ONLINE







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Chronological List of Past and Present Editors of Xjenza

The Journal of the Malta Chamber of Scientists

2023-

Editor: Cristiana Sebu

Associate Editors: Ian Cassar, Alexandra Bonnici, Joseph Galea, Lourdes Farrugia, Godfrey Baldacchino, Liberato Camilleri Xjenza Online Vol. 12 Special Iss. (2024) Xjenza Online Vol. 11 Special Iss. (2023) Xjenza Online Vol. 11 Iss. 1 and 2 (2023)

2018-2022

Editor: Cristiana Sebu Senior Editors: Sebastiano D'Amico, David Magri Associate Editors: Sandro Lanfranco, Ian Thornton, Gianluca Valentino, Ian Cassar, Alexandra Bonnici, Joseph Galea, Pierre Vella, Lourdes Farrugia, Godfrey Baldacchino, Liberato Camilleri Xjenza Online Vol. 10 Iss. 2 (2022) Xjenza Online Vol. 10 Iss. 1 (2022) Xjenza Online Vol. 10 Special Iss. MNS Proceedings (2022) Xjenza Online Vol. 9 Special Iss. (2021) Xjenza Online Vol. 9 lss. 2 (2021) Xjenza Online Vol. 9 Iss. 1 (2021) Xjenza Online Vol. 8 Iss. 2 (2020) Xjenza Online Vol. 8 lss. 1 (2020) Xjenza Online Vol. 7 Iss. 2 (2019) Xjenza Online Vol. 7 lss. 1 (2019) Xjenza Online Vol. 6 Iss. 2 (2018) Xjenza Online Vol. 6 Iss. 1 (2018)

2013-2017

Editor: Giuseppe Di Giovanni Associate Editors: David Magri, Ian Thornton, Ian Cassar, Philip Farrugia, Sebastiano D'Amico, Nicholas Sammut, David Mifsud, Godfrey Baldacchino, Liberato Camilleri, Carmel Cefai Xjenza Online Vol. 5 Iss. 2 (2017) Xjenza Online Vol. 5 SI MNS Proceedings (2017) Xjenza Online Vol. 5 lss. 1 (2017) Xjenza Online Vol. 5 Virtual Issue COST (2017) Xjenza Online Vol. 4 Iss. 2 (2016) Xjenza Online Vol. 4 Iss. 1 (2016) Xjenza Online Vol. 3 lss. 2 (2015) Associate Editors: David Magri, Ian Thornton, Ian Cassar, Philip Farrugia, Sebastiano D'Amico, Nicholas Sammut, Joseph Galea, David Mifsud, Sandro Lanfranco, Mario Valentino, Godfrey Baldacchino, Liberato Camilleri Xjenza Online Vol. 3 lss. 1 (2015) Xjenza Online Vol. 2 Iss. 2 (2014) Xjenza Online Vol. 2 Iss. 1 (2014) Xjenza Online Vol. 1 Iss. 2 (2013) Xjenza Online Vol. 1 Iss. 1 (2013)

2003-2007

Editors: Joseph N. Grima and Richard Muscat Xjenza Vol. 12 (2007) Xjenza Vol. 11 (2006) Xjenza Vol. 10 (2005) Xjenza Vol. 9 (2004) Xjenza Vol. 8 (2003)

1996-2002

Editor: Angela Xuereb Associate Editor: Richard Muscat Xjenza Vol. 7 (2002) Xjenza Vol. 6 (2001) Associate Editors: Martin Ebejer and Richard Muscat Xjenza Vol. 5 (2000) Xjenza Vol. 4 Iss. 2 (1999) Xjenza Vol. 4 Iss. 1 (1999) Associate Editors: Martin Ebejer, Richard Muscat, and Christian A. Scerri Xjenza Vol. 3 Iss. 2 (1998) Xjenza Vol. 3 Iss. 1 (1998) Associate Editors: Martin Ebejer, Richard Muscat, Christian A. Scerri and Emmanuel Sinagra Xjenza Vol. 2 Iss. 2 (1997) Xjenza Vol. 2 Iss. 1 (1997) Xjenza Vol. 1 Iss. 2 (1996) Xjenza Vol. 1 Iss. 1 (1996)

Scope of Journal

Xjenza Online is the Science Journal of the Malta Chamber of Scientists and is published in an electronic format. Xjenza Online is a peer-reviewed, open access international journal. The scope of the journal encompasses research articles, original research reports, reviews, short communications and scientific commentaries in the fields of: mathematics, statistics, geology, engineering, computer science, social sciences, natural and earth sciences, technological sciences, linguistics, industrial, nanotechnology, biology, chemistry, physics, zoology, medical studies, electronics and all other applied and theoretical aspect of science.

The first printed issue of the journal was published in 1996 and the last (Vol. 12) in 2007. The publication of Xjenza was then ceased until 2013 when a new editorial board was formed with internationally recognised scientists, and Xjenza was relaunched as an online journal, with two issues being produced every year. One of the aims of Xjenza, besides highlighting the exciting research being performed nationally and internationally by Maltese scholars, is to provide a launching platform into scientific publishing for a wide scope of potential authors, including students and young researchers, into scientific publishing in a peer-reviewed environment.

Instructions for Authors

Xjenza is the Science Journal of the Malta Chamber of Scientists and is published by the Chamber in electronic format on the website: https://www.xjenza.org/. Xjenza will consider manuscripts for publication on a wide variety of scientific topics in the following categories

- 1. Research Articles
- 2. Communications
- 3. Review Articles
- 4. Notes
- 5. Research Reports
- 6. Commentaries
- 7. News and Views
- 8. Invited Articles and Special Issues
- 9. Errata

Research Articles form the main category of scientific papers submitted to Xjenza. The same standards of scientific content and quality that applies to Communications also apply to Research Articles.

Communications are short peer-reviewed research articles (limited to three journal pages) that describe new important results meriting urgent publication. These are often followed by a full Research Article.

Review Articles describe work of interest to the wide community of readers of Xjenza. They should provide an in-depth understanding of significant topics in the sciences and a critical discussion of the existing state of knowledge on a topic based on primary literature sources. Review Articles should not normally exceed 6000 words.Authors are strongly advised to contact the Editorial Board before writing a Review.

Notes are fully referenced, peer-reviewed short articles limited to three journal pages that describe new theories, concepts and developments made by the authors in any branch of science and technology. Notes need not contain results from experimental or simulation work.

Research Reports are extended reports describing research of interest to a wide scientific audience characteristic of Xjenza. Please contact the editor to discuss the suitability of topics for Research Reports.

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Invited Articles and Special Issues Xjenza regularly publishes Invited Articles and Special Issues that consist of articles written at the invitation of the Editor or another member of the editorial board.

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Article Structure

A manuscript for publication in Xjenza will typicall have the following components: Title page, Abstract, Keywords, Abbreviations, Introduction, Materials and Methods, Results, Discussion, Conclusions, Appendices and References.

The manuscript will be divided into clearly defined and numbered sections. Each numbered subsection should have a brief heading. Each heading should appear on its own separate line. Subsections should be used as much as possible when cross-referencing text, i.e. refer to the subsection by the section number.

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- The title should be concise yet informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
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Results Results should be clear and concise. Numbered/tabulated information and/or figures should also be included.

Discussion This should explore the significance of the results of the work, yet not repeat them. Avoid extensive citations and discussion of published literature. A combined section of Results and Discussion is often appropriate.

Conclusions The main conclusions based on results of the study may be presented in a short Conclusions section. This may stand alone or form a subsection of a Discussion or Results and Discussion section.

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Kramer et al. (2010) have recently shown ...

or parenthetically

as demonstrated (Allan, 2000a, 2000b, 1999; Allan and Jones, 1999).

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- Agree, E. M. and Freedman, V. A. (2011). A Quality-of-Life Scale for Assistive Technology: Results of a Pilot Study of Aging and Technology. *Phys. Ther.*, 91(12):1780–1788.
- McCreadie, C. and Tinker, A. (2005). The acceptability of assistive technology to older people. *Ageing Soc.*, 25(1):91–110.

Reference to a Book

- Brownsell, B. (2003). Assistive Technology and Telecare: Forging Solutions for Independent Living. Policy Press, Bristol.
- Fisk, M. J. (2003). Social Alarms to Telecare: Older People's Services in Transition. Policy Press, Bristol, 1st edition.

Reference to a Chapter in an Edited Book

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- All necessary files have been sent, and contain:
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The main

Special Editorial

A focus on the Maltese economy

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This special edition of Xjenza Online carries eight articles on the Maltese economy, analysing its different aspects and using different approaches, with some studies utilising econometric techniques, while others relying more on a descriptive analysis. Seven out of the eight articles cover specific aspects of the economy, namely housing, education, inflation, competition regulation, the labour market, pensions, and the exchange rate of the domestic currency. One of the articles presents an overview of the Maltese economy, discussing its sustainability.

1 Retirement savings in Malta

The factors that influence individual willingness to participate in a workplace pension scheme, authored by Philip von Brockdorff and his co-authors, is the first article carried in this special edition. Workplace pension schemes provide an alternative, private source of retirement funds to employees, with the contributions typically made by both the employees themselves and their employers. The authors argue that this topic is of interest in light of concerns related to the sustainability of public pensions in Malta and within the EU, resulting ageing population. To investigate this issue, the authors conduct a series of computer-assisted telephone interviews across a sample of 164 workers in Malta who are members of a leading trade union. The results show that respondents' willingness to save in a workplace pension scheme is strongly driven by trust levels of the workers in such schemes. The authors carry out logistic regressions based on the results of the interviews and find that trust in such schemes is positively related with being male, relatively high income and high levels of risk tolerance, meaning the extent to which survey respondents are happy to accept risk as part of their financial decisions.

implications of their findings are that there is the need to encourage greater pension-related savings among younger workers, since they tend to be less likely to invest in workplace pensions schemes. The findings also point towards the need for any workplace pension schemes to cater for the growing diversity within the Maltese workforce, including women, given the different levels of trust in such schemes. The article also discusses the role of trade unions in fostering such schemes and ensuring that they appeal and are accessible to a diverse array of workers in the Maltese labour force.
 2 The sustainable development im-

exercises used to process these results.

The authors derive a number of interesting implications

from the results of the interviews and the regression

2 The sustainable development implications of economic changes in Malta

Lino Briguglio discusses Malta's economic performance between 2012 and 2021, comparing the Malta changes with those of the other 26 European Union (EU) member states and with the EU average. The paper also considers social, environmental and political issues, again within an EU context, so as to place the economic dimension within a sustainable development context. The focus is however on economic aspects, with the other aspects being chosen mostly in view of the fact that they tend to drive, or to be driven, by changes in economic realities. The data presented and discussed in the paper, if synthesised, indicates that between 2012 and 2021, Malta has done relatively very well economically, mostly in terms of economic growth, fairly well in terms of social development and not well at all in terms of environmental and political governance. The paper argues that in matters relating to social and political governance, the situation appears to have, broadly speaking, improved since 2021. However, this is not the case in matters relating to the physical environment, and the situation would seem to have been worsened in some aspects. The paper ends with an optimistic remark that Malta's membership in the European Union, where sustainable development and democracy are assigned major importance, should dissuade maladministration excesses in matters relating to political and environmental governance.

3 The Economic Impact of the Office for Competition on the Maltese Economy

Gilmour Camilleri and his co-authors attempt to guantify the economic benefits of the workings of the Office for Competition to the Maltese economy. To do so, they used an input-output model, which enables them to assess the direct and indirect multiplier effects in terms of Gross Value Added that accrued on the Maltese economy as a result of the Office's control of concentrations between 2014 and 2018. The main conclusion of this study is that the estimated financial benefit to the Maltese economy in terms of GDP, averaged \in 10.2 million per year, of which \in 7.1 million are direct effects and \in 3.1 million are indirect benefits. These amounts equate to an average return ratio of 30:1 for every Euro allocated to the Office in terms of Gross Value Added. The return ratio aims to capture the benefit to the economy in relation to a euro of budget allocated to the Office to cover the cost of its operations, such as salaries, rent and other overhead costs.

Noting that this ratio is higher than those found in similar studies, the authors list a number of caveats relating to the results of the study, suggesting that these results should be interpreted with caution. However, the authors argue that notwithstanding these limitations, quantifying the benefits-to-cost ratio of competition authorities is a useful exercise as it informs the competition authorities about the estimated effect of their intervention.

Several policy implications can be derived from the study, including that such an exercise helps the Maltese authorities in gauging the rate of return from the annual budget allocated to the Office for Competition, which they can use to increase awareness of the benefits of competition law and policy. This study also helps the Office to conduct forecasts and estimates of pending market studies and market investigations, merger control and cases involving competition enforcement. Furthermore, it also aids in conducting annual costing estimates according to its targets and setting case priority based on expected economic impacts.

4 Educational Attainment and Gender Gaps in the Maltese Labour Force

Tiziana M. Gauci analyses the main trends in educational attainment in Malta during the decade between 2010 and 2021 and discusses factors that directly affect gender gaps in the Maltese labour market. Data indicates that educational attainment in Malta has improved substantially during the period under consideration, but pronounced gender gaps remain. The paper considers two major factors that would seem to affect gender gaps in labour force participation rates, namely parenthood obligations and choice of study areas at tertiary level. The author derives a number of policy implications from these findings, including that women should be encouraged to follow STEM subjects and that work-life balance initiatives are crucial for decreasing the gender gap in the labour force.

An important implication of this study is that women are more likely to experience longer out-of-work spells than men, because of the unbalanced division of housework and care activities between men and women in households. Consequently, differences in human capital between the genders are bound to increase with age. Moreover, career interruptions may entail negative consequences for women's careers paths, although the repercussions of these decisions vary depending on the length of the interruptions. The author argues that work-life balance initiatives should not only focus on women with young children but rather should be more open to encompass both men and women in fulfilling their caring responsibilities. An interesting argument by the author is that given that the changes in the labour market are largely technologically-driven, females who follow non-technical study areas tend to find themselves at a disadvantage when it comes to career advancement possibilities. The share of women in STEM occupations is often depleted even further through what is known as the "leaky pipeline" syndrome whereby women move away from STEM jobs, and opt for teaching professions, for example, because of challenges such as finding a work-life balance, among others.

5 Exchange Rate Pass-Through to Consumer Prices

The Exchange Rate Pass-Through (ERPT) is commonly defined as the extent to which exchange rate changes are reflected in the price levels of an economy. This matter has important implications in a number of policy-relevant areas. Glenn Abela and Noel Rapa use an econometric model to estimate the pass-through to consumer prices in Malta after adoption of the euro. Their results indicate that the ERPT to overall Harmonised Index of Consumer Prices (HICP) is largely driven by the goods component while ERPT to services prices is largely insignificant across the period considered. They find that, in general, changes in currency exchange rates are reflected in local prices for up to a year after they occur. Pass-through to goods prices however, tends to be more persistent over time: exchange rate changes feed through to prices after one quarter and remain relevant even up to two years after the change. Their results are also mostly consistent with economic theory and with the empirical literature for euro area countries.

