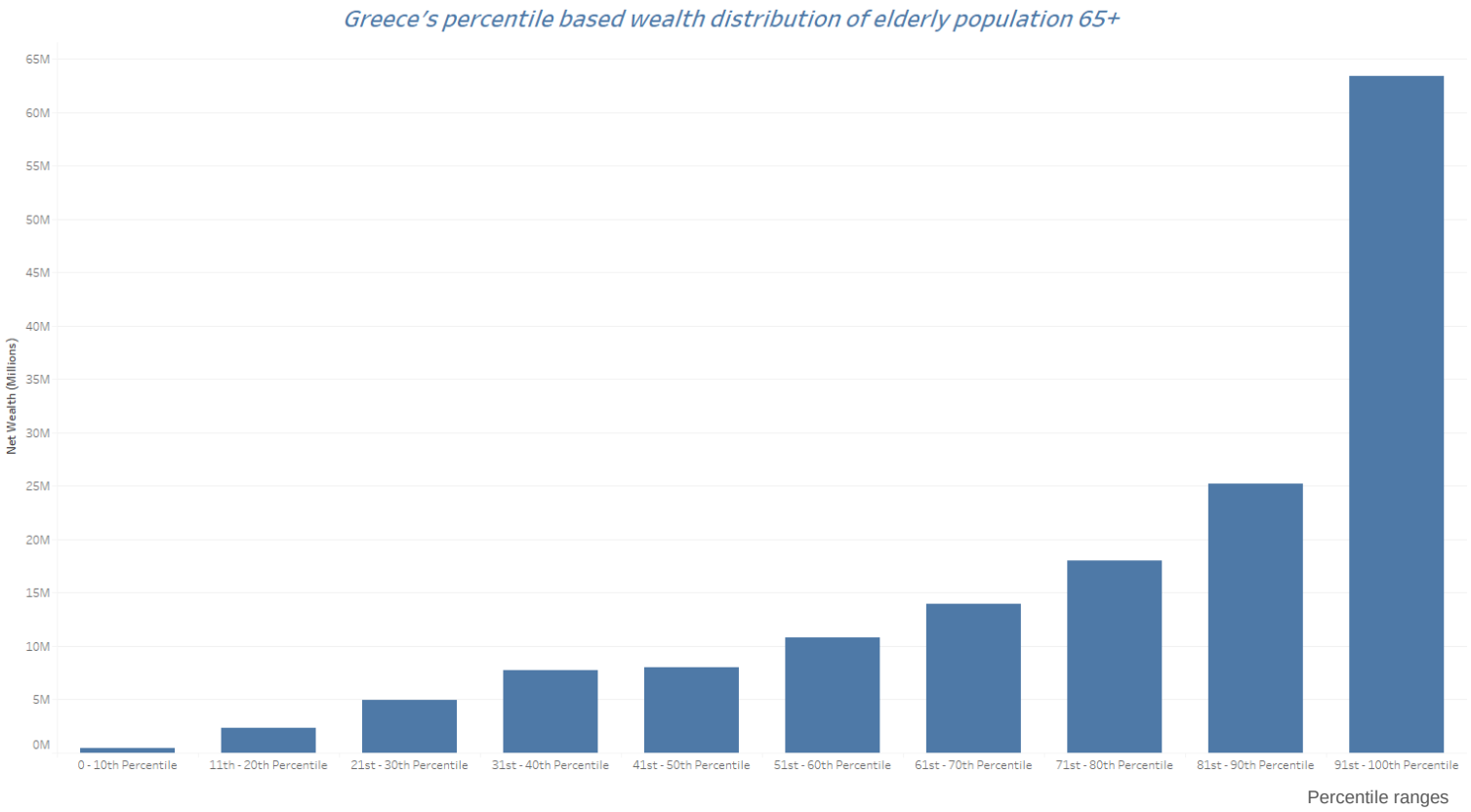


Figure 45 - Greece's household percentile-based wealth distribution graph.

As Greece's distribution portrayed in figure 45 there should be a relatively steady or linear increase within the percentile distributions, however this is not the case as shown by Figure 45 which displays the percentile distribution. Greece actually has one of the more interesting and different percentile wealth distributions from a increase stand point. Previously as shown with other countries in both U and Slope-shaped distributions there has been a steady linear increase throughout the 20th-80/90th percentiles, however Greece has a large degree of variance when considering these ranges. Table 21 displays Greece's relative increases below.

Table 21 - Greece's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**403.1%**
11th-20th -> 21st -30th	**112.8%**
21st-30th -> 31st -40th	**55%**
31st-40th -> 41st -50th	**3.79%**

41st-50th -> 51st -60th	**34.8%**
51st-60th -> 61st -70th	**29.04%**
61st-70th -> 71st -80th	**28.9%**
71st-80th -> 81st -90th	**40.3%**
81st-90th -> 91st -100th	**151.04%**

With the previously examined countries there has been a common trend developing when examining the relative increases between the decile brackets. This trend usually shows an exponential relative increase from the 20th-80/90th percentiles however Greece has shown to have an unstable and fluctuating increase. These fluctuations can be seen below in figure 46 where the relative increases have been graphed to display what the average of countries here have shown verses Greece's relative increases.

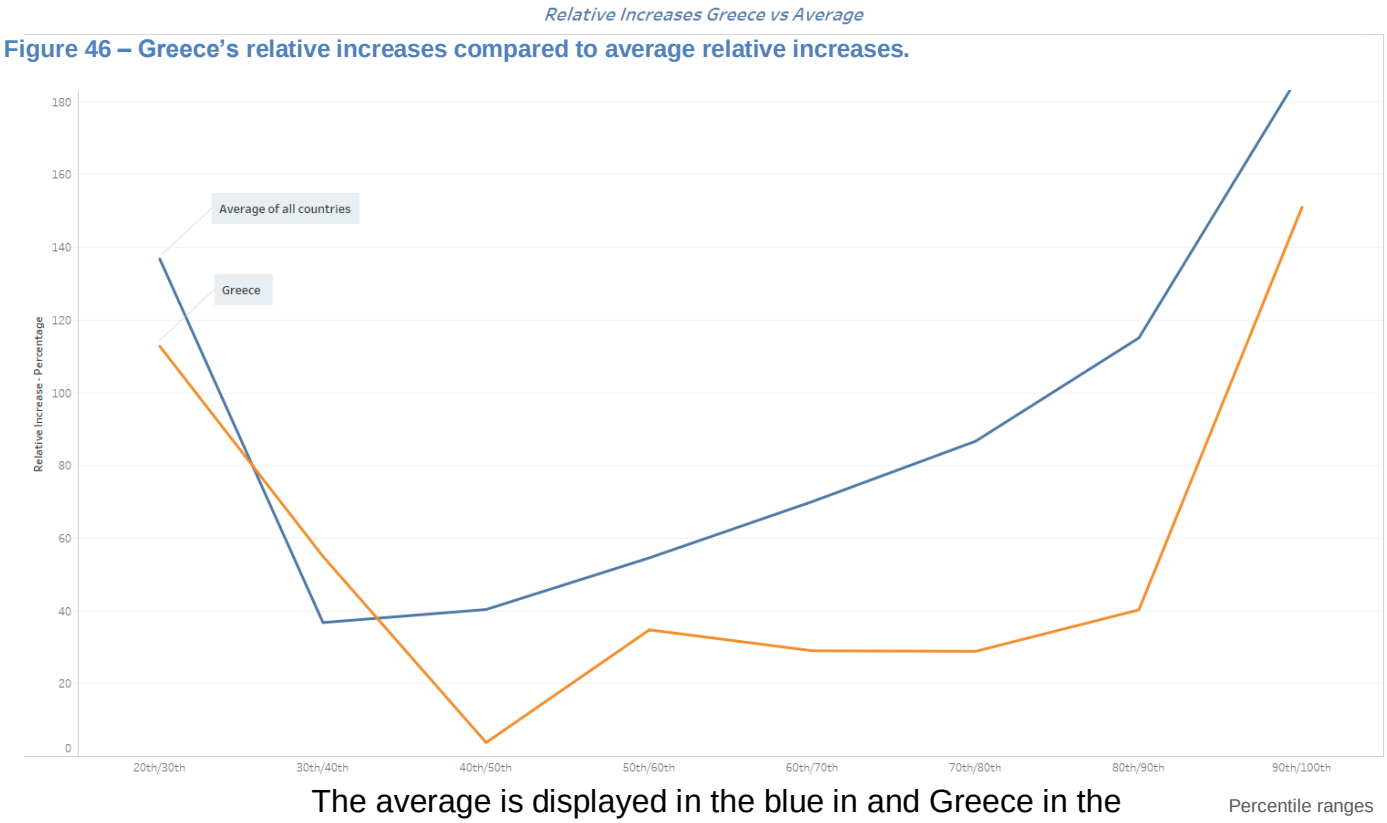


Figure 46 – Greece's relative increases compared to average relative increases.

The average is displayed in the blue in and Greece in the orange. Both relative increases begin with a sharp decline from the 3nd to 4rd deciles compared to the 4rd and 5th deciles and this decline is even greater when the difference between the 1st and 2nd deciles is included. After the first initial decline there is typically an expediential increase as shown through the average which reaches a peak of 188.7%

versus the peak of Greece at 151%. However while the differences between the two final brackets may not be high the difference throughout the middle section is. Where the average has an expediential curve Greece has two dips. This can be seen in both the 5th to 6th deciles and the 7th to 8th deciles which shows little to marginal growth. The lowest point of Greece is 3.79% and is 12.6% lower than any other relative increase of any other country observed. It does open to many questions how a population when ranked through percentiles of wealth in ascending order can have such similar levels of wealth and brings into question not only the sample size observed but also the Greece's wealth hierarchy.

The lowest point of relative increase observed across all the countries occurs within Greece at only 3.79% between the 4th to 5th deciles vs 5th to 6th deciles. The aggregate levels for these two brackets comparatively are €7,733,830 and €8,027,230. It is difficult to imagine what processes would cause almost 20% of a given sampled population to have almost the exact same levels of net wealth but this method of analysis certainly provides a deeper level of insight into any given population.