The study of ERPT to local consumer prices has important policy implications. Exchange rate movements are one of the channels through which monetary policy can affect consumer prices. In this light, factors that lead to different levels of exchange rate pass through have implications on the effectiveness of monetary policy in stabilising consumer price inflation. This is even more important for small and open economies within monetary unions, which on the one hand might have specific characteristics that considerably affect the extent of ERPT to consumer prices, whilst not having a fully independent monetary policy. Against this backdrop, further studies on the characteristics that can affect ERPT in Malta can shed more light on the effectiveness on monetary policy in stabilising consumer prices in our economy.

6 The Beveridge Curve in Malta

The Beveridge curve, which shows the relationship between unemployment and job vacancies, is the subject of Melchior Vella's paper, with an empirical analysis covering the period 1998-2022. The author argues that the rapid economic growth recorded between 2013 and 2022 has had a major impact on the labour market, with improvements in efficiency in the matching between supply of labour and employment. This suggests that the Maltese Beveridge Curve over the last decade has shifted inward. This hypothesis was tested empirically using the estimated job entry and exit rates derived from administrative data. The results show, among other things, that despite the record high ratio of job vacancies to unemployment, the labour market still maintained a sufficiently high job finding rate. The findings also indicate a shortage in the creation of new occupations by the economy, despite employers having a desire to hire more workers. In fact, years of high vacancies, such as 2017 to 2019 and 2012 to 2022 could have resulted in congestion effects created by the employers themselves, increasing search costs and thereby reducing the firms' returns from hiring additional workers, everything else remaining constant. One reason for this, proposed by the author, is that in

a small domestic market, the search by one employer is likely to crowd out other firms' chances of finding a suitable employee. However, this negative externality has not translated into a higher unemployment rates, as, according to the author, matching efficiency has also increased, likely reflecting the heavy reliance of immigration on the needs of the economy and the use of active labour market measures.

An important policy implication of this study is that in order to address the challenge at hand, policymakers and market participants should focus on strategies that mitigate congestion externalities. Policy initiatives could include investment in skill development and labour market information systems that provide data on job openings and workforce capabilities.

7 House purchase affordability for first-time buyers in Malta

The affordability of home ownership in Malta has in recent years become a major social and economic area of concern in Malta, especially for first-time buyers. In his study, Brian Micallef develops a housing affordability index that is specifically targeted for this category of buyers covering the period 2000–2022. The index refers to the ratio of household income to the minimum income required to qualify for a mortgage to purchase a property and thus takes into consideration the financing conditions faced by borrowers. He finds that property price-to-income ratios have trended upwards during the period under consideration. For example, for a two-wage earner couple, the ratio of property prices to the household income has increased from 3.7 in the early 2000s to 5.7 in 2022. For single individuals, property prices have risen from around 7 times their income to almost 11 times during the same period. A factor that affects housing affordability is the locality of the property.

The author points out that price-to-income ratios do not take into consideration financing costs, which until 2022 have trended downwards. Since 2022 a combination of factors – such as supply chain disruptions due to the COVID-19 pandemic, high commodity prices, the war in Ukraine and tight labour markets – have led to significantly higher inflation rates and a tightening of monetary policy. While in Malta policy rates tend to be imperfectly and sluggishly passed to the bank retail rates, higher interest rates are likely to exert additional pressure on housing affordability.

An implication derived by the author from the results of this paper is that assessments of affordability should move away from simply considering medians or averages and instead consider the different income groups and localities of the various properties. For example, the situation of first-time buyers can differ significantly from that of the median household. In addition, buyers face difficult trade-offs involving, for instance, decisions about location, property type and size. Such considerations will require additional granular data, some of which may not be available. The author argues that such information is crucial to ensure that housing policies in Malta are based on sound and accurate information and, equally importantly, designed to target those that truly require assistance.

8 Further evidence on core inflation in Malta

Very often inflation is measured by the overall index of consumer prices, but Reuben Ellul Dimech argues that what is known as core inflation is a better measure to explain the effective price pressures experienced in an economy. Traditionally, core inflation excludes volatile items like food and energy prices, providing a more stable measure of underlying inflation trends faced by consumers. On the other hand, the headline inflation rate covers all goods and services included in the official measure for inflation, which offers a comprehensive view of overall price changes in an economy. The author further argues that core inflation measures are useful in periods of heightened inflation caused by short-lived or transitory shocks. The author, using a dynamic factor model, produces estimates of core inflation for Malta based on data relating to the harmonised indices of consumer prices (HICP) for the period January 2006 to August 2022. The results indicated that the price inflation experienced in Malta, post-March 2021, was not transitory in nature.

According to Ellul Dimech, the core inflation measure has a number of desirable properties for policymakers. For example, in the case of Malta, this index did not have the sharp upward or downward swings found in Maltese overall HICP data. During the period under consideration, the results show that the underlying inflation remained high throughout 2020, while all other official inflation statistics showed effectively lower inflation rates. This would seem to indicate that households in Malta were experiencing higher inflationary pressures than official statistics suggests. The implication of this finding is that core inflation information is useful for policymakers and social institutions with an interest in price pressures and wage bargaining. This also suggests that collective wage-bargaining based on official statistics does not capture inflationary biases and could discriminate in favour or against households, depending on the deviation of official statistics from core inflation.

Overall

As can be seen from the above syntheses of the arguments put forward in the articles included in this special edition, a variety of themes relating to the Maltese economy were covered. The editors would like to thank all the authors of the articles, which have rendered this volume interesting to read and containing various useful economic policy implications. The editors are also very grateful for the valuable suggestions by the reviewers of the articles. von Brockdorff, P. et al. (2024). Xjenza Online, 12 Special Issue:5-18.

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Research Article



Retirement savings in Malta: Is there a role for workplace pensions?

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Abstract. This paper seeks to understand the main factors that influence individual willingness to participate in a workplace pension scheme. The topic of workplace or occupational pensions has garnered significant interest in recent years, particularly because of concerns related to the sustainability of public pensions within the EU due to rising population ageing. To this end, we conduct a series of computer-assisted telephone interviews (CATI) across a sample of workers in Malta who are members of a leading trade union. The questionnaire delves into a variety of issues, notably savings and investment behaviour, risk appetite as well as perceptions regarding workplace pensions. The results show that respondents' willingness to save in a workplace pension scheme is strongly driven by individual trust levels in such schemes. In turn, logistic regression results indicate that trust in such schemes is positively associated with being male, high levels of income and higher levels of risk tolerance. We discuss these findings in terms of their implications for the widespread uptake of workplace pensions in Malta and their potential impact on retirement earnings and inequality. We also discuss the importance of trade unions in ensuring that such schemes appeal and are accessible to a diverse array of workers in the Maltese labour force, ensuring that their needs and concerns are addressed while also driving forward any legislative measures to protect investors.

Keywords: Workplace pensions, pension adequacy, fiscal sustainability, Malta

1 Introduction

Welfare states are facing a significant challenge due to the ongoing and intensifying demographic shifts towards an ageing population (Hinrichs, 2021). Although the oldage dependency ratio is expected to continue increasing in developed economies, the estimated increase is particularly acute in Malta. The European Commission (2021) estimates that the number of people aged 65 years or over as a proportion of the working-age population (20-64) will increase from 30.4% in 2022 to 65% in 2070 in Malta and from 36% in 2022 to 59% in 2070 in the EU. In other words, the old-age dependency ratio in Malta is estimated to increase by 34.6 percentage points relative to the 23 percentage point increase in the EU overall, making it one of the largest estimated increases in the EU over this period. Therefore, the current statutory payas-you-go (PAYG) pension system is going to come under increasing strain as the median age of the population continues to increase following a fall in the relative size of the working-age population and increasing life expectancy (Vella & von Brockdorff, 2019). Indeed, mirroring the relatively larger estimated increase in the old-age dependency ratio, gross public pension expenditure-to-GDP is expected to rise by 3.8 percentage points between 2019 and 2070 to 10.9% in Malta, relative to the 0.1 percentage point increase in the EU, although it is important to note that overall expenditure will still remain below the EU average even after this increase.

In this light, the last decades have witnessed an intensification of public pension reform activity across the EU (Hinrichs, 2021). This was done by centering on increasing retirement ages to keep people in work for longer and by extension, paying into the pension system for longer. Namely, pension reform policies in Malta included raising the pension age gradually to 65, increasing the contributory period and offering a percentage increase in pensions for each year worked after the pensionable age to encourage later retirement (Grech, 2017; Malta Fiscal Advisory Council, 2017).

These public pension reforms sought to enhance the fiscal sustainability of public pensions (Carone et al.,

2016). However, although national governments' priority involves keeping pension costs contained to secure the sustainability of their finances, they also face the challenge to ensure that on an individual level, pensions are adequate. In the context of intensifying population ageing, a significant re-think about the pension system in Malta is necessary since the balance between fiscal sustainability and pension adequacy is becoming increasingly pronounced. The relevance of this point is further amplified when considering that the old-age dependency ratio is also expected to rise faster in Malta, increasing by 32 percentage points to 60.5% in 2070, relative to an overall increase of 21.1% in the EU (European Commission, 2021). As a result, there will be increased strain on public finances from a longer retirement and the increased risk of old-age poverty later in retirement (European Policy Committee and Social Protection Committee, 2020).

Although the provision of pensions schemes in Malta has a long history dating back to 1885 with the first publicly provided scheme for police officers, private pension schemes are still comparatively nascent in nature, possibly owing to the abolition of such schemes in 1979 as part of the two-thirds pension reform. Nonetheless, in recent years the Maltese government has sought to actively promote participation in private pension schemes, notably via the launch of the third pillar pension scheme in 2014 which introduced tax credits related to the uptake of personal retirement schemes. This was followed up by the introduction of tax credits for both employers and employees to encourage the provision of and participation in voluntary occupational pensions schemes in 2017, with both sets of tax credits increased further in 2021.

Against this context, understanding the willingness to save in occupational pensions schemes in Malta is one of urgent significance. Thus, the objective of this study is to understand the role and determinants of saving in occupational pensions in Malta using a unique dataset of trade union members, the majority of which are aged below 35. These results are then used to derive relevant policy implications to facilitate the uptake of occupational pensions to improve adequacy in pensionable income while also reducing the burden on the current pension system.

2 Literature Review

In response to the retrenchment of public pensions, private alternatives to traditional publicly funded pensions have become increasingly widespread in several countries (Börsch-Supan et al., 2008; Burtless, 2012; Keune, 2018). These have namely taken the form of private occupational pension schemes which are employment-based pensions organised at the sector or firm level. This occurred as national governments pushed for reforms aimed

at their expansion, but also through the introduction of incentives to save into workplace pensions schemes, such as in the form of tax benefits (Dummann, 2008), with these schemes even becoming mandatory or quasi-mandatory in some countries (European Commission, 2021). Furthermore, the European Commission has long argued that these second-pillar pensions are required due to population ageing (e.g. European Commission, 2003, 2012). Nevertheless, the design and provision of these schemes remain heterogeneous within and between EU countries, with occupational pensions representing a relatively larger proportion of pension provision in countries like Denmark and the Netherlands where coverage is high.

Aside from softening the burden of ageing populations on social security schemes, the reason behind this increased participation in workplace pensions is that these schemes provide an important income supplement to firstpillar pensions, resulting in more income security for the elderly and can also help secure adequate replacement rates (Anderson, 2019; Haverland, 2007; Natali, 2018). The latter point is particularly salient for individuals who face uncontrollable barriers to prolonging their working lives to reach a desired replacement rate, such as poor health (Topa et al., 2018).

Economic literature has identified various factors which influence the demand for occupational pensions (Dummann, 2008). The notion of saving for retirement can be traced back to the classic life-cycle hypothesis worked out by Modigliani and Brumberg (1954), which is built on the notion that income in retirement is smaller than that during the working period and therefore individuals save money when they are working in order to finance their consumption once they are in retirement. Since individuals derive a higher utility from smoothing consumption and maintaining living standards across their lifetime, individuals design a lifetime savings plan (Crawford et al., 2012). Thaler and Sunstein (2008) argue that one of the key problems with such life-cycle models is the complexity individuals face in designing an optimal savings plan for their lifetime, making it difficult to make rational decisions when it comes to pension planning. Secondly, retirement savings might not always be the priority for individuals (Foster, 2017), namely due to paying off mortgages, and therefore people also face difficulty in following their optimal savings plan (Thaler & Sunstein, 2008).

Aside from the two problems associated with life-cycle models, and by extension retirement planning, previous studies have found evidence that gender and age also influence savings decisions linked to retirement. Younger employees are found to save less through occupational pensions (Dummann, 2008). This could be driven by a lack of knowledge of the necessity in planning for retire-

ment or perceived restricted portability of occupational pensions for a demographic which values labour mobility. Research has also highlighted the role of heuristics (e.g. present bias and inertia) in negatively influencing engagement with pension schemes generally (James et al., 2020), but particularly for younger employees aged between 25 and 39 (James, 2018). Indeed, other studies (eg. MacLeod et al., 2012; Scottish Widows, 2020) have shown that individuals were not actively planning their retirement until their 30s or 40s, and males think about pension provision before females, albeit at a decreasing rate, with the latter potentially being driven by a lack of affordability (Prabhakar, 2017).

Pension features, namely automatic enrolment, simplification, and commitment devices, also influences workplace pension participation (Carroll et al., 2009; Madrian, 2012; Prabhakar, 2017). Madrian and Shea (2001) found that there was a significant increase in the number of participants in the scheme when it required individuals to opt-out. They further argue that this might be due to procrastination, but this might occur due to a myriad of factors. For instance, procrastination in opting-into an occupational pension can occur because of the complexity in making saving decisions as highlighted by Thaler and Sunstein (2008) or due to a lack of information on the pension scheme or automatic enrolment. The authors suggest that education may be the appropriate tool if this finding is driven by a lack of information.

On this note, existing work similarly suggests that educated employees are more likely to participate in a workplace pension scheme (Bernstein, 2002; Dummann, 2008), since this group is better informed and has a better understanding on the details of pension plans and the associated benefits, including tax reductions. Furthermore, when looking specifically at the results for financial education, studies similarly find that individuals who do not possess adequate financial literacy are less likely to plan for retirement and reach retirement with insufficient accumulated wealth (Hilgert et al., 2003; Lusardi & Mitchell, 2007). Ring (2005; 2012) suggests that educating individuals on retirement planning can help assess the trustworthiness of financial products, institutions, and related advice.