4.2.6. Finland

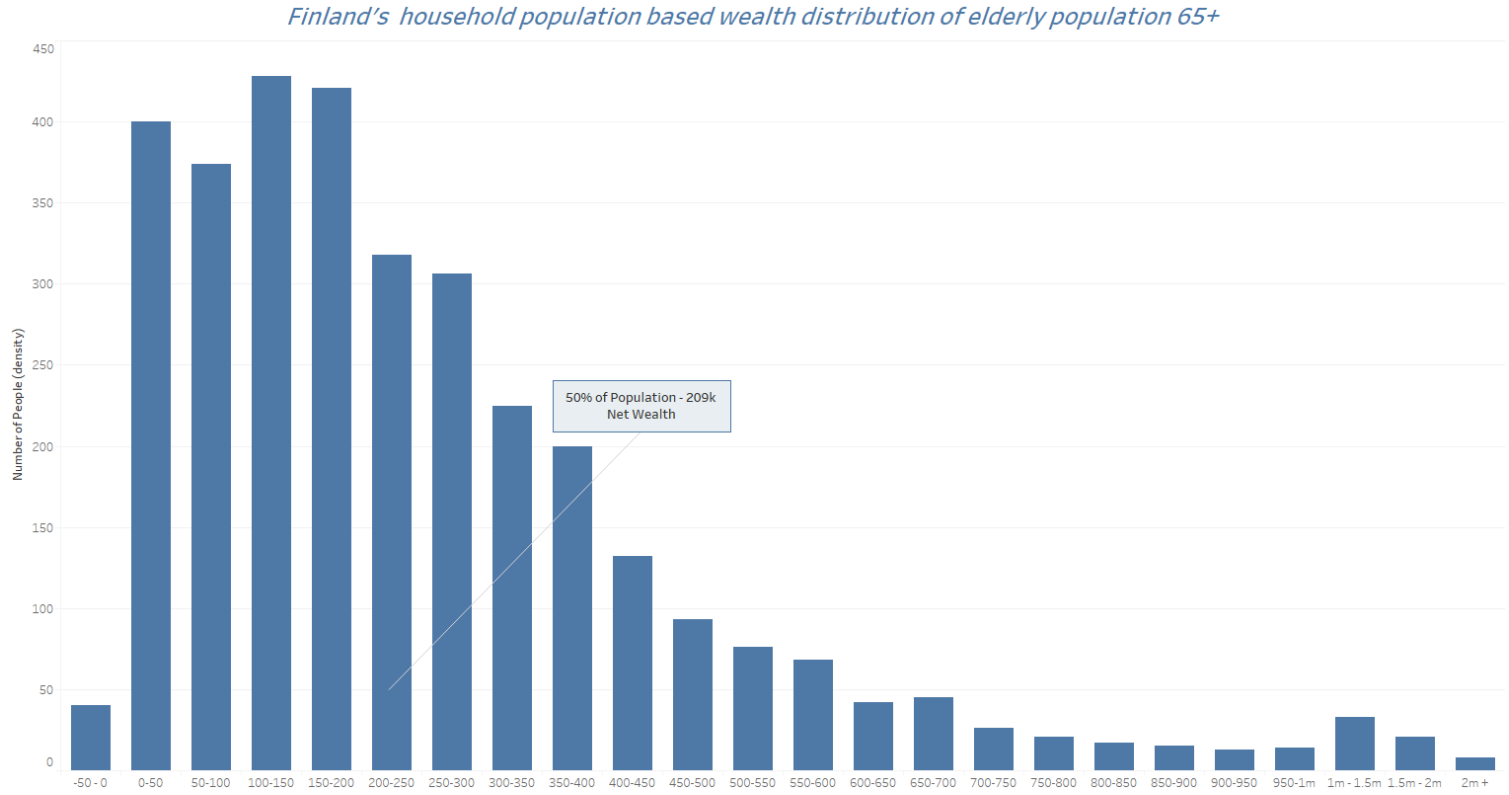


Figure 47 - Finland's household population-based wealth distribution graph. €209,000 median net wealth.

Figure 47 displays the population-based wealth distribution for Finland. Within this graph there are 3,336 data points and the average age of participants observed is 78.5 years which ranks 11th/15th of the observed countries. Finland has a median net wealth value of €209,000 and an average wealth of €279,000.

Finland provides another strong or staple example for the Slope-shaped distribution. It is clearly marked by its median which is technically within the €200K-250K bracket; however the initial peak begins arguably within either the €100K-150K or €15K-200K ranges.

Table 22 below displays Finland's rate of decline. As shown, the beginning range is taken from the €100,000-€150,000 bracket and ends at the €800,000-€850,000 bracket. Finland has the lowest rate of decline of all the Slope-shaped countries which is not surprising based upon the population-based distribution graph because it has a fulsome and gradual decline right until the €1M+ range. This is even a contrast to the other Slope-shaped countries which have a much shorter range observed with a steeper rate of decline.

Table 22 - Finland's rate of decline.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€100,000	€900,000	€800,000	96.96%	0.121% per €1,000

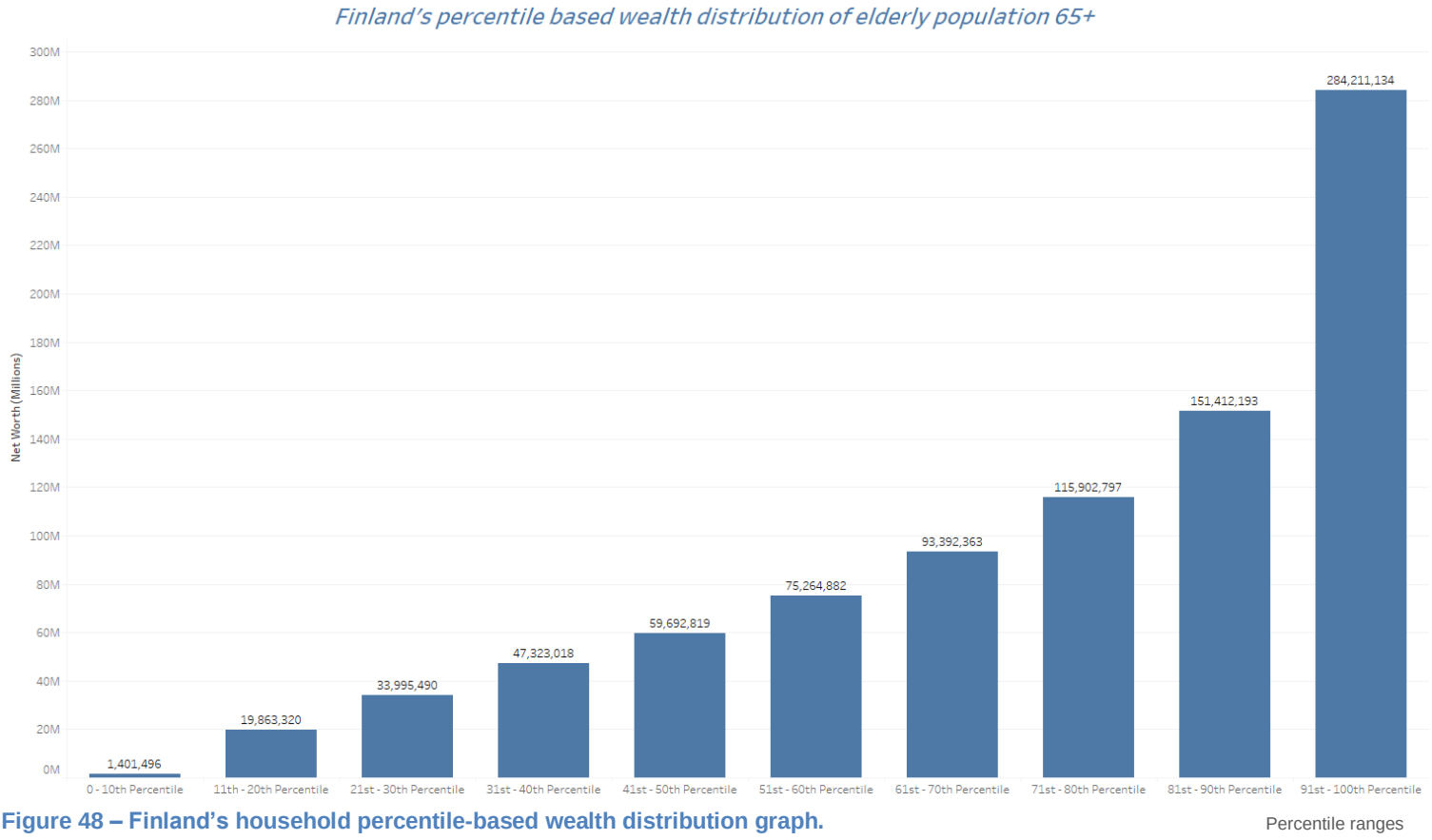


Figure 48 – Finland's household percentile-based wealth distribution graph.

Figure 48 displays the percentile-based wealth distribution for Finland. It contains 246 data points.

Finland's percentile-based wealth distribution pattern follows a relative linear increase predominantly throughout the middle ranges. There are some discrepancies within the relative increase curve for example commonly seen between the 0-10th vs 11th-20th is the largest increase in aggregated wealth which is disproportionally larger than the difference in the remaining 90% of the population. This being said, Finland has a steady relative increase throughout the 20th-90th percentiles with an increase averaging 41.14% and reaching a peak of 87.79% between the 81st-90th vs 91st-100th percentiles.

Listed below are the relative increases for Finland's percentile distribution. A notable part of these increases is the similarities between percentiles within the spectrums complete context. For example, there are two instances of a 26% increase within the lower/mid percentile ranges which is then followed by a decrease to 24% on to accounts. Towards the end ranges there has always been a sharp increase when comparing the top ten percent to the proceeding bracket; however it is unusual to observe that the 81st-90th percentile bracket has a 30.63% relative increase which is only a difference of 6% comparative to the previous brackets. This is unusual in that the top twenty percent within the countries observed in this thesis have all seen sharp increases within the top 20% and typically the 81st-90th percentile bracket has an increase of ~50-80%. Shown below in table 23 are all the relative increases across Finland's decile ranges.

Table 23 - Finland's relative increase table.

Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th-21st	**1317%**
11th-20th -> 21st-30th	**71.14%**
21st-30th -> 31st-40th	**39.20%**
31st-40th -> 41st-50th	**26.13%**
41st-50th -> 51st-60th	**26.08%**
51st-60th -> 61st-70th	**24.08%**
61st-70th -> 71st-80th	**24.10%**
71st-80th -> 81st-90th	**30.63%**
81st-90th -> 91st-100th	**87.79%**

Finland's wealthiest ten percent of the population account for a relatively low amount of the total net wealth with respect to the other 15 countries examined. Of the total €881,058,016 observed in this data set, the top ten percent accounts for €284,221,134 or 32.26%. Beginning from the bottom ten percent and climbing, the top ten percent of Finland's population would account for the same amount of aggregate wealth as the

bottom 65% of the population which is one of the lowest encompassments of the 15 countries observed.

Figure 49 below visualises the relative increases of Finland compared to the average increases experience across the 15 countries observed in this thesis. Finland has relatively low increases across all of its decile ranges only ever being higher than the average between the 3rd and 4th deciles. Finland interestingly has very stable relative increases across the majority of its population as from the 3rd decile to the 9th only ranges from 26% to 30% which is highly unusual compared to other Slope-shaped and U-shaped distributions.

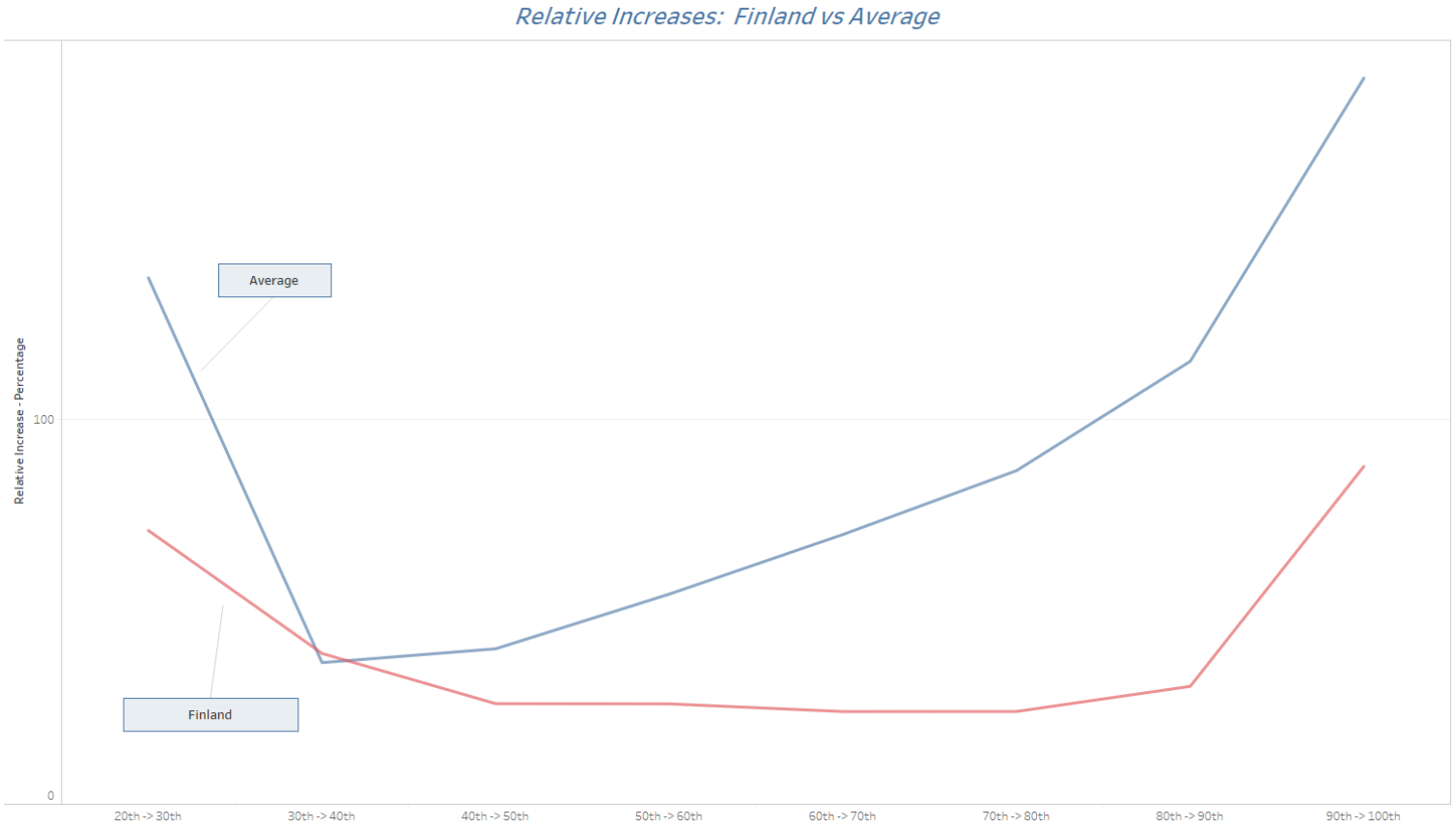


Figure 49 – Finland's relative increases compared to average relative increases.

4.2.7. Malta

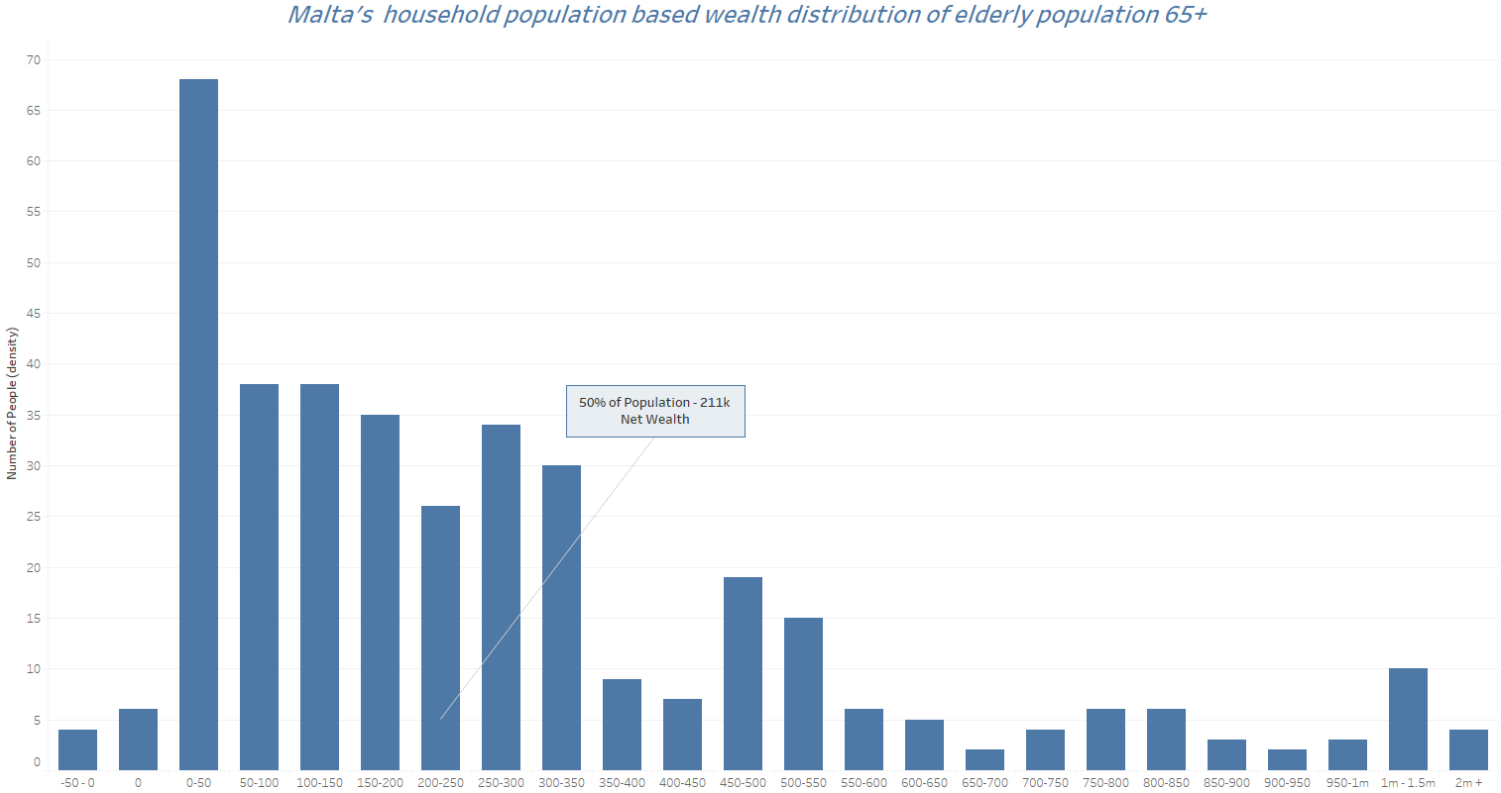


Figure 50 - Malta's household population-based wealth distribution graph. €211,000 median net wealth.

Figure 50 displays the population-based wealth distribution for Malta. Within figure 50 there are 380 data points with no identifiable average age. The average age is no identifiable because the Malta data set specifically does not record ages and instead the labour force status here is used – only observing those who indicate that they are retired. Malta has a median net wealth of €211,000 and an average wealth of €310,000.

It is noteworthy to indicate that within the latter aggregated ranges there were no recorded data points within the €1.5M-2M range. This is particularly strange given that the Malta data set has a reasonable number of total data points and begs the question as to why there were no participants within that wealth range.

Malta has an interesting Slope-shaped distribution. There could technically be arguments for a U-shaped distribution, however given the overall trend starting from the initial peak until the flat line, here deemed the €650K-700K bracket, there is clearly a Slope-shaped distribution despite the troughs within the €350K-450K range.

The largest bracket within the Malta data set is the €0-50K range which contains 68 data points or 17.89% of the total population. This is the largest percentage of the population within the €0-50K range within any of the observed countries. The smallest bracket aside from the €1.5M-2M bracket is the €650K-700K range which only has 2 data points and represents just 0.52% of the total population.

Malta is not a typical Slope-shaped distribution by any definition. Typically as seen in countries such as Portugal or Greece there is a smooth curve to a Slope-shaped distribution, it would be clearly defined and contain an obvious flat line. However despite this there are several different rates of decline provided for Malta in table 24 below.

Table 24 - Malta's rate of decline.

Range 1	Range 2	Total Wealth Observed.	Population Decrease (Percentage)	Rate of Decline per €1,000
€0	€400,000	€400,000	89.85%	0.224% per €1,000
€0	€650,000	€650,000	97.1%	0.149% per €1,000
€0	€900,000	€900,000	97.1%	0.107% per €1,000

Each rate of decline calculated above begins at the €0-€50,000 bracket however each of the three rates of decline end at different brackets as shown in table 24. The highest rate of decline is seen with the first rate at 0.224% density reduction for every €1,000 increased. The lowest rate of decline is seen within the last rate, which is an extreme example, with a decline of only 0.107% per €1,000. Most likely the first rate would be used over the other two rates if only one could be chosen.

Figure 51 displays the percentile-based wealth distribution for Malta with a total amount of 380 data points observed.

Malta's percentile-based wealth distribution is similar to many of the previous wealth distributions displayed across both slope and U-shaped distributions. This particular percentile distribution has a linear slope from the 20^{th}-90^{th} percentiles and spikes with the top ten percent of the population.