Mirroring the link between education and occupational pension scheme participation, studies have concluded that income levels are an important determinant of retirement savings behaviour, with higher-income households having the ability to save more towards their retirement (Amari et al., 2020; Shariff & Isah, 2019). Risk aversion is another element which has been found to influence personal savings behaviour (Almås et al., 2020; Bommier & Grand, 2019).

3 Method

3.1 Survey

To understand the willingness to save in private occupational pensions schemes and the associated determinants in Malta, we use a unique data set extracted from a telephone survey carried out in the last quarter of 2018. This dataset has the specific advantage of including several determinants which we would expect influence an individual's decision to save in a private pension scheme, namely education, income, financial literacy, and risk aversion. Apart from including a question on the willingness to save in an occupational pension scheme, this survey further asks about the individual's ability to trust this scheme. Ring (2012) argues that trust is a crucial element in pension decisions considering the uncertainty over pension outcomes and the risks associated with pension investment. Furthermore, as workplace pensions are provided by or through an employer, then engagement with the scheme is likely to be impacted by the level of trust employees have in their employers and financial institutions to provide suitable schemes. On this note, Ring (2012) argues that uncertainty over pension outcomes and the risks of pension investment imply that trust is important in pension decisions. Additionally, the European Commission (2012) has argued that there is scope for further development of private funded schemes, but this would require that such schemes become safer. In turn, this would foster more trust in saving in such workplace pensions.

Furthermore, the sampled individuals are employed members of the UHM, Voice of the Workers, one of the largest trade unions in Malta which represents workers from several economic sectors and accounts for around 26% of unionised individuals (DIER, 2019). Trade unions have had important roles in the evolution and the provision of secure occupational pensions in other countries, namely by developing strategies for limiting investment risks, limiting the involvement of private financial actors, and ensuring that the interests of the investment managers are aligned with those of the employees engaging with the scheme (Anderson, 2019; Keune, 2018). Secondly, since individuals are heavily influenced by the 'messenger' of information (Dolan et al., 2010), trade unions as representatives of the workers have another important role in the uptake of occupational pension schemes in Malta.

Following a presentation of summary statistics and aggregated results, this paper will present pairwise correlations to understand the key correlates of individual willingness to save in a workplace pensions scheme. This will be complemented by the estimation of a logistic (logit) regression model to delve into the determinants of trust in occupational pensions schemes. The logit model is used to estimate the likelihood of something occurring in a dichotomous choice variable (in this case, the likelihood of trust in workplace pension schemes, which is binary), by fitting a linear logistic model based on a set of correlates that may explain this likelihood.

At this point, a number of potential shortcomings are worth noting. Firstly, the study is exploratory in nature, with questions on willingness to save in workplace pensions being largely hypothetical in nature, which may generate noise in our data. Secondly, the nature of the questionnaire itself means that tasks which effectively require due time and consideration (e.g., savings decisions) were in reality taken in an artificially short amount of time, and this may also impact the accuracy of the responses. Thirdly, the questionnaire consists of closed-ended questions, with no scope for elaboration or qualitative responses which may add further insight or indeed context to the responses. The sample size of 164 respondents may also limit the external validity of the conclusions and results drawn in this paper, and any causal interpretations should be undertaken with caution.

3.2 Data and summary statistics

Table 1 presents the summary statistics of the sample (n = 164) for the key variables. As shown through the statistics, the target respondents for this survey were individuals aged 35 and younger. Indeed, this category makes up around 70% of the total sample. It is useful to gather the views from a predominantly younger sample of respondents given that in the context of population ageing, private workplace pensions would be of the most benefit to this age group. Secondly, previous research shows that younger workers are typically less likely to engage with workplace pension schemes and therefore understanding the reasons for non-participation is crucial (Dummann, 2008). The 36-50 and 51+ sub-samples include 25 respondents each. In turn, as older workers are likely to be looked after exclusively through the state pension provided by the Maltese government, this group serves as a useful benchmark for the views of younger members who may not be able to rely so heavily on the state to provide them with an adequate retirement in income.

Most respondents have an upper-secondary level of education (just under 50%), with 25% of the sample having successfully completed post-secondary education and around another quarter having a tertiary level qualification. Nevertheless, those aged 35 and under, the largest sub-sample, display higher levels of academic qualifications relative to the overall sample average, whereas respondents in the 51+ category are largely skewed towards lower levels of education. In turn, these education statistics are mirrored in the reported income levels with most

Variable		Share
Gender	Male	54.9%
	21-35	69.5%
Age	36-50 51+	15.2% 15.2%
Education	Upper-secondary Post-secondary Tertiary	47.6% 25.0% 27.4%
Income	$\leq €15,000$ €15,001 - €25,000 €25,001 - €35,000 ≥ €35,000	23.8% 62.2% 12.2% 1.8%
Risk-seeking	0 - 25 26 - 50 51 - 75 76 - 100	30.5% 39.0% 20.1% 10.4%

Table 1: Description of key independent variables.

respondents (around 62%) earning between $\in 15,001$ and $\in 25,000$ yearly, followed by 23.8% earning $\in 15,000$ or less. The 51+ cohort records a larger share of respondents in the lowest income category relative to the sample average (28.0%).

The sample of union members is characterised by a strong degree of risk-aversion, with almost three-fourths of the respondents ranking themselves as more risk-averse when it came to investing their savings. There was a divergence in attitude to risk across age groups with those in the 51+ category being more risk averse than younger respondents.

As mentioned earlier, the survey includes a set of questions which seek to evaluate financial literacy. As one would expect, financial illiteracy tends to influence household financial behaviour (Lusardi & Mitchell, 2007). In this light, the level of financial literacy needs to be included within the discussion on the role of occupational pensions in Malta from a policy perspective, to provide individuals with the resources to improve their financial education to make optimal saving decisions to ensure they have an adequate pension.¹ Consistent with previous studies (eg. Nicolini et al., 2013; Van Rooij et al., 2011), these questions assess concepts which are the cornerstone of financial planning and transactions, namely interest compounding, inflation effects, time discounting

¹A copy of the survey questionaire is shown in Appendix A

Share of correct f	Share of correct financial literacy responses by question type						
	Numerical skills	Interest compounding	Inflation	Time discounting	Real value of money	Risk	
Correct responses	65.2%	52.4%	62.2%	50.0%	70.7%	59.1%	
Share of sample I	by number of	correct financial	literacy res	sponses			
Correct response	S						
None		1.8%					
1		7.3%					
2	14.0%						
3	21.3%						
4	26.8%						
5	18.9%						
All	9.8%						

Table 2: Financial literacy

and the real value of money. Respondents were given a 'do not know' option when answering these questions to reduce the possibility of a correct response from a guess response, reducing the accuracy of the financial literacy statistics (Lusardi & Mitchell, 2007). Statistics of these questions are reported in Table 2 below.

The proportion of correct responses varies according to the underlying concept. Questions assessing knowledge on the real value of money, numerical skills and inflation recorded the largest share of correct responses, with the share of correct responses ranging from 62% to 71% of the total number of respondents. In line with our expectations, respondents demonstrated the highest levels of literacy in areas where finance permeates day-to-day experience. Similarly, when assessing respondents' knowledge on relative risk of different investment options, more than one third of respondents incorrectly categorised an investment in a diversified fund as riskier than an individual stock. However, the share of correct answers decreases to around half of the sample when asked about interest compounding and time discounting. Although at least half of the respondents answered each question correctly, only 9.8% of the sample answered all six financial literacy questions correctly. This would indicate that the respondents' knowledge of concepts which lie at the basis of financial planning is not extensive. Despite the lack of comparability in financial literacy assessments (Nicolini et al., 2013), this result aligns with the results of previous studies which concluded that widespread financial illiteracy is a common characteristic of several developed countries (Atkinson et al., 2006; Lusardi, 2019; Lusardi & Tufano, 2015). Despite these results, around 73% of

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the sample believe that their level of financial literacy is average.

As shown in Table 3, a significant majority of respondents have said that they would be willing to save in a private workplace pension scheme to have another source of pension income aside from the state funded pension scheme. A similar share of the sample has indicated that they would trust a private workplace pension that was provided by their employer. These results are consistent across age cohorts, although the youngest cohort exhibited relatively less willingness to save and trust in workplace pensions. This finding is consistent with other responses, namely, this age group also showed relatively less concern that the pension they will receive under the current system will not be adequate, albeit still largely agreeing with this statement. Nevertheless, only around 60% of respondents indicated that they currently save regularly, of which only 21% mentioned that one of the reasons they save is for old age and retirement.

4 Results and Discussion

4.1 Results

This first subsection presents a correlation matrix of respondents' willingness to save in work pensions (future section, Q8) together with the following variables: trust in an occupational pension (future section, Q9) and sociodemographic characteristics. The latter includes gender, age, education and income (Demographics section - Q1, 2, 4, 6). The results indicate that each of these variables are positive correlates of the willingness to save variable. However, the trust variable has the strongest positive correlation (in terms of both the magnitude of

Variable		Full	Age group)
		Sample	21-35	36-50	51+
Willingness to save in occupational pension	Yes	80.5%	77.2%	84.0%	92.0%
	No	19.5%	22.8%	16.0%	8.0%
Trust in occupational pension	Yes	82.3%	78.1%	100.0%	84.0%
	No	17.7%	21.9%	0.0%	16.0%

Table 3:	Description	of de	ependent	variables
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the coefficient, as well as the statistical significance of the correlation). The strong positive correlation between trusting and saving in an occupational pension is in line with a priori expectations; therefore, it verifies the validity of the data obtained from the survey. More importantly, this finding highlights the importance of fostering trust in occupational pensions given that trust is a necessary precondition to encourage saving in these pensions.

Building on the key result of the first subsection, the second subsection seeks to determine what influences trust in occupational pensions, or rather, what variables are more likely to result in higher levels of trust in these pension schemes. Thus, we regress the trust in an occupation pension variable on the aforementioned socio-demographic variables, a measure for risk aversion, as well as a financial literacy index and a dummy variable denoting whether the respondent is a regular saver. The risk aversion variable is sourced from the Risk Appetite section (Q1), while the financial literacy variable is obtained from a simple combination of the six questions asked within the survey itself designed to test financial literacy, as detailed in Table 2.

The results of the logit regression are reported below in Table 5. As seen below, three explanatory variables have yielded statistically significant coefficients, namely gender, income and risk preferences. Specifically, male respondents are 14.5% more likely to trust workplace pensions relative to their female counterparts, which tallies with recent work analysing gender inequality in relation to private pensions (Bonnet et al., 2018). Secondly, higher incomes are also associated with higher levels of trust in workplace pensions, potentially capturing the fact that higher earners would know more about such schemes and their intricacies than others due to prior experience with investments or similar schemes. Thirdly, individuals with higher levels of openness to risk are also more likely to trust such pension schemes, once again potentially reflecting a greater level of familiarity with investments within this cohort, particularly equity portfolios, and thus the way in which such schemes operate and their potential upside. It is interesting to note that both education and financial literacy are not statistically significant, which shows that it is experience rather than knowledge that drives trust in such schemes and, in turn, willingness to save in a workplace pension. Similarly, regular savers do not exhibit higher trust levels in these schemes, potentially due to the fact that saving behaviour in Malta typically consists of relatively simple activities like placing money in a bank account or the purchase of government bonds, as opposed to riskier undertakings like investments in equity markets or portfolios, as attested by the high levels of deposits held in Maltese banks (Central Bank of Malta, 2022).

4.2 Discussion

The findings presented above raise a number of interesting questions regarding the potential widening of workplace pension coverage in Malta. Firstly, the pairwise correlation results indicate that younger individuals are less likely to save in a workplace pension scheme than older workers, which tallies with previous findings from the literature (e.g. Kristjanpoller & Olson, 2015). This underscores the need to educate younger generations on the importance of investing in a pension scheme at an early age in order to ensure financial stability upon retirement, particularly in light of the well-documented issues in public pensions funding which are looming both in Malta and across Europe due to ageing populations (European Commission, 2021).

Secondly, the gender gap observed in our regression results when it comes to trust in pensions must also be tackled, since this translates to lower uptake of private pensions among women, to the tune of 39% across the entire EU-27 (Bettio et al., 2013), with various ramifications for living standards and relative poverty at retirement age. At the same time, we also find that higher incomes are positively correlated with trust in workplace pensions. Therefore, apart from the aforementioned legislative and informational initiatives aimed at boosting trust in general, a targeted effort must be made to cater any such scheme to the diverse needs of the Maltese workforce, including women and low-income earners, to avoid unne-

	Willingness to save in workplace pension	Trust in workplace pension	Male	Age	Income	Upper secondary education
Willingness to save in workplace pension	1					
Trust in workplace pension	0.457*	1				
Male	0.141	0.190*	1			
Age	0.162*	0.146	0.131	1		
Income	0.129	0.188*	-0.054	0.019	1	
Upper secondary education	0.178*	0.083	0.127	-0.168*	-0.016	1

Table 4: Pairwise correlation results

cessary exclusion from such schemes, both in terms of the actual design of these schemes as well as the provision of information to assuage any doubts and engender trust.

In addition, our regression results point towards a higher degree of trust among those with greater risk-seeking tendencies. This possibly illustrates that at least amongst our sample of Maltese workers, such schemes are viewed as being relatively risky compared to other potential retirement savings plans like bank account savings, government bonds or even property purchases, and in part reflects Malta's under-developed equity markets. Therefore, any potential workplace pension scheme must offer savers a variety of potential portfolios to invest in, with varying degrees of risk (e.g., high, medium and low), depending on the risk appetite of the individual, and explain in clear terms what this entails in order to change perceptions.

Another implication that emerges from our results is that any burgeoning widespread effort to introduce workplace pensions should be preceded by a thorough information campaign aimed at explaining the operations of the pension scheme including risk categories, investment strategies and other salient points in order to foster trust in the system, with transparency and openness being key prerequisites to the design of a workplace pension, given how crucial trust is to willingness to save in such schemes. This would complement more formal structures that foster trust in workplace pensions, as discussed by Burtless (2012), who advocates for relevant legislation that enables the existence of different pension vehicles while protecting pension savers via various measures.

Finally, it is important to discuss the potential role of trade unions in the design and promotion of workplace

pensions, given that our sample was derived from a population of unionised workers in Malta. As discussed by the likes of Anderson (2019) and Keune (2018), as pension financialisation increases, retirement income is increasingly financed by income from financial assets rather than payroll contributions and taxes. This development generates distributional and political dilemmas given the associated risks, including gender and income disparities in retirement income as discussed earlier, which may lead to outcomes that differ significantly from those promulgated under traditional welfare state pensions. Indeed, Natali (2018) argues that occupational pensions and their recent reforms are largely consistent with the weakening of workers' protection. In the case of weak industrial relations and trade unions, for instance, workplace pensions may provide protection for some workers but not for others, particularly when it comes to platform workers and low-income cohorts, especially when they are based on voluntary contributions and led by employers, while also potentially increasing exposure to high-risk investments (Ebbinghaus, 2012). Therefore, trade unions cannot be ignored when it comes to the provision and design of workplace pensions as observed in various countries like Sweden and Denmark, extending to a variety of potential roles ranging from the provision of information and education to workers, to potentially assisting in the administration of such schemes and ensuring that suitable mechanisms are in place to protect workers from employer insolvency and guarantee pension portability across different jobs.