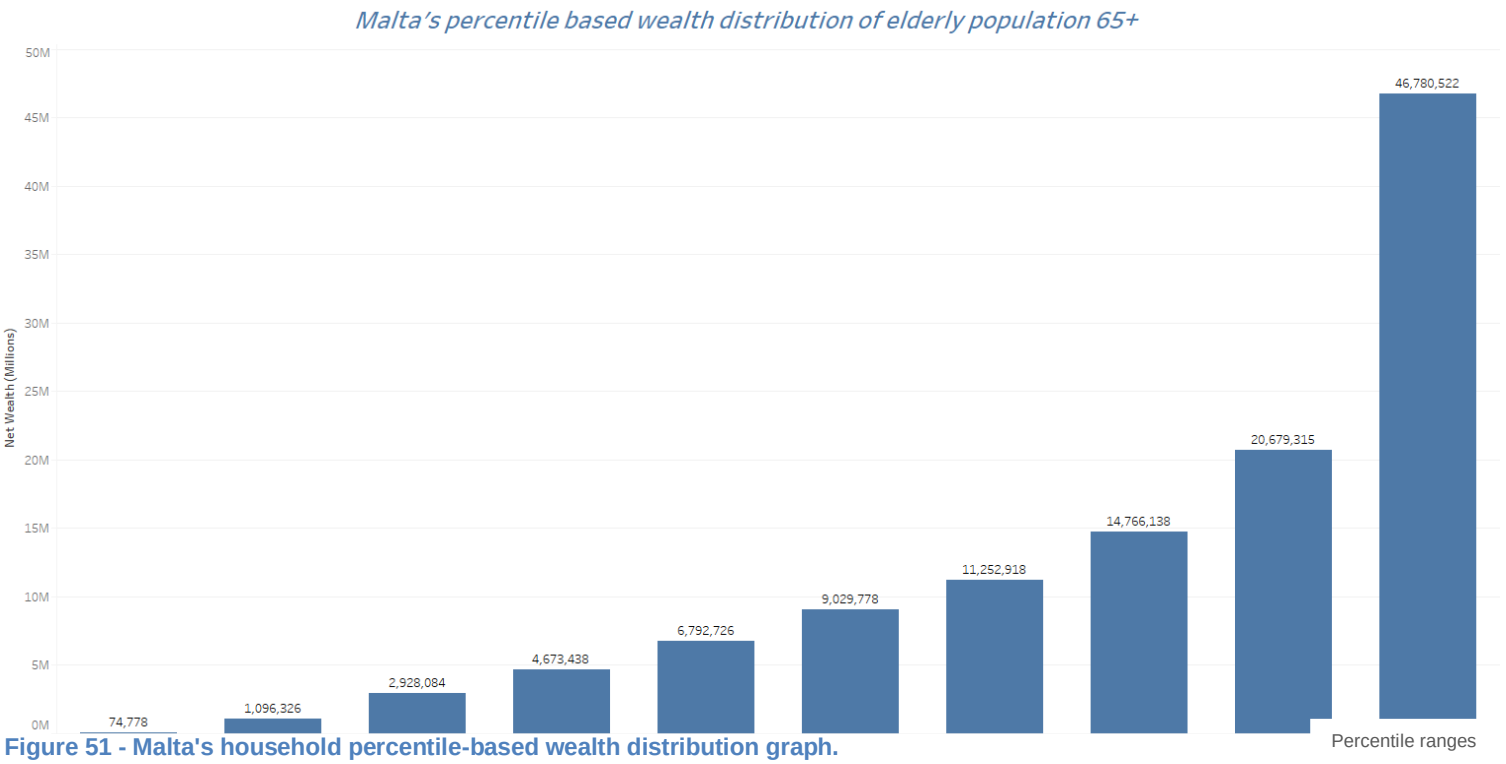


Figure 51 - Malta's household percentile-based wealth distribution graph.

The total wealth observed with this distribution is €118,074.024. Of this sum, the top ten percent accounts for 39.61% or roughly four times its proportion of the population. As shown, the top ten percent in Malta account for €46,780,522 which encompasses the bottom 70% of the population.

The largest relative increase is once again observed between the two lowest percentile brackets, the relative increase is 1366% however a difference of only €1,021548 separates these percentiles. Outside of the two initial brackets the largest relative and absolute increases are observed between the 81st-90th vs 91st-100th percentiles. The relative increase between these two groups is 126.21% and represents an absolute increase of €26,101,207. All of the relative increases can be seen in table 25.

Table 25 - Malta's relative increase table.

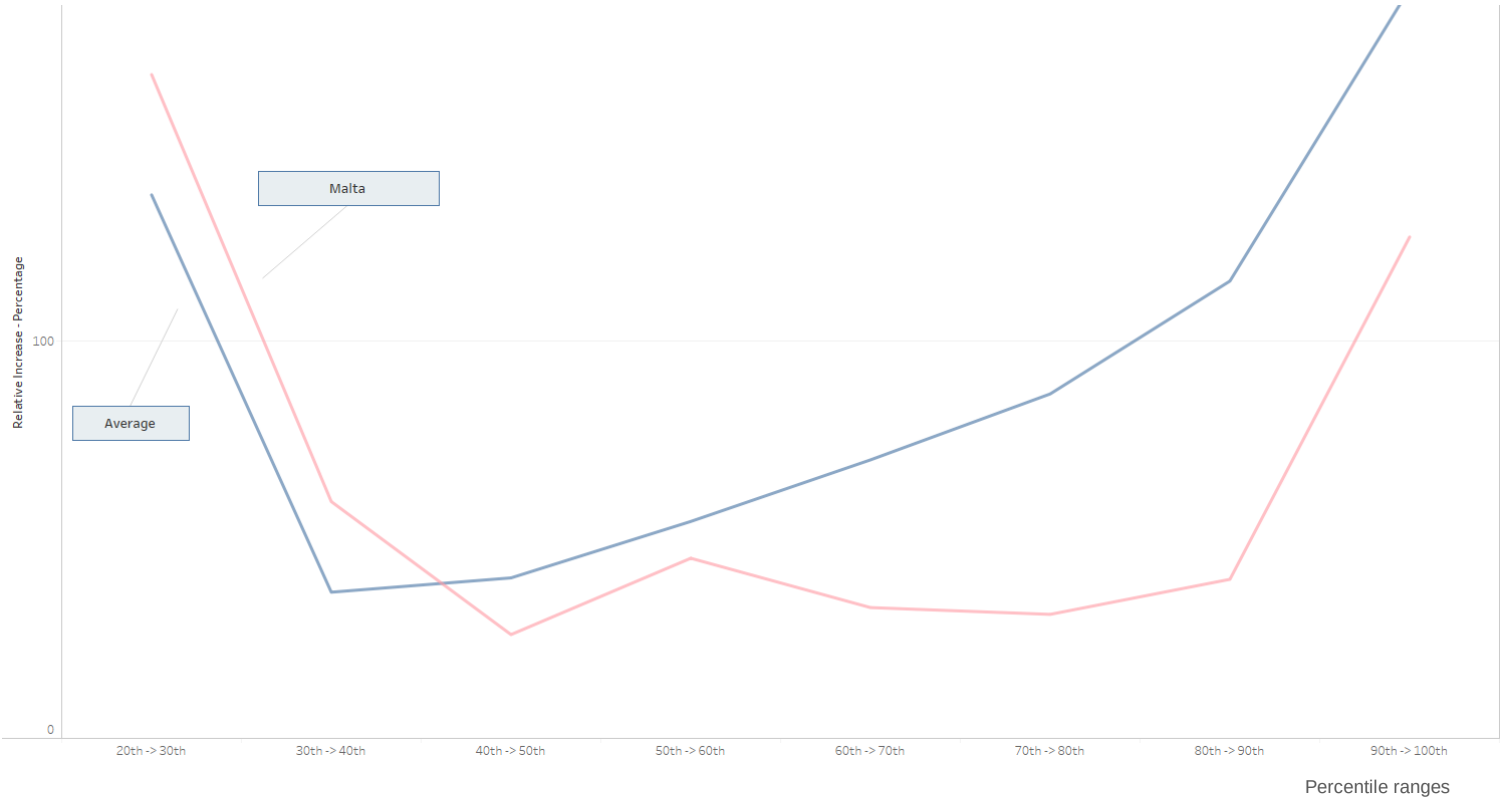
Percentile Ranges (increasing)	**Relative Increase**
0-10th -> 11th -21st	**1366%**
11th-20th -> 21st -30th	**167.08%**
21st-30th -> 31st -40th	**59.6%**

31st-40th -> 41st -50th	**26.13%**
41st-50th -> 51st -60th	**45.34%**
51st-60th -> 61st -70th	**32.93%**
61st-70th -> 71st -80th	**31.22%**
71st-80th -> 81st -90th	**40.04%**
81st-90th -> 91st -100th	**126.2%**

In figure 52 Malta's relative increases are visualised against the average relative increases experienced across the 15 countries examined in this thesis. There are several interesting points within this figure the first being that Malta's relative increases have a high level of variance. This is primarily because it begins much higher than the average, then dips below and finally has a large increase between the 9th to 10th decile ranges. Along with these fluctuations, Malta also has peaks and troughs within its middle ranges which, for other Slope-shaped countries, has usually been a space of flatness.

Relative Increases: Malta vs Average

Figure 52 - Finland's relative increases compared to average relative increases.



4.3. Key Findings and Summaries

The following section is designed to review the data provided in this chapter with a transnational focus. The majority of the data provided in this chapter it has been viewed through a national focus and it is now important to compare the whole data set together and see which countries sit at either ends of multiple spectrums of analysis. It is important to recognise that while these statistical points are important they do not substitute for an in depth analysis of any country and represent the overarching conclusions of the content with highlights on specific aspects of analysis.

4.3.1. Slope Distribution Summaries

Figure 53 is the summary graph for all countries observed that have been categorised under the slope type distribution. Just like the previous summary graph, it displays net wealth on the X axis and the count of population on the Y axis. These countries include: Slovenia, Greece, Malta, Netherlands, Italy, Portugal and Finland. As described above, the slope type distribution is primarily categorised by having only one peak. Typically early into the wealth distribution this peak represents the majority

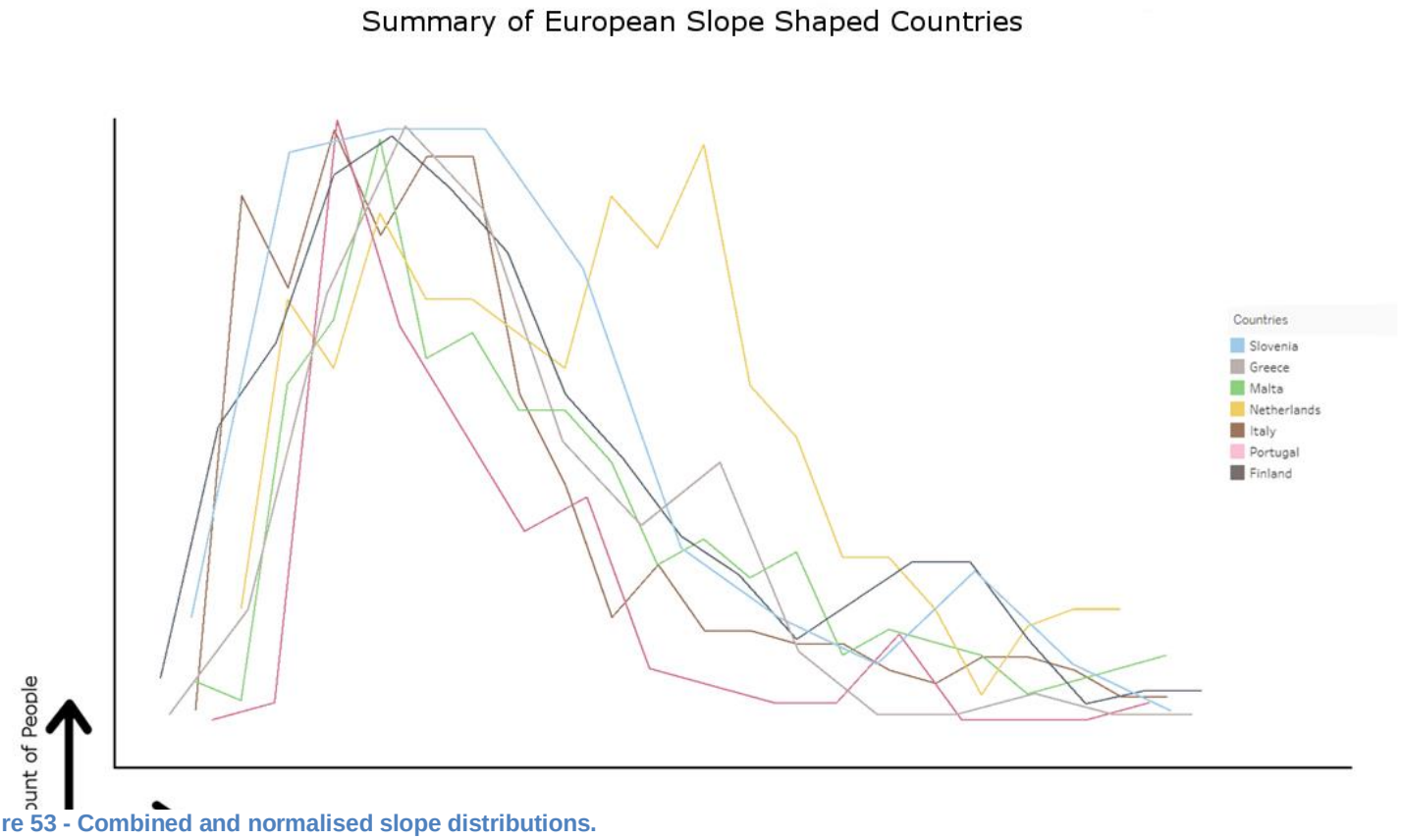


Figure 53 - Combined and normalised slope distributions.

of the population. Within the observed countries an average of 73% of the population for these countries remains within or with close proximity (+/- €200k net worth). This is typically different form the ‘U’ shaped distributions which have a small, but significant number of the population outside of the first peaks proximity and generally have a fuller distribution throughout the middle ranges of wealth.

Of the countries observed in this category, six out of the seven are seen to be in the lower end of the median net wealth rankings compared to the total 15 countries. With the exception of Netherlands all the other countries rank within the bottom eight. Along with these bottom seven countries are some of the lowest observed differences between the median and the mean, starting with the lowest country, Slovakia and the highest being Italy with a ratio of 1.46. Compared to ‘U’ shaped distributions which Luxembourg has the highest ratio of 3.036 and Belgium has the lowest ratio of 1.61 which is still 11.17% higher than the Slope-shaped distributions maximum ratio.

Within figure 53 is another interesting outlier, Netherlands. Netherlands seems to exhibit both U shape and Slope-shaped distributions. At a closer look one could justify that Netherlands actually has two peaks which would, by default, categorise it has being in the U-shaped distribution category. There is merit for this line of argument however while it does display a dual peak distribution it does not sufficiently show a hollowing out between them. In fact the second peak of Netherlands is actually higher than the first original peak of the population. This in combination with the lack of significant difference between the two peaks leads it to be categorised under the Slope-shape distribution. The highest observed wealth data point is observed within the Estonia survey, this participant recorded a net wealth of €86,000,000, the second highest was France with €58,290,000 and Luxembourg third with 33,480,000. Conversely, the lowest recorded net wealth is observed within Germany with €-323,300 followed by Finland with €-276,200 and thirdly the Netherlands with €-149,600.

4.3.2. Distribution Shape Summaries

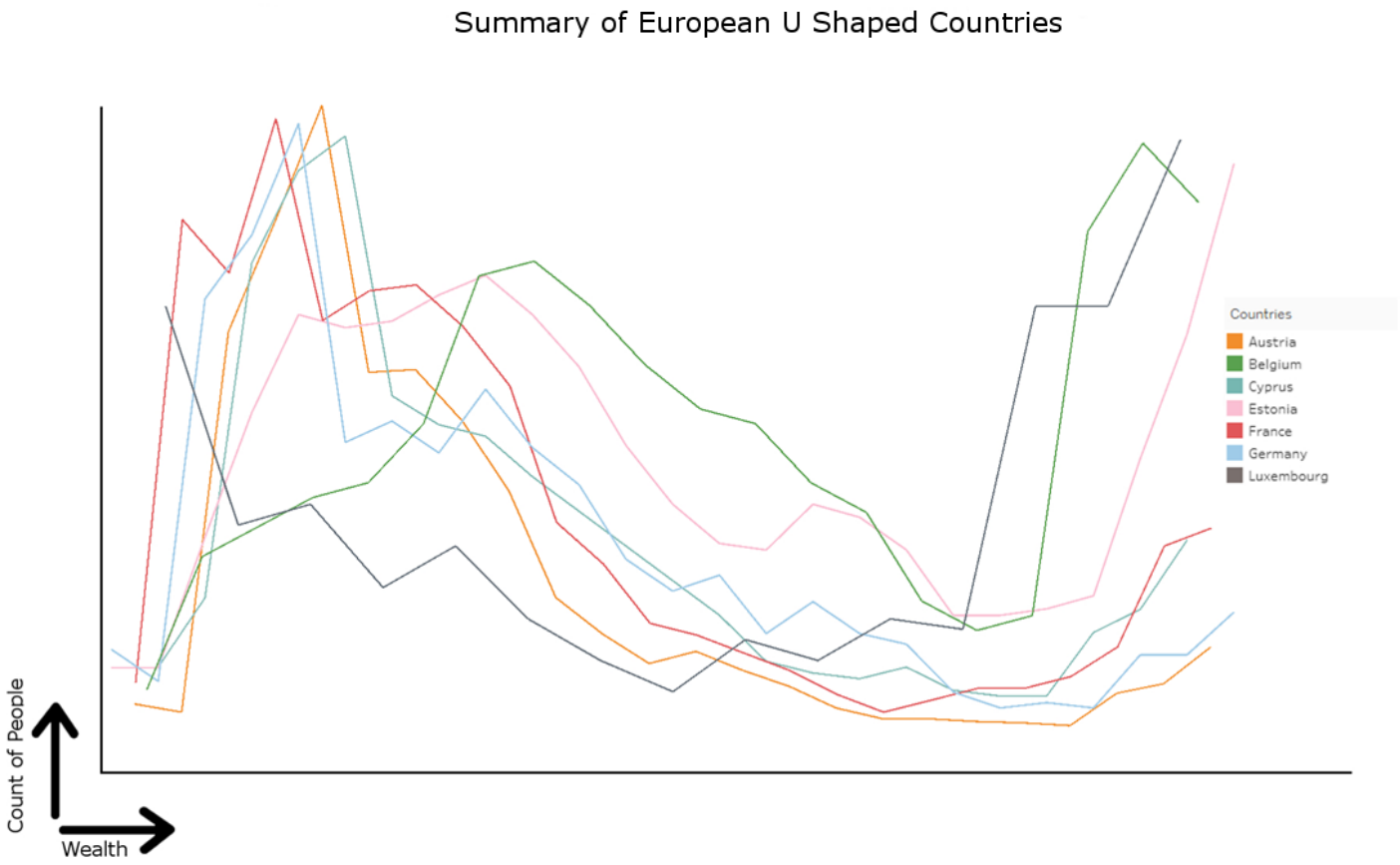


Figure 54 - Combined and normalised U distributions.

Figure 54 is the summary graph which is designed to show trends between countries. It acts just like the absolute distributions seen earlier in this chapter with wealth scaling on the x axis and the count of people on the Y axis. Figure 54 does not offer any specific scales due to the orientation and scale of each different dataset. It becomes impossible to graph on one axis all seven countries because they all share different scales of absolute counts of people simply due to how large some of the datasets from popular countries are. For example, one country may have 20,000 participants retired and over the ages of 65 who are observed where as a more popular country may have 50,000 or even 100,000. This becomes problematic when trying to graph multiple countries on one axis because the scaling required for countries with more participants would distort the graph relative to those with smaller countries.

Luxembourg as represented in figure 54 has been altered to only show wealth starting from €400k and ending at over €2 million. The reason

for this is not only to show the U-shaped characteristics of Luxembourg but also because of Luxembourg's unique socioeconomic aspects. Out of all countries observed, Luxembourg has the highest difference between median and mean net wealth levels; it also has the highest median and mean net wealth levels of €902,000,000 which is significantly higher than other countries. Luxembourg also has a relatively small population of just 543,202 which is only 23.7% of the average population size for the countries observed. Due to Luxembourg's rich and small population it exhibits a strange but ultimately U-shaped distribution which is primary due to a high median net wealth which only really begins to take shape at €400k but then shows a very strong dichotomous distribution towards the upper end. Effectively Luxembourg displays the same U-shaped characteristics but they are observed in a different wealth beginning at €400k instead of typically where other countries begin at €0 or €50k.

France has been used as the primary example of the U-shaped distribution in this paper however one could also argue a strong case for Belgium, Luxembourg or Estonia as better examples of the U-shaped distribution. However due to France's position both in the global economy and as one of the leaders of Europe it is most appropriate to use a country which may not necessarily prove the concept absolutely but is a leading candidate in all other regards.

4.3.3. Key Figures and Findings across All Countries

A countries median and average level can vary to a great degree. This is primarily because the median and the average measure at a fundamentally different angle, the median is concerned with the wealth held for the 50th percentile or the 'middle' data point. The average however is more of a simulation that predicts what the most common person would look like, or what their levels of wealth would be based upon the sum total of the money observed divided by the population. Normally the difference between the average and the median would not be large enough to mention – and this is the case for many statistics, however because of capital's extensive spectrum, even the difference between these two concepts can reveal certain key aspects of the distribution.

The country with the highest median level of net wealth among its population is Luxembourg measured at €902,100, correspondingly Luxembourg also holds the highest average net wealth which is measured at €1,414,000 which is a difference of €511,900. The lowest observed net wealth is seen in the Slovenian data set comparatively measuring just €130,000 and it also has the lowest average wealth measured at €159,000, which is only 11.24% of Luxembourg's average net wealth. In addition, Luxembourg, with the highest median net wealth measures 593.92% larger than Slovenia's. Following the median and the mean, the ratio created by dividing one into the other can effectively just how large the gap between the two measurements is and thus the positive skew in the normal distribution[5]. The highest median mean ratio is seen within Estonia, which has the second highest median and mean net wealth values. Estonia's ratio is equal to 3.036 (€1,414,000/€902,100) which is significantly larger than Luxembourg's (1.567) despite having lower median and mean values. The lowest ratio is seen within the Netherlands which has a mean:median ratio of 1.208 and is surprising given the rest of the low ratio countries typically have very low base median and mean values too.

[5] The median as the denominator.