Explanatory variables	Coefficient
Male	0.1451**
Age	0.0043
Education	0.0022
Income	0.1088**
Financial Literacy	0.0191
Risk-seeking	0.0019*
Regular Saver	0.0209
N	164
R-squared	0.1374
LR test	21.02

Table 5: Logistic regression results. Coefficients denote marginal effects at the mean. ***denotes statistical significance at the 1% level; **denotes statistical significance at the 5% level; *denotes statistical significance at the 10% level.

5 Conclusion

This paper has sought to understand the key drivers and barriers to the uptake of workplace pensions across Maltese workers. To this end, a structured questionnaire was designed and administered across a sample of 164 unionised workers via computer-assisted telephone interviews (CATI). The survey included questions related to financial literacy, risk appetite and saving behaviour, while also gauging respondents' willingness to save in a hypothetical workplace pension scheme. Responses were collated and analysed in order to understand what drives this willingness to save across various socio-economic, demographic and individual characteristics. Pairwise correlations showed that the key driver of willingness to save in a workplace pension is trust in such schemes, with the strength of this association far outweighing the other correlates (which included age and education).

Thus, a logistic regression was run in order to understand the key drivers of trust in a workplace pension scheme, which would provide invaluable insights regarding the design of such schemes in the Maltese context. The results showed that males, higher income earners and risk-seekers were more likely to trust a workplace pension scheme, which in turn has significant implications for potential inequalities when it comes to retirement savings and ultimately earnings.

We discussed these findings in light of their relevance to the creation of any potential workplace pension scheme in Malta, including the important role that trade unions can play in fostering trust of such systems while protecting workers. The main implications of these findings centre around the need to encourage greater pension-related savings among younger workers, since they are, based on our data, less likely to invest in workplace pensions schemes, in line with the rest of the literature. Our findings also point towards the need for any workplace pensions schemes to cater for the growing diversity within the Maltese workforce, including women, given the lower levels of trust in such schemes observed in our logit results. Further research can be undertaken in order to understand the nuances behind these findings, potentially via a series of focus groups and interviews with workers to understand their perceptions regarding workplace pension schemes and the conditions that would entice or dissuade them from participation.

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Appendix A Questionaire

Understanding DC Investment Savings in Malta – Draft Survey Instrument

Thank you for participating in this survey. The aim of this survey is to understand whether there is an appetite amongst younger Maltese workers to participate in private occupational pension savings in conjunction with saving for a state pension provided by the government of Malta. In trying to understand this key issue, a range of subject areas including demographics, savings behaviour, expectations about the future and financial literacy will be examined. It is important to answer honestly, as there are no wrong answers in this survey, and given the number of participants, we are only concerned about the aggregate response rates, from which we will be able to analyse the demand for private sector occupation pensions.

Demographics

- 1. What age are you?
- ____(numerical text box)
- 2. Are you male or female?
 - □ Male
 - □ Female
- 3. What nationality are you?
- 4. What level of education do you have (select highest academic qualification)?
 - □ SEC □ MATSEC-Level □ HNC/HND
 - □ Undergraduate degree □ Masters Degree
 - □ Masters De
- 5. If you have a University degree what was your main degree subject?
- _____Drop down menu of high-level degree list including a box for other 6. *What is your annual income?*
 - □ Less than €15,000
 - □ €15,001 to €25,000
 - □ €15,001 to €25,000 □ €25,001 to €35,000
 - □ More than €35,000
- 7. Outside of pension savings, how much do you have saved and or invested?
- 8. Do you make investments with your personal wealth?
 - □ yes
 - 🗆 no
- 9. If yes, what is your preferred investment/asset class when investing your own money? Rank options below
 - Equities (Shares in companies on the stock market)
 - _____ Bonds (Fixed income investments)
 - _____ Property (Housing, both commercial and rental)
 - _____ Alternatives (Any other investments including precious metals, antiques, collectables) _____ Other
- 10. *If no, what would be your preferred investment/asset class when investing your own money?* Rank options below
 - _____ Equities (Shares in companies on the stock market)
 - _____ Bonds (Fixed income investments)
 - _____ Property (Housing, both commercial and rental)
 - _____ Alternatives (Any other investments including precious metals, antiques, collectables)

_ Other

- 11. If yes, do you prefer pooled investments such as mutual funds or direct investments e.g. buying individual shares? □ Pooled investment
 - □ Direct investment
 - \Box A combination of both
 - \Box I do not invest
 - □ I don't know

Risk Appetite and Risk Aversion

- 1. How would you characterize your attitude to risk when investing your own money?
- Slider Risk-averse (I do not like risk in my investments) to Risk-seeking (I like high risk investments) 2. *What investment would you view as riskier?*
- □ €100 invested in a company on the Maltese Stock Exchange
 □ €100 invested in a Maltese Stock Exchange Mutual Fund
- 3. How would you rate the risk of each investment below?
- 30-day government bond AA Corporate Bond Pooled Equity Fund Individual Company Share An Individual Emerging Market Company Share **Answers above to be randomised each will have a Slider going from risk-free to very high-risk.**
- 4. Suppose you had €100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?
 - □ More than \in 102;
 - \Box Exactly \in 102;
 - \Box Less than \in 102;
 - \Box Do not know;
- 5. Suppose you had €100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have in this account in total?
 - □ More than \in 200;
 - \Box Exactly \in 200;
 - \Box Less than \in 200;
 - □ Do not know;
- 6. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?
 - \Box More than than today;
 - \Box Exactly the same;
 - \Box Less than today;
 - \Box Do not know;
- 7. Assume a friend inherits €10,000 today and his sibling inherits €10,000 3 years from now. Who is richer because of the inheritance?
 - \Box My friend;
 - \Box His sibling;
 - \Box They are equally rich;
 - \Box Do not know;
- 8. Suppose that in the year 2018, your income has doubled and prices of all goods have doubled too. In 2018, how much will you be able to buy with your income?
 - \Box More than today;
 - \Box The same;
 - \Box Less than today;
 - □ Do not know;

- 9. How would you characterize your financial literacy?
 - Average;
 - \Box Below Average;
 - \Box Above Average;

Looking to the Future and Private Pension Savings

- 1. When thinking about your own future, how good or bad do you think your life will be during the next 10 to 15 years?
 - $\hfill\square$ worse than now
 - \Box the same as now
 - \Box a bit better than now
 - \Box much better than now
- 2. When thinking about your own future, how good or bad do you think your life will be during the next 10 to 15 years?
 - $\hfill\square$ worse than now
 - $\hfill\square$ the same as now
 - \Box a bit better than now
 - \Box much better than now
 - 🗆 I do not know
- Rank each of the following statements as to how they will apply to your life in the next 10 to 15 years.
 Each statement will have a slider going from zero to 100 with 'Do not agree at all' at zero and 'Fully agree' at 100
 - I enjoy my life, and have a lot of fun.
 - I have my own family and children.
 - I have a good job that is fun.
 - I save as much as I can.
 - I am actively involved in volunteering.
 - I have a good living standard and can afford a lot.
- 4. To what extent do you agree to the following statements about retirement provisions?

Each statement will have a slider going from zero to 100 with 'Do not agree at all' at zero and 'Fully agree' at 100

If people do not save privately for retirement (in addition to a state pension), more and more people will be poor in old age

Because there are fewer young people and more old people, the mandatory state pension fund has less money to spend

If workers paid into a private pensions as well as the government pension fund then the mandatory state pension fund would have much fewer problems

One can expect higher returns on private pension schemes than on the mandatory state pension

If politicians really made an effort there could be a well-funded mandatory state pension in the future I am afraid that I will only get a small pension under the current system and I will be poor in retirement My generation will have to work far longer than the age of 65

- 5. Do you save regularly?
 - \Box Yes

 \Box No

If yes:

- 6. Why do you save (select all that apply)?
 - \Box Larger purchases e.g. car, furniture etc.
 - $\hfill\square$ Provision for unforeseeable events
 - \Box For old age and retirement
 - \Box Vacation & travel

- $\hfill\square$ Provision, in case that I am unable to work because of illness
- \Box Purchase of a privately owned home
- $\hfill\square$ Make use of government incentives to save
- $\hfill\square$ Funding of own education and studies
- $\hfill\square$ Repayment of debt

<u>lf no:</u>

- 7. Why do you not save (select all that apply)? Textbox to allow answer to be typed
- 8. Would you be in favour of private workplace pensions for retirement savings to supplement the state pension? □ Yes
 - 🗆 No
- 9. Would you save into a private workplace pension for retirement saving as well as the state pension?
 □ Yes
 - \square No
- 10. Would you trust a private workplace pension that was provided by your employer?
 - □ Yes
 - \Box No
- 1. This question will be used twice to try to test anchoring on the amount suggested for savings rates. 50% of those who are being considered for occupational pensions will get version one, and 50% will get version two. V.1 Would you be willing to save 3-5% of your monthly salary into an occupational pension if your employer also paid in 3-5%?

V.2 Would you be willing to save 6-8 % of your monthly salary into an occupational pension if your employer also paid in 3-5%?

12. How much do you think you would need to save, as a percentage of salary, into a private pension to have a chance of having a good occupational pension in retirement? Drop down list of 0-100% Xjenza Online: Science Journal of the Malta Chamber of Scientists www.xjenza.org DOI: 10.7423/XJENZA.2024.1.02

Research Article



The sustainable development implications of major economic changes in Malta between 2012 and 2021

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Abstract. The objectives of this paper are to discuss Malta's economic performance between 2012 and 2021, and to compare such performance with the other 26 European Union (EU) member states and with the EU as a whole. The paper also considers social, environmental and political issues, again within an EU context, so as to place the economic dimension within a sustainable development context. The focus is however on economic aspects, with the other aspects being chosen mostly in view of the fact that they tend to drive, or to be driven, by economic realities. The data presented and discussed in the paper, if synthesised, would seem to indicate that between 2012 and 2021, Malta has done very well economically, less well in terms of social development and not well at all in terms of environmental and political governance. The paper argues that in matters relating to social and political governance, the situation appears to have, broadly speaking, improved since 2021. However, this is not the case in matters relating to the physical environment, and the situation would seem to have been worsening in some aspects.

1 Introduction

1.1 Objective

The objectives of this paper are to discuss Malta's economic performance during the decade 2012-2021, and to compare such performance with the other 26 European Union (EU) member states and with the EU as a whole. The paper also considers social, environmental and political issues, again within an EU context, so as to place the economic dimension within a sustainable development context. The focus is however on economic aspects, with the other aspects being chosen mostly in view of the fact that they tend to drive, or to be driven, by economic realities.

1.2 Method

The approach adopted in this paper to attain the stated objective is to produce a series of graphs, derived from reputable databases¹, with an accompanying commentary, mostly covering data between 2012 and 2021, showing developments in Malta over this period, and comparing Malta's changes with those of the remaining 26 states.

As the title of this paper indicates, its wider context is sustainable development and the data therefore covers economic, social, and environmental issues, which are generally considered as the pillars of such development, It needs to be stated at the outset that it was impossible to include all indicators relating to these pillars, and only those considered by the present author to be highlight ones and suitable to capture major changes in the three dimensions under consideration are included in this study. In addition, for the sake of space and parsimony, it was not considered advantageous to clutter this chapter with indicators that convey similar or quasi-similar information as the ones selected.

With regard to the economic dimension, the highlight indicators selected for the purpose of this paper related to real GDP growth, GDP per capita in purchasing power standard and debt/GDP ratio. In terms of the social dimension, the highlight indicators are related to health, education and poverty, while for the environmental dimension the indicators are related to air and noise pollution and waste management.

In this article we added a fourth pillar of sustainable development, namely political governance, which can be considered as an over-arching requisite for sustainable development. For this reason, indicators relating to corrup-

 $^{^1{\}rm The}$ databases utilised include those administered by Eurostat, the National Statistics Office of Malta, the World Bank, UNCTAD, UNWTO, and the IMF

tion and the rule of law are included in this analysis.

1.3 Brief Background

The Maltese economy is one of the smallest in the world in comparison with other politically independent states, and the smallest in the EU. According to Malta's National Statistics Office, in 2021, Malta's gross domestic product (GDP) at market prices amounted to approximately $\in 15$ billion, equivalent to around 0.1% of the GDP of the 27 EU member states (EU27) taken together. The population in Malta was estimated at about 519 thousand at the end of 2021. The growth rate of the population between 2012 and 2021 averaged 2.3% per annum, mostly due to inward migration, as the natural population increase in Malta was very low. The population density in Malta was about 1600 per square kilometre in 2021, the highest in Europe. The proportion of non-Maltese nationals in the total population increased steadily between 2012 and 2021, reaching about 22% in 2021.

Problems associated with Malta's small size include constraints relating to its limited ability to reap the benefits of economies of scale, its poor natural resource endowment, and its limitations on the degree of domestic competition, due to the prevalence of monopolistic and oligopolistic market structures. The country's small size also leads to a very high dependence on imports and exports, exposing the economy to external shocks. Insularity brings additional problems associated with international transport costs, which is a major concern given that Malta depends so heavily on foreign trade. These are permanent characteristics of the economy, and the best that policymakers can do is to mitigate the disadvantages associated with these features.

1.4 Layout

The paper is organised in six sections. Section 2, which follows this introduction, deals with changes in the structure of the Maltese economy between 2012 and 2021, comparing such changes with those in the other EU member states. Section 3 describes changes in economic growth in Malta, again comparing them with those of the other EU member states. The social, economic and political dimensions are discussed in Section 4, 5 and 6. The paper concludes by deriving sustainable-development implications from the findings, identifying the main successes and failures and briefly discussing the prospects for the future.

2 Structure of the Maltese economy

2.1 Overall sectoral distribution

Between 2012 and 2021, about 9% of Malta's gross value added was generated by manufacturing, 67% by the mar-

ket services sector (including property income), 1% by agriculture and fisheries, and 4% by construction and quarrying. The remaining 19% mostly represented the share of government.² For a nation of its size, Malta's economy is relatively diversified, although there are a number of specific industries dominated by single, or a few, large firms. The other 26 EU member states had broadly similar structures, as shown in Figure 1, with services, including government, dominating the economies, averaging 72% in the EU. Three small states, namely Luxembourg, Malta and Cyprus had the most services-oriented economies. The manufacturing sector's share in the EU averaged about 16% and was the lowest in the same three small states. The agriculture/fishing sector was relatively small in all member countries, averaging 2% in the EU, with Bulgaria and Romania registering the highest share. During the period under consideration, the fastest growing activities in Malta were in the services sector, including information, communications and financial services.



Figure 1: Structure of the EU economies (% of GDP, Average 2012-2020). *Source: UNCTAD.*

2.2 Agriculture and Fisheries

The agricultural sector in Malta consists principally of small holdings on terraced strips of land, and the soils tend to be shallow. In addition, there are constraints associated with limited precipitation. The most important crops are potatoes, tomatoes, onions and fruit (especially citrus fruit, stone fruit and grapes). Since the 1990s horticultural production has increased markedly.

The GDP share of the Maltese agricultural and fisheries sector averaged about 1% during the 2012-2021 period and did not exhibit a clear tendency to increase or decrease its share, in spite of competition from imported fresh products from Italy. The sector also faces serious challenges in terms of available land area due to over-development, mostly relating to construction activity. When compared to other EU member states, the share of agriculture in Malta is one of the lowest, about

 $^{^2{\}rm This}$ share covers public administration and defence, compulsory social security, education, human health, and social work activities

half the share of the EU average, with the highest ratios pertaining to Eastern and Central European countries.

Fishing in Malta is mostly seasonal, as the main commercial species are migratory. Although Malta is surrounded by sea, fishing does not generate much income or employment—a situation exacerbated by the dwindling catches in the central Mediterranean. As a result, the share of GDP contributed by this sector has remained very small. Since the 1990s there has been an expansion of aquaculture, resulting in a rapid increase in the production of farmed fish, including tuna, most of which is exported.

2.3 Manufacturing

Malta's manufacturing share of GDP is one of the lowest in Europe, as shown in Figure 1. The sector contributed about 9% to Malta's GDP on average between 2012 and 2021 but exhibited a declining trend from about 12.6% in 2012 to about 7.5% in 2021. However, there are a number of successful manufacturing establishments producing high-technology products, including electronic components, which have been in Malta prior to 2012. Attempts to encourage foreign direct investment in manufacturing through schemes operated by Malta Enterprise, a government agency promoting Malta as an attractive investment site, were largely unsuccessful, probably because of economies of scale constraints associated with this sector.³

2.4 Market Services

The market services sector in Malta comprises four main sub-sectors, namely distributive trades, transport and communications, banking and finance, and personal services. During the 2000s Malta underwent a process of modernization in most services and, as a result, the sector has become increasingly efficient and export-orientated in transportation, financial services, remote gaming, and ICT-related activities. The overall GDP share of this sector between 2012 and 2021 was 66.5%, from 62.3% in 2012 to 68.8% in 2021. Compared to other EU member states, the share of Malta's market services sector was relatively high, surpassed only by Luxembourg.

An important contributor to the services sector in Malta is tourism. Malta's main tourist attractions are its climate and its sea and to a lesser extent its cultural and historical heritage. Tourism follows a seasonal pattern, with June to October being the peak season. The vast majority of incoming tourists during the period under consideration were of EU origin—mostly from the UK Italy, Germany and France.

Between 2012 and 2019, the number of stayover visitors increased rapidly as can be seen in Figure 2. Due to the COVID-19 pandemic, tourism inflows decreased drastically in 2020 but recouped somewhat in 2021. Tourism density per 100 persons was very high in Malta in 2019 and was the highest in Europe, as can be seen from Figure 3.

The direct share of tourism in GDP is not known with any degree of precision⁴, given the difficulties of calculating the import content of tourist expenditure. Sacco and Cassar (2019) calculated that in 2010, tourism's direct contribution to Malta's GDP was around 6.1%. Estimates produced by the World Travel and Tourism Council ('Travel and Tourism: Economic Impact Report', 2023) indicate that in 2019, the direct, indirect and induced impacts of tourism amounted to 15%.⁵ Again, the number of persons employed in tourism activities is not known with a sufficient degree of certainty. Sacco and Cassar (2019) calculated that the tourism sector directly employed about 8% of the total gainfully occupied persons (employed or self-employed). According to WTTC, in 2019, the sector employed about 21% of the gainfully occupied population, as a result of its direct, indirect and induced effects on the economy. In recent years, a large proportion of employees in the tourist sector were non-Maltese nationals.



Figure 2: Tourist inflow in Malta (thousands): 2012-2021. *Source: National Statistics Office, Malta.*

Another important component of the services sector are financial services, which, according to NSO statistics, directly contributed around 6% of gross value added in 2019, employing about 11,000 persons on a full-time basis. However, this does not include a number of services ancillary to financial intermediation, which are growing at a relatively sustained pace.

ICT-related economic activities in Malta have gone through a period of rapid expansion. Among these are remote gaming and other online electronically based ser-

³During the 1990s, the manufacturing sector contributed about 20% to the economy, but following the dismantling of import protection during the second half of the 1990s and early 2000s, in preparation for accession to the EU, certain manufacturing industries, including furniture, experienced difficulty in remaining in operation, primarily as a result of increased foreign competition.

⁴On this issue, see Cassar et. al. (2016)

⁵According to the WTTC, Malta has the third-most dependence on tourism in the EU, exceeded by Croatia and Greece.



Figure 3: Tourists as a ratio of the population (2012-2021). Source: UNWTO for tourism inflows (numerator of the ratio) and World Bank for population (denominator of the ratio).

vices, which are increasing their share of Maltese exports of services.

2.5 The Public Sector

According to NSO statistics relating to the composition of Gross Value Added in Malta, the government's direct contribution to GVA⁶, averaged about 18% between 2012 and 2021 and did not exhibit a marked tendency to decrease or increase. Employment in the same sector, also according to NSO statistics, averaged about 25% of the total gainfully occupied persons during the same period. Interestingly, employment in this sector increased by about 5.4% per annum between 2012 and 2021 (from about 37 thousand to about 55 thousand). During the same period, Government expenditure in nominal terms increased from about €3 billion in 2012 to €6.8 billion in 2021, averaging 9.5% per annum. According to the classification of the functions of government (COFOG), on average during this period, 58% of the expenditure was allocated on social protection, health and education and 31% on general public services and economic affairs. The remaining 11% were spent on defence, public order, environment, housing and recreation. Government revenue also increased rapidly during the same period, from €2.7 billion in 2012 to €5.8 billion in 2021, an annual increase of 8.4% in nominal terms. Such revenue consisted mainly of direct taxes (personal and corporate) and indirect taxes (including value-added and excise tax), totalling about 60% of government revenue, as well as social security contributions which provided about 22% of government revenue. The total tax burden, including direct and indirect tax and social contributions, as a percentage of GDP was about 33% during this period—not a high ratio by European standards.

During the period under consideration, exports of merchandise, excluding re-exports, were dominated by electronic and electrical equipment. Other important merchandise exports include pharmaceuticals, toys and plastic products, instruments and printing, and fish/crustaceans. Most of the Maltese exports of merchandise were directed towards European countries, mostly to the UK, primarily to France, Germany, Italy and the United Kingdom. Most Maltese imports of merchandise originated principally from the EU, with the same four countries being the most important countries of origin. Trade with non-EU Mediterranean states (including North African countries) is relatively low. Exports of services are relatively diversified and consist principally of tourism, transportation, financial services, remote gaming, and information and communications technology (ICT) activities. Malta's trade in services occurs mostly with the EU.

Malta is highly trade open. Due to its small domestic market, a large proportion of goods and services are exported. In addition, Malta has few natural resources⁷, and most raw materials and industrial supplies have to be imported. A relatively large proportion of consumer goods are also imported. Figure 4 shows the extent to which Malta relies on foreign trade, with trade openness being measured as the average of exports and imports of goods and services as a ratio of GDP. It can be seen that Malta is the second-most trade-open economy in the EU, with Luxembourg topping the list.



Figure 4: Trade Openness (Export+Imports)/GDP×2 in % (Average 2012-2021). *Source: Eurostat.*

2.7 The Financial sector

Malta has developed its international financial centre by actively promoting competitive advantages, including its pro-business legislative framework and the benefits of EU membership. The sector is dominated by two relatively large banks, namely Bank of Valletta and a subsidiary of the UK-based HSBC group, with several smaller banks

⁶The relevant data covers public administration and defence; compulsory social security; education; human health and social work activities.

 $^{^7{\}rm Petroleum}$ exploration has been undertaken on several occasions, but, so far, its extraction has not been found to be commercially viable

also operating in the domestic market. In addition, there are a number of banks that operate mostly in international finance.

A major challenge that is often mentioned in IMF and EU reports about the Maltese financial sector is that bank lending is highly dependent on construction-related activities, which have grown rapidly in recent years. Additional financial risks included money-laundering, at times involving individuals holding public office, which has tarnished the reputation of Malta's financial sector, posing a threat to relations with correspondent banks, which are crucial for international business, particularly in clearing US dollar transactions.

2.8 Foreign Investment

Despite having a very small domestic market and lacking natural resources, Malta still manages to attract considerable foreign investment, mostly in the financial sector. The country's EU membership, its strategic location in the Mediterranean Sea, its English-speaking labour force and favourable tax arrangements all serve to attract investors to Malta. The tax refunds offered to investors, effectively resulting in a net tax of just 5% on profit, have been described as a fiscal trick and a harmful tax practice within the EU. However, the Maltese authorities defended this tax regime as lawful and as a generator of substantial tax revenue, which creates many job opportunities, particularly for accountants.

In 2014 Malta introduced the so-called 'Individual Investor Programme' (IIP) granting Maltese citizenship to wealthy non-EU nationals who invest substantially in the islands. The programme, which has generated considerable revenue for the Maltese Government, has come under scrutiny by the European Commission for allegedly increasing the country's vulnerability to money laundering, tax evasion and organized crime. In 2020, the government of Malta strengthened the due diligence procedure associated with the IIP.⁸

2.9 The Labour Market

The labour market is characterized by a relatively low participation rate of women when compared to other EU member states, averaging at around 61% of the female working-age population (15–64 years) between 2012 and 2021, as shown in Figure 5. However, the female participation rate increased during this period from 49% in 2012 to 73% in 2021, as younger women with a relatively high propensity to work replaced older women and as labour market policies were introduced to attract women to the workforce. The male participation rate was substantially



Figure 5: Male and female activity rates (% of working age population, average 2012-2021). *Source: Eurostat.*

higher than the female one, amounting to about 78% of the male working-age population – one of the highest in Europe.

Another characteristic of the labour market is the relatively large proportion of gainfully occupied persons in the public sector and the large proportion of foreign workers engaged in e-gaming and financial services (with relatively high wage rates) as well as in the hospitality, the food delivery and the construction industries (with relatively low wage rates, and sometimes underpaid).

The unemployment rate in Malta, during the same period, measured as a proportion of the labour force, averaged 4.4%, one of the lowest in Europe, as shown in Figure 6, with a tendency to decline from 6.1% in 2012 to 3.4% in 2021. This low rate of unemployment, resulted mostly from the rapid rate of economic growth which outstripped the growth in the labour force, including migrants, leading to shortage of labour in some sectors. According to Maltese employers' associations, labour shortage was exacerbated by employment of workers in the public sector.⁹

3 Highlight Economic Indicators

3.1 Economic growth

Economic success of a country is often measured in terms of its real GDP growth rate. The Maltese economy grew rapidly during the decade under consideration, as shown in Figure 7. The average growth rate was about 6% per annum, the second highest in the EU as can be seen in Figure 8.

3.2 Income per capita

Income per capita in Malta also increased, although at a lower rate than GDP. This is due to the fact that the

⁸Details relating to the due diligence process in this regard are available at: https://www.rcint.com/insights/ due-diligence-guide-for-obtaining-maltese-citizenship/.

⁹In 2021, five organisations representing employers and businesses, namely the Malta Employers' Association, the Malta Chamber of Commerce Enterprise and Industry, the Malta Chamber of SMEs, the Malta Hotels and Restaurants Association and the Gozo Business Chamber called on the government "to put an immediate halt on the drain of human resources from the private sector, to be employed in the public sector including state appointed bodies."



Figure 6: Unemployment rate (% of the labour force, average 2012-2021). *Source: Eurostat.*



Figure 7: Malta GDP annual growth rates at constant prices (%). *Source: IMF and NSO.*

denominator of the ratio, namely population, also grew rapidly during the same period.

Figure 9 shows income per capita, measured in Purchasing Power Standard (PPS).¹⁰ During the decade under consideration Malta ranked in the 12th place, lower than the EU average. As expected, the countries with the lower end of the ranking are mostly Southern, Eastern and Central European countries.

3.3 The debt/GDP ratio

An indicator often referred to when assessing the economic sustainability of a country is its government debt in relation to GDP. The Malta government debt, in nominal terms increased steadily during this period, at an average rate of 6.3% per annum, from about \in 4.9 billion in 2012 to about \in 8.3 billion in 2021, however due to the fact that the GDP increased at a faster rate in nominal terms than gross debt, the ratio debt/GDP remained under 60%







Figure 9: Income per capita PPS (Average 2012-2021). *Source: Eurostat.*

in all years¹¹, tending to decrease up to 2019 and to rise after that year, as can be seen in Figure $10.^{12}$



Figure 10: Malta's gross debt/GDP ratio (%). *Source: Euro-stat.*

Figure 11 shows Malta's gross debt ratio in comparison with the other EU member states. It can be seen that Malta's ratio was not on the high side when compared to most other EU member states.

4 Highlight Social Indicators

This section covers a number of social indictors, which are often associated with economic realities, focussing on

¹⁰PPS stands for Purchasing Power Standard which is used as an adjustment for differences of price levels between countries, so that a given unit buys the same volume of goods and services in all the countries covered.

¹¹The EU Stability and Growth Pact required each Member State to adopt a fiscal policy aiming for a debt limit of 60% of GDP.

¹²Malta was placed by the EU Commission under the so-called excessive deficit procedure for two years in view of its high debt and deficit ratios. However, since 2013 the budget deficit has been gradually reduced, and in 2017 and 2019 some years a budget surplus was recorded.



Figure 11: Gross government debt/GDP ratio in the EU (%, average 2012-2021). Source: Eurostat.

education, health, and presence of poverty, which are considered to be major pillars of social development. $^{\rm 13}$

4.1 Health

An indicator often used to capture the overall health situation in a country is life expectancy, Figure 12 shows that life expectancy in Malta was the highest in Europe during the decade under consideration. This could be partly due to the Malta's climate, but Malta's satisfactory public health care, as evidenced in various health statistics, including the self-reported unmet needs for medical examination and care¹⁴ which in Malta is relatively low compared to the other EU member states, as can be seen in Figure 13.



Figure 12: Life expectancy (Years, average 2012-2021). Source: Eurostat.

However, not all is rosy in matters relating to health in Malta. A worrying tendency in this regard is the rate of obesity, with about 28% of the population being obese, the highest in the EU.¹⁵ Other worrying tendencies in Malta in this regard is the relatively high prevalence of diabetes and high blood pressure, associated with eating

habits and the loss of the Mediterranean diet.