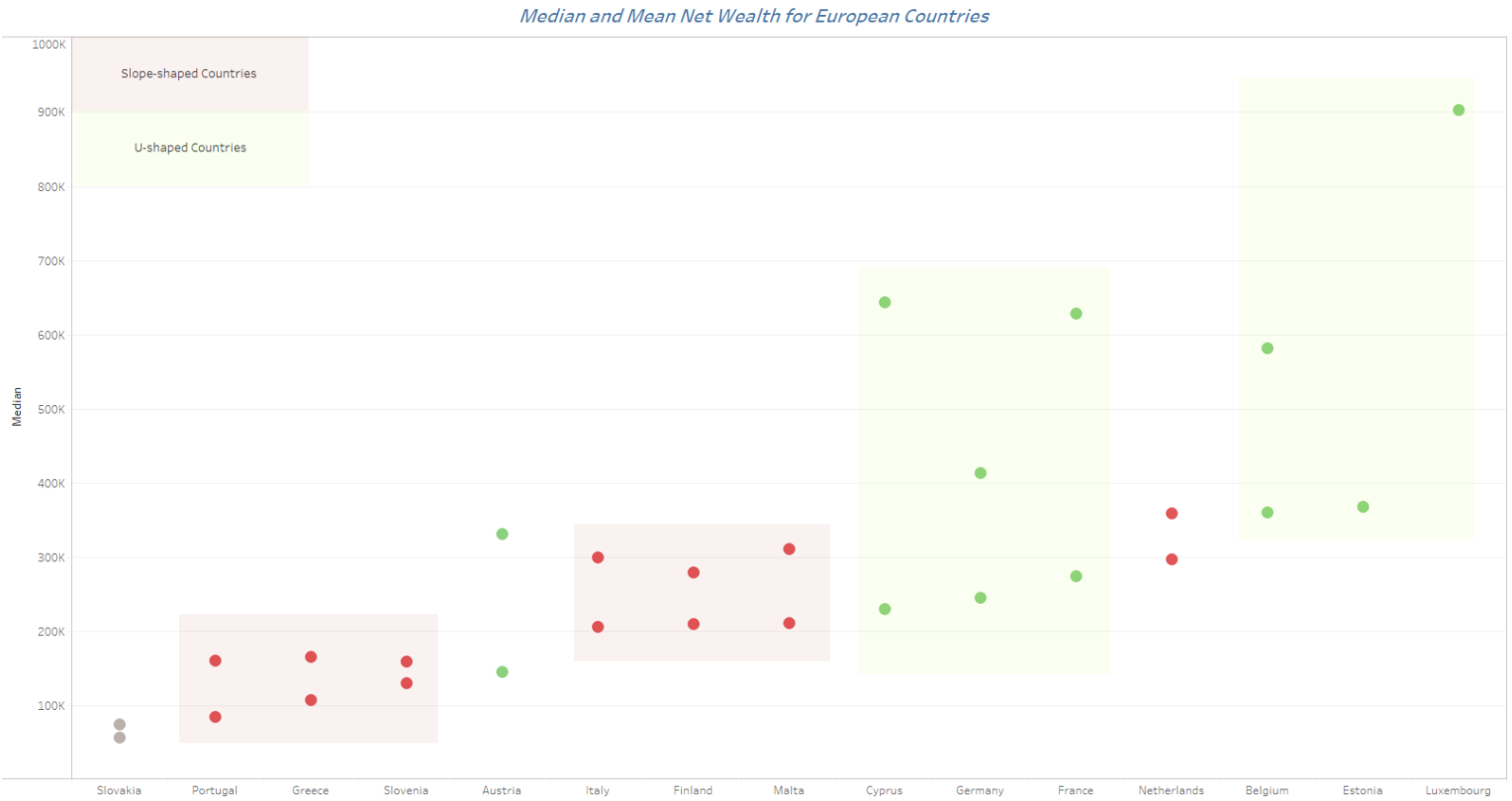


Figure 55 - Median and mean net wealth levels. Slovakia has an uncategorised distribution type due to data availability. Not shown are Estonia's and Luxembourg's mean net wealth levels at €1,118,000 and 1,141,000 respectively.

To expand upon this, figure 55 shows the median and mean levels of net wealth for all 15 countries observed in this thesis. The lower dot for each country is its median net wealth and the dot above it indicates the countries mean net wealth. The shaded areas represent the two different distribution types, Slope-shaped in the red and U-shaped in the green. It interesting that all of the Slope-shaped countries, apart from the Netherlands, reside within the lowest median net wealth levels whereas the U-Shaped countries all reside in the middle-upper ranges with both Estonia and Luxembourg having mean net wealth values registering over the €900,000 ranges.

As described in the initial briefings of both the Slope-shaped and U-shaped distribution sections, there is a fundamental level of analysis that emerges surrounding the percentage of the population residing in the over one million ranges. This basic population break down, which separates the supposedly wealth and extremely wealthy section of the population apart from the rest, can provide interesting information as to how *top heavy* any given wealth distribution is. This percentage concept should always be

viewed in the context of both the median/average levels of wealth and the preceding distribution of population which precedes it. Luxembourg has shown to hold the greatest percentage of its population above the one million euro net worth measuring 41.05% of its total population. Of this 41.05%, 44% are between the €1M-1.5M and 37% are two million and over. The lowest country is *technically* both Slovakia and Slovenia which have no observed population over the ages of 65 above the one million net worth range however both of these countries rely on relatively small data sets and for this reason are not considered the lowest. The country which *actually* has population within the latter aggregated ranges with the lowest percentage of population is Greece with only 1.32%. The second lowest is Malta with 3.6% and many other Slope-shaped countries are below 5%. There is significantly less relative difference between the Slope-shaped countries compared to the U-shaped countries and a much larger variation within the U-shaped countries is observed.

It is important to see how the countries ranked in terms of their percentile points of analysis. Throughout the descriptions of each country there has been a focus on the top ten percentile, unsurprisingly as it has very unique characteristics, how this top ten percent relates to the rest of the distribution is an interesting point of analysis. Estonia's richest 10% of its population encompasses the largest relative sum of money within its population measuring approximately 165% the same size of the bottom 90% of the population. This is closely followed by Cyprus at 160%. Another interesting point of analysis is the country with the least relative difference between all brackets including the top ten percentiles. This point of least relative increases is perhaps one of the strongest arguments for the case of equality within a given wealth distribution. Slovenia has the lowest relative increase average between from the 11^{th}-100^{th} percentiles calculated at 28.79%. The main reason for only capturing the 11^{th}-100^{th} percentiles and excluding the bottom ten percent is because of the wide variances between countries within this bracket, ultimately these variances

are so large compared to the remaining population that is can severely bias the calculation[6].

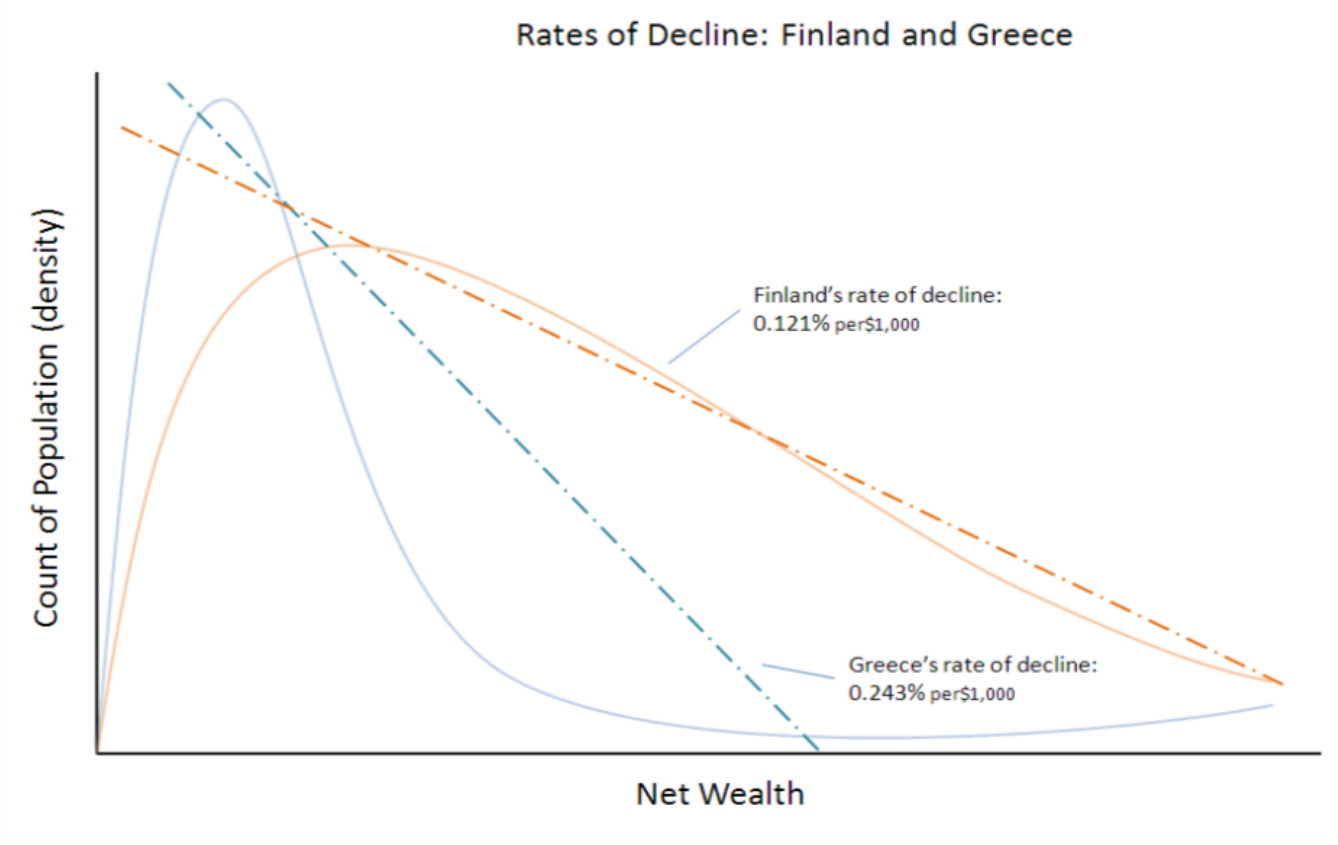


Figure 56 - Greece and Finland's Rates of Decline.

The Slope-shaped countries have their rate of decline as an added point of analysis. As described in the methodology section, the rate of decline in a Slope-shaped country can act as a numerical proxy for the middle class of net wealth holders. This is because a lower rate of decline would mathematically represent a smaller difference between the median peak over the observed range of net wealth resulting in a flatter curve. The country with the highest rate of decline observed was Greece. Greece's rate of decline is calculated to be 53.23 per$_{€50,000.}$ This rate of decline denotes that for every €50,000 further along the wealth spectrum one would expect an average of 53.23% less people than the proceeding €50,000 range. This rate of 53.23 per$_{€50,000}$ is significantly higher than the lowest of Finland which has a rate of decline of only 18.1 per$_{€50,000}$ so that for every €50,000 of difference between two populations or ranges of wealth one would expect to see on average a decrease of 18.1% of the population. From these two rates one can conclude that Greece has a

[6] It is observed that populations with small data sets are heavily influenced by data points with negative values which are primarily responsible for the levels of such wide variance between the 1st-10th vs 11th -20th brackets.

much steeper rate of decline than Finland which symbolises a distribution with a larger relative middle class. Both rates can be seen in the graph provided below which shows the distributions in the lighter shades and the rates of decline in the darker shades.