Figure 13: Percentage of persons aged 16 years or over in relation to the population, with unmet health needs (%, average 2012-2021). *Source: Eurostat.*

4.2 Education

Malta faces major challenges relating to education, one of which is the rate of early school leavers. Figure 14 shows that between 2012 and 2021 Malta had the highest percentage of early school-leavers (18-24 years)¹⁶, compared to that of other EU member states. On a positive note, however, the percentage tended to decrease from 27.2% in 2012 to 16.7% in 2020, with the 2020 rate still relatively high.

During the same period, tertiary education attainment in Malta was low compared to other EU member states, as shown in Figure 15, which measures the share of the population aged 25-34 who have successfully completed tertiary studies (e.g., university, higher technical institution, and others). Again here, the percentage has decreased over the decade under consideration with an increase in tertiary education enrolment. In addition, funded tertiary educational opportunities have increased significantly, as the University of Malta (UM) and the Malta College of Arts, Science and Technology (MCAST) have expanded the number of courses they offer.



Figure 14: Percentage of early school leavers in relation to the population aged between 18 and 24 (average 2012-2021). *Source: Eurostat.*

 $^{^{13}{\}rm For}$ example, the United Nations Development Programme (UNDP) includes health and education, in addition to income per capita, to construct its reputable Human Development Index

¹⁴Self-reported unmet needs for medical care concern a person's own assessment of whether that person needed examination or treatment for a specific type of health care but did not have it or did not seek it because of the following three reasons: 'financial reasons', 'waiting list', and 'too far to travel'.

¹⁵https://ec.europa.eu/eurostat/databrowser/view/hlth_ehis_ bm1e/default/table?lang=en)E

¹⁶Early leavers from education and training denotes those aged 18 to 24 having attained at most, lower secondary education and not being involved in further education or training.



Figure 15: Percentage of population aged between 25 and 34 who have successfully completed tertiary studies (average 2012-2021). *Source: Eurostat.*

4.3 Poverty

Poverty in Malta is not a major social problem when compared to the rest of the EU member states. This can be noted in Figure 16 which measures the percentage of persons at risk of poverty¹⁷ indicating that on average, over the decade under consideration, the rate was lower than the EU average. As expected, most countries with a very high risk are those in Eastern, Central and Southern Europe. Over the decade the ratio in Malta hovered around 16.5%.



Figure 16: Percentage of the population at risk of poverty (average 2012-2021). *Source: Eurostat.*

Eurostat measures the inequality of income distribution by calculating the ratio of total income received by the 20% of the population with the highest income (the top quintile) to that received by the 20% of the population with the lowest income (the bottom quintile). It can be seen from Figure 17 that Malta was on the lower side on this index indicating a relatively even distribution of income when compared to other EU member states. Although in Malta the distribution is not overly uneven, it has tended to increase steadily in its unevenness during the decade under consideration from 3.9% in 2012 to 5% in 2021.



Figure 17: Income distribution: ratio of income received by the top population quintile to that by the bottom quintile (average 2012-2021). *Source: Eurostat.*

5 Highlight Environmental Indicators

Malta fares very badly with regard to various environmental indicators. Figure 18, based on the Eurostat SILCsurvey, shows the percentage of the population aged 16 and over who reported that they face the problem of pollution, grime or other environmental problems in the local area such as smoke, dust, unpleasant smells or polluted water. Malta has the highest percentage, which is more than twice the EU average. The Malta percentage in this regard decreased from 40% to 27% between 2012 and 2015 but hovered around 32% since then.



Figure 18: Percentage of the population aged 16 and over reporting pollution, grime or other environmental problems (average 2012-2020). *Source: Eurostat.*

As regards, noise pollution, the self-reported perception data again indicates a very bad performance for Malta, when compared to other EU member states, as shown in Figure 19. The indicator measures the proportion of the population who declare that they are affected either by noise from neighbours or from the street. There was no clear tendency that this problem increased or decreased markedly during the period under consideration.

Figure 20 shows the tonnage recycled from municipal waste divided by the total municipal waste arising. Again, in this case, Malta comes last in the list, suggesting poor environmental governance, when compared to other EU member states. A more detailed analysis of this variable indicates that between 2012 and 2020, Malta's ranking within the EU has tended to fall.

¹⁷This indicator relates to the share of people with an equivalised disposable income (after social transfer) below the at-risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income after social transfers. A similar pattern emerges from data relating to "At risk of poverty and social exclusion" where the rate hovered around 20%.



Figure 19: Percentage of the population living in households considering that they suffer from noise (average 2012-2020). *Source: Eurostat.*



Figure 20: Percentage rate of municipal waste recycling (tonnage recycled from municipal waste divided by the total municipal waste arising, average 2012-2020). *Source: Eurostat.*

6 Political governance Indicators

Although the pillars of sustainable development are generally associated with economic, social and environmental issues, good political governance could be considered as an overarching requirement. Political governance relates to decision-making in policy formulation and the development of institutions to implement it. Various indicators have been proposed to measure good political governance, but two factors are often considered as undermining good governance, namely corruption and disregard of the rule of law, with the former being considered as one of the most significant barriers to effective rule of law (Kaufmann, 2015).

In the Corruption Perception index¹⁸ (Figure 21), Malta was ranked 19th among the EU 27 member states during the period under consideration, with an average score of 55, in a range with a maximum of 100 which signifies absence of corruption. This means that only 8 countries were considered to be more corrupt than Malta.

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According to the World Bank Rule of Law indicator¹⁹, Malta ranked 13th among the EU27 (Figure 22). Although the two indices do not exactly tally, they both indicate that Malta is not considered to be one of the best politically governed EU member states.

Furthermore, during the period under consideration, the rule of law was recorded as having deteriorated by the World Bank index, with a score that decreased from 1.34 in 1912 to a score of 0.86 in 2021 as shown in Figure 23. A deteriorating trend was also reported in the Corruption Perception Index from a score of 57 in 2012 to a score of 54 in 2021.



Figure 21: Corruption perception Index – maximum of 100 signifies absence of corruption (average 2012-2021). *Source: Eurostat, based on Transparency International data.*



Figure 22: Rule of Law in the EU Member states (average 2012-2021). Source: World Bank (2022).

7 Summary and Prospects

7.1 What the data shows and does not show

The data presented and discussed above, if synthesised, would seem to indicate that between 2012 and 2021, Malta has, overall, done very well economically, less well in terms of social development and not well at all in terms of environmental and political governance.

¹⁸The indicator is based on a combination of surveys and assessments of corruption and ranks countries based on how corrupt a country's public sector is perceived to be, with a score of 0 representing a very high level of corruption and a score of 100 representing a very clean country. The CPI is published by Transparency International.

¹⁹The indictor contains estimates of governance. with scores ranging from approximately -2.5 (weak) to 2.5 (strong) governance performance. The indicator reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.



Figure 23: Percentage rate of municipal waste recycling (tonnage recycled from municipal waste divided by the total municipal waste arising, average 2012-2020). *Source: World Bank* (2022).

The economic growth in Malta during the period under consideration has been impressive, sustaining a very respectable per capita income and a low unemployment rate, compared to other EU countries. However, the statistics do not show a number of policy-induced shortcomings, including the absence of pension reform in view of the unsustainability of the current pension pay-as-you go system and weak financial oversight, which led Malta to be grey-listed by the Financial Action Task Force (FATF) in 2021 due to deficiencies in the fight against tax evasion and money laundering.

It needs also to be said that many economic problems faced by the Maltese economy are not policy induced and relate to the very small size of the country, limiting its diversification possibilities and imposing economies of scale constraints—physical characteristics that will remain regardless of economic policy.

In terms of the social indicators, Malta registered high health scores but low education scores, when compared to other EU member states. In the social component of this paper, we also included the "at risk of poverty index" and an income distribution index. These are often viewed as economic variables, but they have major social implications. In both indices, Malta finds itself somewhat in the middle of the range among the EU member states, but in the case of income distribution, there was a tendency for increasing unevenness. Again, here, the statistics do not show all that needs to be shown to describe social governance, given that this is a complex condition and relates to changes which are difficult to measure. For example, the health indicators presented above did not cover the health risks and social discomfort caused by high population density, and the social threats resulting from corruption, including the negative effects on ethical values. Likewise, the education statistics did not deal with its quality, which could be one reason why Maltese students tend to attain low scores in the Programme for

International Student Assessment (PISA).²⁰

Malta has not performed well at all in terms of the environmental dimension, as indicated by the pollution and waste management indictors. As in the case of economic and social statistics presented here, the environmental statistics do not capture fully the factors that lead to environmental degradation or otherwise, such as for example the biodiversity loss and deforestation caused by construction and tourism.

The dismal picture shown in the three environmental indicators are probably mostly due to weak environmental governance. For example, in the case or recycling, government did not assign major importance to the circular economy. The construction industry is very weakly regulated, and as a result often generates air and noise pollution and destabilises whole neighbourhoods. This situation is exacerbated by lack of environmental awareness among the population. However, the high population density of Malta may also have played a part in this matter, particularly with regard to waste generation and traffic pollution.

In terms of political governance, Malta ranked somewhere in the middle of the range of country scores, but there was a tendency of a deterioration in the rule of law and corruption indices.²¹ In spite of this, however, Malta is still considered as a free country, especially with regard to civil liberties (Freedom House, 2023). Again here, the political governance statistics considered in the present study do not reflect all political realities, including the high degree of clienteles and patronage prevalent in Maltese politics.

7.2 Is Malta following the path of sustainable development?

The indicators presented above beg the question as to whether Malta was following the path of sustainable development during the period under consideration. One cannot give a straight-forward answer to this question, as, going by the data presented above, Malta did well in some pillars of sustainable development, and not so well in others. Thus, Malta's economic success, during the decade under study was accompanied by weak political and environmental governance.

Does it therefore follow that such governance weaknesses enabled economic growth? Some authors discuss this issue, exploring, for example, whether corruption greases the wheels of economic growth (Briguglio et al., 2019; Kelsall, 2014; Méon & Weill, 2010; Rodrik, 2008)

 $^{^{20}\}rm{The}$ index is derived from a triennial survey of 15-year-old students, assessing the extent to which they have acquired the key knowledge and skills essential for full participation in society, focussing on proficiency in reading, mathematics and science.

²¹This has led Economist Intelligence Unit (2023) to label Malta as a "flawed democracy".
and whether environmental protection raises production costs and hampers free enterprise (Gray, 2015). In such discussions the issue of short-term gains as against long term losses often arises. In the context of sustainable development, however, economic growth is considered as only one aspect of such development with social and environmental concerns given equal importance as that given to economic matters. In addition, the EU assigns major importance to political governance in the pursuit of sustainable development (Niestroy et al., 2019) arguing that such development depends highly on policy coordination.

A case in point where economic activity in Malta clashes with the quest for sustainable development relates to construction, to which reference has been made many times in the present paper. In terms of government policy, this sector has been aided and abetted by different administrations in Malta.²² The sector has major negative social and environmental impacts, adversely affecting the quality of life of a large number of the Maltese population (Zammit, 2022). In addition, construction depends on land availability, which is in very short supply in Malta, posing further questions as the sustainability of this sector. Another economic activity in Malta, again aided and abetted by consecutive governments, is tourism, practically disregarding the fact that it causes social discomfort in high tourist-density localities and generates negative environmental effects (Briguglio et al., 2019; Dodds, 2007). In both types of economic activity, government policy assigned primary, if not exclusive, importance to their economic benefits to spur Malta's economic growth.²³ It should be recalled that sustainable environmental policies can be considered as fostering weak or strong sustainability, relating to the extent to which natural capital, when degraded or destroyed, can be replaced by other forms of man-made capital. Weak sustainability implies that natural capital is substitutable, whereas strong sustainability implies that natural capital is not. The case of construction in Malta is a classic case of the latter stance, given that the mushrooming building activity has led to depletion of environmental assets, which will be lost forever.

7.3 Prospects

This paper was written in early 2023, when there were already signs of improvement in some areas which looked gloomy during the 2012-2021 period covered by the paper. For example, progress was achieved with regard to financial oversight, leading the FATF to officially confirm that Malta had been taken off the grey list in 2022. In the educational sphere many improvements were registered, including that the rate of early school leavers was drastically reduced, and the proportion of persons educated to tertiary level increased markedly.

However, in matters relating to the physical environment, the situation did not seem to improve all, and may be worsening. For example, the frequent sale of government land to private entities, has resulted, and is likely to continue resulting, in further environmental degradation. The Environment and Resources Authority, which has the remit of safeguarding the environment, is practically toothless and the Planning Authority, with the mission of making the Maltese Islands a more pleasant and desirable place to live in, is doing exactly the opposite.

As regards political governance, the situation would seem to have been improved somewhat since 2021, in that there seems to be better checks and balances relating to corruption, but, at least for the coming years, the large parliamentary majority enjoyed by one political party²⁴ would enable the government, if it wants to, to appoint accommodating persons in charge of the regulatory institutions. Optimistically, Malta's membership in the European Union, where sustainable development and democracy are assigned major importance, should dissuade maladministration excesses, and restrain the country from being an "elective dictatorship".²⁵

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²²It is well known that construction developers are financial donors to the two main political parties in Malta and this could be one reason why different administration have tended to support and, even worse, tolerate malpractice in this sector.

 $^{^{23}}$ These two economic sectors have many things in common. Major operators in construction and tourism have been associated with state capture and corruption. They both depend highly on imported labour, which, as already indicated, has led to a major increase in the population – again leading to further adverse social and environmental effects.

²⁴Some commentators are of the view that the 2017 and 2022 consecutive electoral victories of the Labour Party, where due mostly due to its economic policies and its progressive civil liberties when in government (Galea, 2023). Others attribute this to a weak political opposition (Said, 2021) and to the populist stances of the party in government (Schembri, 2023).

²⁵This term refers to a situation where parliament is excessively dominated by the government of the day. It is often associated with "First Pass the Post" electoral system but it can also happen proportional representation systems. The term is attributed to Lord Hailsham, in a Richard Dimbleby Lecture at the BBC in 1976.

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Research Article



Estimating the Economic Impact of the Office for Competition on the Maltese Economy

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Abstract. The Office for Competition in Malta is the leading administrative competition authority responsible for promoting sound competitive practices for attaining and maintaining well-functioning markets. This study quantifies the economic benefits on the Maltese economy via an economic impact assessment for the designated roles of the Office for Competition. Through an application of time-series econometrics, input-output modelling framework and the OECD's guidelines to conduct such assessments, this study explores the direct and indirect multiplier effects that accrued on the Maltese economy as a result of the Office's control of concentrations activities between 2014 and 2018. This study finds that the estimated financial benefit to the Maltese economy in terms of GDP averaged €10.2 million per year, €7.1 million in direct effects and \in 3.1 million in indirect benefits. This equates to a direct benefit-to-costs ratio of 30.4:1. This study should aid Maltese authorities in gauging the rate of return from the annual budget allocated to the Office for Competition and increase awareness of the benefits of competition law and policy.

Keywords: competition, input-output, economic impact, Malta

1 Introduction

By preserving a sound competitive environment, competition policy leads to many benefits for society – lower consumer prices, allocative and productive efficiency, product variety, better quality, and entrepreneurial innovation. These benefits do not arise because firms are altruistic benefactors but rather because of their pursuit of profit maximisation within a competitive environment. The presence of rival undertakings in the same market striving for the same goal leads them to develop and produce products that customers want to buy while attaining cost efficiency. These benefits are often attributed to the utopian paradigm of perfect competition, wherein many small firms are subject to market-imposed conditions. Sometimes, even a limited number of market players can attain such benefits as long as no adverse practices undermine competition. Even in highly concentrated contestable markets, the threat of 'hit-and-run' market entrants is enough to prevent firms from increasing their prices. Competition should therefore be regarded as a means to increase consumer welfare.

Although competition law is rarely contested, it is not straightforward to demonstrate how and to what extent competition policy contributes to the welfare of society. Although competition can be a positive- sum game, there are instances where competition makes a consumer or a producer worse off. On the demand side, not all consumers may be served by competitive markets for reasons of affordability or negotiation power. On the supply side, the market's playing field is rarely level, and while market opportunities for aspiring entrepreneurs exist, these are usually gobbled up by large companies enjoying economies of scale and better access to finance who are usually first entrants.

While the fate suffered by losers is unpleasant, competition policy aims to protect and promote sound competitive practices, not individual competitors. Competition authorities that over-emphasise the importance of fair play may mislead small businesses and consumers into thinking that competition policy ensures a level playing field and a fair market outcome. Rather, the aim of competition authorities is to promote sound competitive practices to further the attainment and maintenance of well-functioning markets for the benefit of consumers and economic operators.

Against this background, this study estimates the return ratio for Malta's Office for Competition (hereinafter referred to as "the Office") in terms of its contribution to the Maltese economy during the 2014-2018 period for its control of concentrations activities. The return ratio relates to the implementation of competition law and policy as administered by the Office for Competition and not to the Office for Competition per se. The return ratio is based on direct and indirect output multipliers in an input-output modelling framework. Similar exercises have been carried out by the Competition and Markets Authority (CMA) in the UK to justify the budget allocated to it for competition policy.

This article is organised in five sections as follows. Section 2, which follows this introduction, briefly reviews the literature and presents the context of this study, particularly the work conducted by the Office between 2014 and 2018. Section 3 provides a detailed description of the methodology adopted. Section 4 presents the estimated impacts. Section 5 concludes by presenting the key learning outcomes and the caveats of the study.

2 Literature Review

The effect of competition policy on macroeconomic performance can be conceptualised in terms of changes in allocative, productive, and dynamic efficiency (Ilzkovitz & Dierx, 2015). First, a successful competition regime facilitates the entry of new firms and the exit of the least efficient firms, thus restraining the market power of incumbents through the presence of more efficient firms (allocative efficiency). Second, firms are compelled to utilise their resources most efficiently to thrive and survive the price and cost competitive pressures, ultimately constraining firms to operate at the minimum point of their long-run average cost curves (productive efficiency). Third, competition stimulates firms to differentiate themselves in the marketplace through innovation and the development of new products, hence maintaining their competitive edge (dynamic efficiency). The latter positive spill-over effects are generally contested because firms are unlikely to invest in research and development if they are prevented from protecting the returns to their investment through, for example, the imposition of barriers to entry.

Studies on competition authorities distinguish between tangible and intangible effects (García-Verdugo et al., 2017; Ilzkovitz & Dierx, 2015). Tangible effects refer to interventions by authorities, such as concentration controls, which prevent situations from arising that would substantially reduce competition, such as higher prices because of fewer firms operating in the market. The effects of interventions focus on specific cases, activities, and industries. The results are generally published as a two- or three-year moving average in order to smooth out the high volatility of low and high prices between years. Intangible effects are generally composed of productivity, innovation

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and growth effects, and the deterrent effects associated with interventions by the authorities.

The operation of competition authorities not only safeguards competitive markets with trickle-down effects on consumers but also discourages other companies from committing infringement or abuse of market power. For example, competition law has been found inter alia (i) to increase the number of firms and lower the mark-up in the market (Kee & Hoekman, 2007); (ii) to enhance total factor productivity (Borrell & Tolosa, 2008; Buccirossi et al., 2008, 2013) with some finding inconclusive effects (Ma, 2011; Voigt, 2006, 2009); and (iii) to boost GDP (Clougherty, 2010; Gutmann & Voigt, 2014; Petersen, 2013). Though the literature underlines that intangible effects associated with cartel enforcement far outweigh the tangible benefits, the literature has not yet provided precise estimates of the effect of anti-cartel policies. Yet, there are reasonable grounds for believing that good cartel enforcement might deter more than 50% of the potential harm for cartels (Competition & Markets Authority, 2015, 2017). While the existing literature acknowledges the significant deterrent effects of competition policy enforcement, no established methodologies for measuring intangible effects exist. An overarching consensus is that direct impact assessments underestimate the overall effectiveness of competition authorities.

Competition authorities conducting impact assessments do so for different reasons, quantifying the value of their work to present to the public and the Government as the most cited advantage. Usually, these impact assessments are also included in the annual reports. In April 2014, the OECD (2014) published guidance on assessing the expected impact of activities undertaken by competition authorities. The OECD recommended that to be comprehensive, an impact assessment should (i) include the impact of all decisions relating to blocked mergers, mergers approved with remedies and cartels, (ii) cover all the decisions listed above taken over the course of the previous year/s, and (iii) account for the benefits accrued to consumers.

3 Context

The Malta Competition and Consumer Affairs Authority Act (Chapter 510 of the Laws of Malta) prescribes a number of duties to be carried out by the Office. Some of the key responsibilities include: investigating anti-competitive conduct and instituting court proceedings before the Civil Court; examining and controlling concentrations between undertakings in terms of their effect on the structure of competition on the market; studying markets and recommending action where necessary; encouraging undertakings to comply with competition law and promoting sound competitive practices; and providing advocacy to the Government of Malta on matters related to competition law.

During 2014 and 2018, the Office undertook several investigations and recorded a number of concentration decisions. Based on the Annual Reports for these years, the Office undertook the following:

- Twenty-nine (29) concentration decisions, of which one proposed concentration was terminated after the involved parties were unable to propose commitments that satisfy the MCCAA's requirements;
- Five enforcement decisions, including interim measures on companies operating within the insurance sector and issued a commitment decision in the school uniforms retail market;
- Two investigations, one on school transport fees and one on the fuel sector;
- Acted as an advocate of competition law on five different occasions;
- Conducted a sector inquiry on the interest rates charged on loans to small- and medium-sized enterprises; and
- Assisted the Civil Court in proceedings involving competition matters.

Looking at sectoral data (Figure 1), the sector that featured the most in the Office's work is wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation, and food services activities sector. It accounted for nearly one-fourth of all the Office's decisions during the period under consideration, which is broadly the share of the sector of total Gross Value Added (GVA) in Malta. The second highest is the professional, scientific, and technical activities, administrative and support services activities sector at 22.8%, followed by the financial and insurance activities sector at 14.8%. The arts, entertainment and recreation sector accounted for the lowest share (4.6%) of the Office's decisions, while no cases involved parties within the agriculture and fishing sector, the construction sector, mining and quarrying, or the utility sector.

4 Methodology

Many competition authorities often publish assessments of the overall impact of their decisions. The objective of these assessments is to quantify in a simple and concise manner the expected benefits from the decisions on mergers and antitrust infringements, amongst others. These assessments differ from an ex-post evaluation of decisions that some competition authorities also undertake. An expost evaluation involves an assessment of the actual effects observed after the decision has been made. Since competition decisions usually require some time to produce the desired results, this implies that ex-post evaluations can identify and assess the actual effects they

4.1 Results

In line with the OECD recommendations and to produce estimates of the economic impact in terms of Gross Value Added (GVA) from both the direct and indirect role of the Office, this study employs the input-output modelling framework. The input-output modelling framework enabled the authors to decompose the total economic impact between the direct and indirect effects.

The input-output modelling framework used in this study is the Leontief demand-driven model (Miller & Blair, 2009) based on the symmetric input-output table (SIOT) for Malta published by the NSO in 2016 for the reference year 2010. This study employs a 17-sector-by-sector SIOT, following the NACE Rev. 2 industry classification.¹ By breaking down the economy into finer units (sectors), input-output techniques are able to trace out undetected effects in traditional macroeconomic analysis that relate to the changes of aggregate variables rather than the effect of these changes on the composition, across the various sectors of the aggregate variable.

The solution to the Leontief demand-driven model, expressed in matrix algebra notation, is expressed below in equation (1):

$$\vec{x} = (I - A)^{-1} \cdot \vec{f}$$
 (1)

where \vec{x} is a column vector representing the level of output for each *n* sector in the economy, $(I - A)^{-1}$ is the Leontief inverse and \vec{f} is a column vector representing the level of final demand for each *n* sector in the economy.

The elements within the Leontief inverse matrix incorporate the notion that increases in final demand have a larger impact on the production of output than solely the initial additional output produced (direct production effects) required to supply the exogenous increase in fi-

¹The 17 sectors are the following: (1) Agriculture, Forestry and Fishing; (2) Manufacturing; (3) Electricity, Gas, Water Supply and Waste Management; (4) Mining, Quarrying and Construction; (5) Wholesale and retail trade; repair of motor vehicles and motorcycles; (6) Transportation and Storage; (7) Accommodation and Food Service Activities; (8) Information and Communication; (9) Financial and Insurance Activities; (10) Real estate activities; (11) Professional, scientific and technical activities, and administrative and support service activities; (12) Public Administration and Defence; (13) Education; (14) Human Health and Social Work Activities; (15) Arts, Entertainment and Recreation; (16) Other Service Activities; and (17) Households as employers and activities of extraterritorial organisations.

25 Percentage (%) 20 15 10 0 Manufacturing Public Construction Real estate Arts Information Financial and Professional. Wholesale and retail trade; activities administration entertainment and insurance scientific and and defence, and recreation communication activities technical transportation education and activities and tourism health sectors sectors

Figure 1: Decisions of the Office for Competition by Sector - January 2014 to December 2018. Source: MCCAA; Authors' Calculations.

nal demand. The Leontief inverse thus incorporates the concept that the production process required to produce a unit of output for use by final demand, also requires the production of output by other industries for use as intermediate inputs. Furthermore, the production of these additional intermediate inputs requires subsequent increased rounds of production since output has to be produced to satisfy the second round of input requirements. All these rounds of additional increases in output are referred to as the indirect production effects of an exogenous increase in final demand on total output production.

Given that the aim of this study is to assess the economic impact of the Office on the Maltese economy, value-added multipliers were derived as these put forward a more representative measure of the economic impact effects on GDP. The value-added multipliers for the respective n sectors in the economy were obtained following 2, (expressed in matrix algebra):

$$\vec{sv}' = \vec{u}' \cdot (I - A)^{-1}$$
 (2)

where $\vec{sv'}$ is a row vector of sectoral simple value-added multipliers, \vec{sv}' is a $(1 \times n)$ row vector of value-added / output coefficients (the amount of value-added generated per euro of output produced), and $(I - A)^{-1}$ is an $n \times n$ matrix representing the Leontief inverse.

The resulting simple value-added multipliers illustrate the effect of an additional euro of final demand for the output of the respective sector, when all of the direct and indirect effects in the production process are converted into a euro estimate of new value-added generated.

Simple value-added multipliers, reflect only direct and indirect effects on value-added caused by exogenous changes to final demand. These estimates, however, omit the notion that increased production requires more labour input which in turn increases household income which further increases demand and consequently, more production. Households' income-expenditure behaviour is thus not endogenised within the derivation of these multiplier estimates. Within input-output literature, total output multipliers are generally referred to as multipliers obtained from a closed Leontief demand-driven model (Cassar & Rapa, 2018). The term *closed* relates to the fact that the technical coefficients matrix is closed with respect to household income-expenditure, and behaviour is endogenised within the economic system. Total multipliers capture the inter-relationships between revenue, income, and expenditure flows made by households and the productive sector. These multiplier estimates acknowledge the fact that an increase in demand for a sector's output has a greater impact on the economy than just the direct effects since there are wider knock-on effects on other industries.

In simple terms, this means that if there is an increase in the final demand for a particular product, we can assume that there will be an increase in the output of that product, as producers react to meet the increased demand (direct effect). As these producers increase their output, there will also be an increase in demand on their suppliers and so on down the supply chain (indirect effect). As a result of the direct and indirect effects, the level of household income throughout the economy will increase mostly due to increased employment. A proportion of this increased income will be re-spent on final goods and services (induced effect). The ability to quantify these multiplier effects is important as it allows economic impact analysis

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to be carried out. The resulting total value-added multipliers illustrated in equation (3) below, now also include the induced effects:

$$\vec{tv}' = \vec{u}' \cdot (I - H)^{-1}$$
(3)

where $t\vec{v}'$ is a $(1 \times n)$ row vector of sectoral total value-added multipliers, \vec{u}' is a $(1 \times n)$ row vector of value-added / output coefficients, and $(I - H)^{-1}$ is an $(n \times n)$ Leontief inverse for the *n* productive sectors obtained following the endogenization of household incomeexpenditure behaviour. It is noteworthy that Oosterhaven, Piek and Stedler (1986) assert that a realistic estimate of the effective multiplier effect of a sector lies approximately halfway between the simple and total multipliers. This assertion was put forward on the basis that generally, simple multipliers tend to underestimate the economic impacts (since they omit labour income and household activities), whilst total multipliers tend to overestimate these impacts due to the rigid assumptions employed regarding the behaviour of household income-expenditure patterns. Given the underlying scope and goals of this study, the estimation of the impact on value-added arising from the operations of the Office shall be taken as the average between the simple and the total value-added multiplier effects (Oosterhaven et al., 1986). The average valueadded multipliers employed for this study were obtained by following equation (4):

$$\vec{av}' = (\vec{tv}' + \vec{sv}')/2$$
 (4)

where $\vec{av'}$ is a row vector of the average value-added multipliers.

4.2 The Direct Economic Effects

Due to various underlying data constraints, only concentration decisions were considered for estimating the direct economic impact of the Office. The disclosure of confidential data by the Office enabled the authors to allocate each concentration decision to a particular economic sector and obtain an estimate of the total turnover of the concentration decision.