5. Discussion

5.1. Dual wealth-distribution categories

This thesis has developed new tools for investigating transnational wealth-distribution analysis. These tools have been tested within the HFCS database environment which has allowed many interesting tools to be tested and emergent ideas to be generated. The emergent idea of wealth polarisation being evident within the elderly population has been shown through a multifaceted analytical framework. Alongside this emergent idea of wealth polarisation is the secondary important finding of two distinct macro distributions. These two outcomes have been called Slope-shaped and U-shaped distributions, and the extremes of both these abstract distributions represent both end points of possible wealth distributions. Of both the distribution types, there are countries which can be clearly identified as one or the other. Table 26 below shows how each country has been categorised in chapter three:

Table 26 - Observed countries and their respective distribution categorisation.

Country	Distribution Type	Ambiguity
Slovenia	Slope	
Greece	Slope	
Malta	Slope	
Netherlands	Slope	Possibly U-shaped
Italy	Slope	
Portugal	Slope	
Finland	Slope	
Austria	U	
Belgium	U	
Cyprus	U	
Estonia	U	

France	U	
Germany	U	Possibly Slope-shaped
Luxembourg	U	

Of all 14 of these countries, two have distributions which could be considered either distribution type. The Netherlands could arguably have a U-shaped distribution type as, when examined through a 2nd window range rolling average, it appears to have two semi-distinct distribution peaks. Typically, when countries have been classified as dual peak distributions or as U-shaped, it is because the €1M+ ranges of the wealth spectrum have a significant increase in population density. The Netherland's distribution does not peak at the €1M+ ranges rather it does so around the €450,000 - €600,000 ranges which would mean that, relative to the other observed countries, it should be considered as a Slope distribution. The Netherlands is a good example of a country which could be considered 'in transition' from one distribution type to another. This would mean that the two central peaks would move apart from one another over time as general inequality increases and the Netherlands would become clearly a U-shaped distribution. Obtaining longitudinal data for the movement of wealth distribution within the Netherlands' elderly population could provide an interesting study to see just how the distribution of wealth would change over time.

Germany is another country whose distribution classification may be argued one way or another as well. This is because, while Germany does have a typical Slope-shaped distribution, it also has quite a significant amount of its population within the €1M+ ranges too. Germany is providing here a good reason for why a mathematical classification is useful in the future to definitively conclude whether or not it is Slope or U-shaped. This would provide another good subject for longitudinal study as the movement of wealth could confirm the emergent idea of a polarised wealth movement within the elderly population through economic dissaving in post- retirement.

Commonly, in the literature focused on transnational wealth-distribution analysis, there is little to no attempt to classify or group countries together based on their distribution alone (Cobham & Sumner, 2013; Cowell, 1998; Davies *et al*, 2008). Typically there is an independent or dependent variable which these countries or populations are then classified by and usually these variables have clear distinctions or clustering elements which allow them to be objectively grouped together. Having said this, the idea of looking only at the wealth distributions of countries through a series of different multifaceted approaches and then clustering them, or placing them on a larger spectrum, is an ambitious yet substantiated development in this thesis. This process of describing the left and right of arc of wealth distributions effectively defines the complete realistic possibilities of wealth distributions and relatively where countries fall within these. This is the first time in the field that countries' distributional shapes have been analysed and visualised in a sense which clearly diverges from the traditional analysis seen in the literature review which is largely mathematically-based and uses summary statistics which are often hard to interpret. The methodologies described in this thesis allow for all types of audiences to understand and investigate, on their own, what individual countries distributions actually are and also what transnational trends appear. This is because they provide information in modern formats which diverge away from the traditional formats of displaying information however there are still a number of quite technical analyses which provide a deeper level of understanding. Overall, using both modern forms of displaying information and a bold dual classification of countries, this thesis provides a robust comparative study of European countries' elderly populations' wealth distributions. Additionally, it produces a deep level of analysis across a large number of countries and supports that deep level analysis with broad overarching conclusions which clearly derive from granular statistical micro data.

5.2. Countering summary statistics and the multifaceted approach

As indicated in the literature review, there has been a trending form of comparative inequality analysis which solely relies on summary

statistics (Atkinson, 1971; Cowell, 1998; OECD, 2013). These summary statistics often use the most common statistic, called the GINI coefficient, to numerically depict the total wealth distributions of given population sets (Skopek *et al*, 2014; Murtin & Mira d'Ercole, 2015). However, as Atkinson, and Cobham and Sumner have pointed out, the use of these summary statistics often obfuscates and fails to describe the actual distribution of wealth (Atkinson, 1978; Cobham & Summer, 2013). It is important to note that typically these studies do encompass a larger number of countries than has been possible in this thesis, and the use of a singular summary statistic, as a shallow measurement, could evolve out of necessity when analysing very large pool of data. However, instead of taking this summary and singular approach to studying household distribution of wealth, this thesis has developed a new multifaceted approach to understanding and describing wealth at a transnational level of analysis. This process comprised of two primary graphs; population- and percentile-based, and was supplemented by: mean/median ratio, relative increase, slope of decline, richest 10% encompassment, and other tools. Over the page in figure 57 is a visualisation of how the multifaceted approach would be applied. The emphasis here is that a multitude of answers, views and analyses form a complete picture which emphasises no one perspective and the *complete* distribution of one population can be explored.

This multifaceted approach provides a substantially deeper view of wealth distributions and has resulted in several significant understandings about trends of elderly European wealth distributions. The multifaceted approach also provides several emergent pieces of information when, for example, the population and percentile graphs are combined. One of the key emergent details is the discrepancies found within the Slope-shaped countries. One would expect that the total wealth owned by the richest 10% of the population would be smaller in Slope-shaped countries because of the lack of population within the €1M+ brackets however this assumption has not held true. In both Portugal and Italy (Slope-shaped) there are significantly large relative increases between the 81st-90th vs 91st-100th percentiles which match those of France and Estonia (U-shaped). One of the logical interpretations of this phenomenon would be that in these particular datasets, and Slope-shaped countries more

generally, there are isolated households with exceedingly high levels of net wealth which heavily skew, by themselves, the percentile distribution. Perhaps another explanation may also be that as the Slope-shaped countries have lower median levels of net wealth that, relatively speaking, the richer population will affect the percentile distributions more heavily as it is comparing to a relatively poorer bottom 90% of the population. The details, such as these, are the combination of two distinct viewpoints, and a summary statistic, such as the GINI, has no capacity to measure inequality in these ways and would thus leave a large gap in one's understanding about the nuances of wealth distributions. The beauty of the multifaceted approach is that any user or writer may explore these different and complimentary views. It becomes increasingly difficult to find

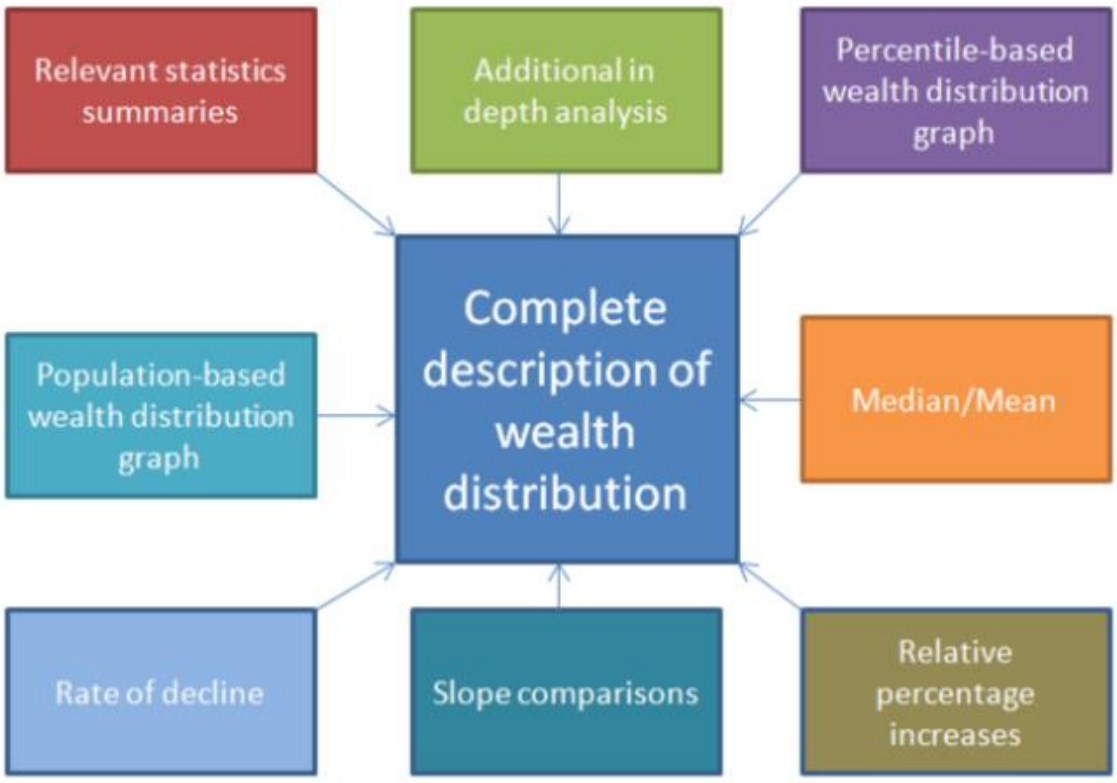


Figure 57 – Overview of the multifaceted approach to wealth-distribution analysis.

flaws in an approach which offers information 'across the board' as opposed to arguing from one standpoint, which may be susceptible to inherent bias in either the formulae used or the information-collection methods. In this sense, the multifaceted approach should only enhance because it would be a shame to have the field of wealth inequality stagnate within one particular method of inquiry.

5.3. Population-based graphs

One of the most powerful and perhaps insightful elements of this thesis' research is the concept of dual wealth-distribution types, namely the U-shape and Slope- shape distributions. The idea of polarisation is measured primarily in the population-based distribution graph, which provides an immediate and deep understanding of the population distribution within the wealth spectrum. The power of this graph is that it provides insights into reality. This is to say, it shows the direct levels of net wealth in a non-relative manner unlike the percentile graphs which display the percentile differences between whole population groups. Because the population-based distribution graph is not relative, it links back to *real* households in a non-abstract form by delineating the *absolute* wealth levels.

Making a point of describing absolute levels of net wealth is key to the development of public knowledge and engagement in the field of inequality. The public and the wider population all find it easy to interoperate absolute wealth ranges such as €150,000-200,000 or €1M+ because it is easier to understand directly how this relates back to reality, whether it takes the form of a house, goods and services, or medical bills, etc. For example, the first powerful insight gained from this graph for many young people would be the net wealth levels of the 50th percentile. This is important when relating to housing prices. If the median net wealth is €200,000 for a household then there is a reasonable probability that the household may not even own it and would be renting[7]. Hypothetically, for 50% of the population not to have sufficient net wealth levels to own a house (certainly not a house in one of New Zealand's popular cities) is quite an alarming figure and its implications are easily interpretable even for somebody who has not encountered the topic before. Examples like this are how the inequality discussion has to link back to reality. One of the problems of relative examination, whilst probably the best at capturing the

[7] It is entirely possible to determine the correlations between net wealth and home ownership rates from the HCFS data however that range of study has been omitted from this thesis.

pure distributions, is that it leaves little to no room for public engagement because of its abstract or esoteric nature.

When displaying the data through a medium such as the population-based graph, it becomes immediately apparent what the most prominent aspects to the distribution are, where the largest proportions of the population reside, and how much of a population relatively falls within each category. Now that the interesting features of any given distribution have been displayed, the user may then investigate further by examining the individual ranges and their relative differences via the Y-axis. This ability to quickly portray the interesting features, and hold a granularity of information, is the fundamental strength of visualization. The population-based wealth distribution contains the capability of describing the distribution from one end of the wealth spectrum to the other without forgoing or emphasising any particular area. It is then translatable onto a comparative framework via the summary graphs provided at the ends of both the U-shaped and Slope-shaped distribution sections.

The summary graphs combine countries in a non-weighted format, however it would be possible to derive a population-weighted average to describe a range of given countries. This would allow for an accurate description across a group of countries, for example, one may pick a selection of Asian countries or European. There are several important decisions into how to best weight the countries. The first and simplest would be to weight by their representation of total relative population. This would mean that smaller, less- populous, countries would be weighted lighter, and highly- populous countries would be weighted heavier. Another option would be to weight by some economic indicator, possibly total GDP or GDP-per-capita. The point being that there are many different weights to use. Given that an appropriate weight is selected, the graph would then provide an average distribution slope for the selected groups of countries of interest. In the majority of studies to date, this is not done in the summary section graphs and each country is treated with weight=1 or of equal weight. This equal weighting is appropriate for the classification process of deciding which countries ‘look’ and mathematically fit either the Slope or U-shaped distributions. After the distribution graph’s shapes are

all mapped onto a common set of axes, it gives the audience the ability to see the overall trends of each distribution type and compare countries side by side to see difference between them. This visual aid is a great platform for visually-dependent audiences, such as the general public, who may be time-constrained.

This assessment of slope and overall shape of a distribution is an immature field of inquiry. As Atkinson, Best, Cobham and Summer, and Skopek have shown, the attraction of indexes and mathematical descriptions of any given population set as the *be-all-and-end-all* of inequality descriptions comes for a long historical tradition of macroeconomics (Atkinson, 1973; Best, 2012; Skopek, 2014). The notion that there is a degree of subjectivity, or even the view that a single problem may require more than one approach, has been uncomfortable for many academics alike. However, there are degrees of subjectivity within the popular indexes used, such as the GINI and Plama, which place emphasis on different parts of the wealth spectrum. The only subjective assessments within the population-based distribution graphs are the decisions made for the latter aggregated ranges and the minimum ranges. These subjective decisions do not change the actual data in any algorithmic sense, but rather only in the sense that the €2M+ range encompass a large range.

6.0. Conclusion

This thesis sets out to develop new methodologies of analysing wealth distributions at a multifaceted level and specifically with a transnational focus. This multifaceted approach with new developmental tools aimed to shift transnational analysis away from summary statistics and towards a broader mode of inquiry. The new tools provide the platform to analyse wealth distributions within the elderly European population, and the combination of the multifaceted approach and new developmental tools generates a dual wealth-distribution concept as an emergent finding within the research.

The new methodologies provide the tools for analysis, and as equally important, the HFCS provides the environment in which to test them. This survey, owned by the European Central Bank, has rich quantities of data on 14 European countries with very high qualities of data. It corrects for many methodological surveying biases through synthesising and over/under counting which has created a gold standard of information on wealth and finance. Each of these 14 countries has been examined through the use of four newly-developed methodologies. The first is the population-based wealth distribution graph, which provides real and absolute levels of wealth and population density. The second is the percentile-based wealth distribution graph, which provides an end-to-end coverage of the relative wealth held within each decile. Thirdly, the rate of decline has been used to assess the slope changes within the Slope-shaped countries, which provides an indication of how wealth changes from high-density to low-density ranges. Lastly, the relative increases between the decile ranges shows the differences between countries and also against the average experience of the 14 countries observed. These four techniques provide the baseline analysis for every country involved, and included alongside them are deep levels of analysis which include assessing the median, mean, and encompassment, among other things.

The results show that a multifaceted approach holds many benefits, the primary of which, is the complete description of any given country's wealth distribution. This is opposed to a typical empirical paper which

boasts one, possibly two, summary statistics to adequately portray the level of inequality within a given country. The multifaceted approach has been shown to be applicable across a medium-sized sample of countries. This is important because many scholars use summary statistics to analyse a much larger sample size of countries admittedly, however with data quality levels so low outside of the HFCS, the very notion of analysing 30+ countries becomes questionable. The multifaceted approach, while taking longer, provides a much broader set of information which allows readers and scholars to not only easily interpret but also cross-compare country to country within a medium which clearly demonstrates all the data being used. This is quite the different case to many summary statistics which can oftentimes be a '*black box'* where their results must be taken as a given. If the wealth-distribution field can move forward together and agree upon a set of standardised methodologies or tools to analyse countries, then conducting transnational analysis can progress much faster than ever before.

Alongside the successful testing of new methodologies is the emergent result of a dual wealth distribution. The findings in this thesis have shown that, when describing these 13 countries distributions, they can be separated into two rather distinct distribution patterns. These two patterns form the end states of a wealth spectrum which on one end has the U-shaped distributions, and on the other, Slope-shaped distributions. Roughly half of the countries fall into either category, and two countries could arguably be categorised each way, which leads to the proposition that they are possibly in a state of transition from a U- to a Slope-shaped distribution, or vice versa. These results provide evidence towards an idea that there are essentially two different macro-distribution types within the European countries. On one hand, countries have a Slope-shaped distribution with one central peak followed by a rate of decline. On the other hand, countries have a U-shaped distribution which supports a dual peak shaped comprising of one large initial peak, a rate of decline and then a smaller secondary peak representing the higher ranges of wealth. This result is particularly interesting because all of these national economies undergo their own economic plan, and despite this, there

appears to be overarching conclusions which can be drawn across them all.

Looking beyond this thesis, there is still a significant amount of work and research to conduct with regards to both the wealth distributions amongst the elderly population, and standardising a multifaceted approach to studying wealth inequality. Including more countries into the comparative approach would be one of the key areas for development. This would, at first, include the remaining 14 countries in the European Union which haven't been studied, and then extended into all 50 countries of Europe. The inclusion of more countries would be imperative to solidifying or disproving the dualistic wealth-distributions types. Although significant data populating progress has been made by the HFCS it is still limited to only 15 European countries. Presently, it doesn't populate enough developing countries to further test transnational wealth distribution analysis, however other national-based surveying instruments may. Unfortunately, as shown, the data used within this thesis and further transnational analysis is completely reliant on the expansion of social surveying. It is in this sense that the analysis always trails the data population phases however it is more likely that the countries within the European Union will be included in the survey rather than ones that are not, which would satisfy the first expansion of analysis.

The HFCS survey provides an excellent platform for research and development in the fields of economic inequality. While, as shown in the methodology section, it is quite difficult to obtain access via the European Central Bank for use of the statistical micro-data, the process is ultimately worthwhile. One of the strengths of using the HFCS is the standardisation it provides. The vast majority of the data is collected, cleaned and weighted in a standardised way which provides a fantastic set of data to use and manipulate. Often the use of a particular database is either a cause for concern or scepticism when it concerns empirical research, however, because of the thorough social-scientific research techniques used, and fully explained in the survey meta-data, the typical scepticisms are put to rest. Using the HFCS in the future is probably the best option,

with a ‘wave’ of data being released this year (2017), which potentially includes more countries.

The cohort-related aspect of this thesis has raised questions of particular interest with several avenues of further research to be possibly conducted. While this thesis has focused specifically on the retired population with hypothetical reasoning as to why certain wealth distributions would emerge, it would also be interesting to analyse younger or even a subset of the elderly population to see if the results hold true. This would not only test the emergent idea of a dualistic wealth-distribution type, but it would also test the flexibility of a multifaceted approach. Along with studying new cohorts would be the research into specific wealth profiles for each age groups and comparing them transnationally. Ideally this would be done over multiple countries, continents and developmental stages to grasp the wealth levels and compositions for each age cohorts.

The field of inequality has much room for development. To aid this, the world is moving towards capturing data in higher quantities and with higher quality. This provides many opportunities to perform greater and more powerful methods of analysis across a larger number of countries. As shown above, there are many different avenues which lead on from this thesis that are not fundamentally constrained by the quantity and quality of available data. The constraints of data are exclusive of the philosophical, statistical and sociological problems which arise when attempting to measure inequality. Scholars over the last century have discussed inequality through many different methods. Most of these methods inevitably emphasise different distributional aspects; the GINI, as Cobham and Summer have pointed out, is affected by middle range differences rather than tail or head gains in the distribution (Cobham & Summer, 2013). The population-based graph uses this same methodology to display the polarisation and the decision to aggregate the higher wealth ranges is subjective, however it is supported by a range of different objective foundations. This level of subjectivity doesn’t undermine the method but rather it should be clearly identified where the subjectivity will have an influence. This is not the case in the GINI because: A) it is a summary statistic and therefore does not describe micro-statistics and B)

because examples of the GINI do not explain how the Lorenz curve affects the weighting of how the co-efficient is calculated. The population-based graph does this by clearly displaying the wealth ranges, and in this sense, is not a 'black box' or something which computes without explanation. The multifaceted approach and the continued development of the study of inequality is a development which will have to tackle these epistemological questions moving forward. Whatever approach becomes popular, or is standardised, will have to offer an in depth approach which is both applicable across many different countries and fully exploits the complementary and emergent information available.

For the field of inequality, this thesis recommends taking a rather dramatic approach: attempt to move away from mathematical equations and formulae to provide different ways of describing reality. It isn't that these formulae are not important, but rather, that they are not the *only* important mechanism to employ when enquiring about wealth distributions.

New methodologies for describing the complete distribution of wealth within populations are an integral part to the future field of inequality. The lack of these new methodologies has hindered a field of work dominated by summary statistics to the extent that it now lacks the capability of analysing wealth distributions in fullness. A combination of new methodologies and a multifaceted approach has been examined in this thesis and proven to yield positive results in an innovative and forward-thinking way.

Inequality is hard. It is hard to define, hard to measure, hard to value, and a great amount of further work is needed in the field. I am confident that this thesis has contributed to, and expanded, the pool of knowledge in the field.

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