The following assumptions were employed to determine the estimate of the direct economic benefit resulting from each concentration decision:

- the concentration decision has an initial impact only on the NACE sector of the acquiring party²,
- the growth in market turnover of the acquiring party (aggregate turnover) for the year the concentration decision was undertaken and the following two years

(for 2014, 2015 and 2016)³ is assumed to be the direct benefit of the concentration decision undertaken by the Office,

- the growth of the entire NACE sector is applied as a proxy for the growth rate in the aggregate turnover of the respective acquiring party, and
- the change in sectoral market turnover is assumed to be completely allocated to final demand.

On the basis of the following assumptions, the direct economic effect is equated to be equal to the change in aggregate market turnover of the acquiring party (dMA). In turn, this is equal to the market aggregate turnover of the acquiring party (TR_a) multiplied by the average sectoral growth rate over the years (year when the decision was taken plus two years after) (Gr_{avg}) (equation (5)).⁴ This exercise was undertaken for each concentration decision between 2014 and 2018.

$$dMa = TR_a \cdot Gr_{\text{avg}} \tag{5}$$

The final step involves multiplying the annual assumed change in the market turnover of each specific sector by the sectors' own average value-added multiplier (equation (4)) as shown in equation (6):

$$DIR_t = \sum_{i=1}^n dM_i \cdot av_i \tag{6}$$

where DIR_t is the impact in terms of value added of the direct effect of the Office for the respective year t, dM_i is the change in aggregate market turnover of the *i*th sector, and av_i is the average value-added multiplier of the *i*th sector.

Repeating this calculation across all the sectors which were affected by the Office's operations in that year and summing the resulting effects would yield the yearly estimate of the benefit to the economy in terms of GVA as a result of the direct interventions of the Office.

4.3 The Indirect Economic Effects

Apart from the direct economic benefits attributed to the operations of a competition watchdog, there are also indirect benefits arising from deterrence effects, i.e., the existence of a competition authority deters companies from engaging in anti-competitive behaviour that they would have otherwise engaged in. This leads to an increase in the number of competing firms, lower mark-ups and boosts total factor productivity and economic growth.

²Concentration cases which involved financial intermediaries acquiring firms operating in the real economy retained their respective NACE allocation.

³It is common in the literature for the benefits of merger/concentration decisions to be assumed to persist longer than one year, for reference see Garcia-Verdugo et. al. (2017).

 $^{^4\}text{For}$ 2017, the average growth rate was calculated based on the average between 2017 and 2018, whilst for 2018 the growth rate applied was solely that observed within the same year.

To the authors' knowledge, similar assessment studies of competition authorities have solely focused on estimating the direct economic benefits that accrue from the existence of a competition watchdog. The omission of indirect effects from such assessments has two important implications: (a) assessments which fail to account for deterrence effects would underestimate the return ratio of competition policy, (b) failing to account for such effects would mislead the competition authority when prioritising cases to investigate. In this sense, this study is novel as it attempts to quantify such indirect effects by applying various empirical methodologies and plausible assumptions. These indirect effects are intended to capture the deterrence effects of anti-competitive mergers and anticompetitive conduct, improvements in productivity and all the other duties of the Office apart from the control of concentrations.

The methodology employed by this study to capture the indirect effects of the Office is centred around the ad-hoc derivation of the share of aggregate Household Consumption attributable to the intangible effects of the Office over the 2014-2018 period. These intangible effects are proxied by the share of consumer sentiment (Eurobarometer, 2019) attributed to healthy competition. Subsequently, these annual aggregate levels are allocated across various NACE sectors in the economy and integrated into an input-output model in order to obtain the annual impact on GVA attributable to these indirect effects.

Resorting to Hendry's general-to-specific modelling, the Engle-Granger two-stage methodology was employed on quarterly Maltese national accounts data to quantify the effects of consumer sentiment on private consumption in Malta. An optimal regression analysis was carried out, followed by unit root testing. All variables were found to be I(1). After eliminating statistically insignificant variables at the 95% confidence level, the following parsimonious specification was used:

$$\Delta \log SC = 0.3582 + 0.0236 \cdot SD + 0.1276 \cdot \Delta CSI_{-1} + 0.5263 \cdot \Delta \log SC_{-4} - 0.4015 \cdot [\log SC_{-1} - 0.2922 \cdot \frac{\log IFE_{-1} \cdot (1 - EFTR_{-1})}{SCP_{-1}} - 0.5947 \cdot \log SC_{-5}]$$
(7)

where SC is real private consumption expenditure, SD is a seasonal dummy variable, CSI is consumer sentiment

indicator, SC_{-4} is lagged real private consumption expenditure as a measure of habit persistence, *IFE* is the compensation of employees, *EFTR* is the effective tax rate, *SCP* is private consumption expenditure deflator, *UNEMP* is the unemployment rate, *INT* is the main refinancing operations rate, and *FL* is households' financial liabilities.

As can be seen from equation (7), the one-quarter lagged value of the consumer sentiment indicator is found to be a statistically significant predictor of real private consumption expenditure in Malta. Holding all the other variables constant, for a one-unit increase in the consumer sentiment indicator, real private consumption expenditure growth in Malta increases by 12.76%.

Consumer confidence cannot be solely attributed to non-economic factors. Ludvigson (2004) argues that roughly 80% of the total consumer confidence indicator is composed of future expectations and economic conditions, while the remaining share captures the indirect effects of non-observable factors. For the period under review, Eurobarometer surveys show that, on average, 66% of the respondents totally agree that competition encourages innovation and economic growth, while 32% totally agree that effective competition has an impact on consumption. If we proxy the effect of competition deterrence effects by deflating the share of consumer sentiment captured by indirect effects of non-observable factors (20%) by the share of respondents agreeing that competition encourages economic growth (71%) whilst further multiplying by the average share of private consumption expenditure to GDP over the period of study (27%), one will arrive at a share of 3.8%.

The indirect effect of the Office for Competition on consumption can be estimated by reducing the estimated consumer sentiment coefficient found in equation (7) by 3.8 percentage points, which is attributed to the perceived effect of effective competition on economic and consumption growth. Therefore, the consumption growth in the counterfactual scenario with no presence of the Office can be found by re-running equation (7) with the deflated coefficient. In addition, sensitivity tests were carried out to gauge the impact of the above assumptions on the results.

Multiplying the level of sector-specific household consumption (resulting from the indirect effects of Office) by the sectors' own average value-added multiplier, repeating this calculation across all the n sectors in the economy, and summing, would yield the annual estimate of the benefits to the economy in form of GVA due to the indirect effects specific to the Office.

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4.4 The Total Economic Effects

The total economic effects were derived by summing each year's direct and indirect effects. To contextualise the estimates, the authors divided the total economic impact by the budget allocated to the Office to cover the costs of its operations between 2014 and 2018 to derive the return ratio, i.e., the return in terms of GVA to the Maltese economy for every Euro of budget allocated to the Office. These estimates allow for comparison with other Competition Authorities across the world as such estimates are very often estimated by the respective Authorities.

5 Results

The methodology employed by this study allows for the assessment of the impact resulting from the direct and indirect effects of the Office, in terms of GVA, at a sectoral level. The resulting estimates discussed in the section are based on the average value-added multipliers described in equation (4) which implicitly invoke the various assumptions surrounding the application of the Leontief Demand Driven model. From the sectoral analysis undertaken, various key findings can be highlighted. Firstly, it should be noted that the year-to-year impact that the Office has on the various sectors is highly influenced by the sectors affected by the concentration decisions, namely its direct effects. However, given the widespread nature and magnitude of the indirect effects and the resulting multiplier effects, on average, all sectors in the economy have been positively impacted in terms of value-added generated by the operations of the Office. The sectors affected most by the Office in terms of value-added generated between 2014 and 2018 have been the: (a) Information and Communication sector, (b) Wholesale and retail trade, repair of motor vehicles and motorcycles sector, (c) Transportation and Storage sector, (d) Accommodation and Food service activities sector, and (e) Real Estate Activities sector. In terms of indirect effects, three sectors stand out: (i) the accommodation and food service activities sector, (ii) the real estate activities sector, and the (iii) wholesale and retail trade, repair of motor vehicles and motorcycles sector. Figure 2 presents the total effect of the Office in terms of its benefit to the economy aggregated across all sectors, for each year considered in this assessment. Figure 2 also disaggregates the annualised figures between the direct and indirect effects of the Office. For ease of interpretation, results are also presented in Table 1.

Over the study period, 2017 followed by 2015, are the two years in which the benefit to the economy in terms of GVA attributable to the operations of the Office amounted to the highest values, at \in 13.7 million and \in 11.8 million, respectively. For each of the years assessed, the direct effects impact of the Office was always higher than



Figure 2: Direct, Indirect and Total Effects of Office in terms of GVA (Euro) between 2014 and 2018, EUR millions. *Source: Authors' Calculations.*

that from indirect effects. Indeed, the average contribution to GVA attributable to the direct effects, between 2014-2018 was \in 7.1 million per year, whilst that of the indirect effects amounted to \in 3.1 million per annum over the same period. This implies an average total benefit to the economy in terms of GVA attributable to the Office over the 2014-2018 period of \in 10.2 million per year.

The return ratio (Table 1) helps the policymaker and economic agents evaluate the benefit of further investing in the Office. The annual return ratio over the 2014-2018 period illustrates the benefit to the economy per euro of budget allocated to the Office, an average of 30.4. Over the time period considered, the minimum return ratio amounted to 24.5 in 2016, whilst the maximum was 41.2 in 2017.

6 Conclusion

It is becoming increasingly important for competition authorities to assess and explain the impact of their interventions on society. Several competition authorities carry out studies in this area to be able to put the budget allocated to them in perspective. While this study follows the same principles, the study adopts the input-output framework as a basis for quantifying the direct and indirect GVA effects emanating from the Office's activities between 2014 and 2018.

The average economic effects in terms of GVA in the period under review are estimated at an annual average of ≤ 10.2 million, of which ≤ 7.1 million is attributed to the direct intervention of the Office. The rest are attributed to indirect effects, interpreted by the authors as capturing deterrence effects of anti-competitive concentrations and anti-competitive conduct, improvements in productivity due to increased competitiveness and returns from other responsibilities carried out by the Office save for control of concentrations. These amounts equate to an average return ratio of 30:1 for every Euro allocated to the Office in terms of GVA.

	2014	2015	2016	2017	2018
Direct Effects	5,320,518	8,875,636	5,487,289	10,479,792	5,300,981
Indirect Effects	2,755,524	2,943,042	3,031,699	3,176,399	3,440,448
Total Effects	8,076,042	11,818,678	8,518,988	13,656,191	8,741,428
Budget Allocation of Office	314,859	340,469	346,862	331,633	336,379
Return Ratio	25.6	34.7	24.6	41.2	26.0

 Table 1: Direct, Indirect and Total Effect of Office in terms of GVA (Euro) and Return Ratio between 2014 and 2018. Source:

 Authors' Calculations

to similar studies (e.g., for 2015 to 2018, the ratio of direct benefits to costs estimated by the UK Competition Authority was 17:1).

There are some important caveats to the study. Firstly, the robustness of the results depends to a high degree on the quality of the data compiled by the NSO. The results are dependent on the input-output table for 2015 published for the Maltese economy and, therefore subject to change as new input-output tables become avail-Secondly, the Leontief demand-driven model is able. based on a number of key assumptions, particularly fixedcoefficient production functions (or fixed technical coefficients), hence input substitution is not allowed, no input constraints (supply of inputs assumed to be infinite), production in every industry is subject to constant returns to scale, output is a linear function of final demand, and each industry is assumed to produce one homogenous product. Thirdly, the indirect effects of competition policy are based on the Eurobarometer survey which methodology although informative and easy to apply, may realistically prove too simplistic to accurately disentangle the tangible effects of competition policy from intangibles (e.g., risk aversion and thrift habits). Furthermore, the assumption that changes in consumer sentiment are solely attributed to the activities of the Office may overstate the indirect economic multipliers inferred and erroneously attribute effects on consumers' sentiment which are driven by alien activities (e.g., trade and consumer policies in the EU, economic growth in the Maltese economy, governance) to the Office. Finally, because competition output is not directly observable, better indicators of consumers' perceptions on the intangible effects of the Office is needed. While competitive prices, lower mark-ups and higher consumer sentiment are uncontested channels through which competition policy affects the economy in general, further research is needed into how competition policy affects different income groups in society. It is often argued that the costs of anti-competitive practices are relatively higher for poorer households than for richer ones.

Notwithstanding these limitations, quantifying the benefits-to-cost ratio of competition authorities is a useful exercise that is very informative about the relevance of competition authorities, the results of their intervention and their evolution over time. This study has a number of policy implications: firstly, it helps the Office to put into perspective the budget allocated to it by the Government of Malta in perspective by gauging the rate of return. Secondly, these results could also motivate case priorities based on expected economic impacts.

Disclaimer

This article presents findings based on a study conducted for the Office for Competition within the Malta Competition and Consumer Affairs Authority. This study's ownership rights, and intellectual property remain exclusively vested in the Malta Competition and Consumer Affairs Authority. The authors were granted permission to publish this academic article. The views expressed in this article have been written under the authors' sole responsibility and should not be construed as representing the views of the Office for Competition, the Malta Competition and Consumer Affairs Authority, the University of Malta, and/or the Government of Malta. Any errors or omissions are the sole responsibility of the authors. The authors would like to thank the staff working at the Office for Competition for their assistance and collaboration.

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Research Article



Educational attainment and gender gaps in the Maltese labour force

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Abstract. The aim of this study is to analyse the main trends in educational attainment in Malta during the decade between 2010 and 2021 and to discuss factors that affect gender gaps in the Maltese labour force. Data show that the educational attainment in Malta has improved substantially during the period under consideration, but pronounced gender gaps remain. The paper considers two major factors that would seem to affect gender gaps in labour force participation rates, namely parenthood obligations and choice of study areas at tertiary level by women. The paper derives a number of policy implications from these findings, including that women should be encouraged to follow STEM subjects and that work-life balance initiatives are crucial for decreasing the gender gap in the labour force.

Keywords: educational attainment, STEM, labour market, parenthood, occupational structure

1 Introduction

The aim of this study is to analyse the main trends in educational attainment in Malta during the decade between 2010 and 2021 and to discuss factors that affect gender gaps in the Maltese labour force including educational attainment, fields of study at tertiary level and parental obligations of the individual. The topic is of special interest considering the persistent under-representation of women in managerial roles, as well as in other leadership positions, despite the continuous efforts to promote gender equality at the workplace.

Figures on educational attainment show that, in the period under consideration, Malta has registered a significant improvement in educational attainment, in part due to the rising role of women in society, though challenges remain. The rise in female education attainment follows the number of policy initiatives implemented by the Maltese government with the aim of increasing the female participation rate, to address the objectives of the Europe 2020 strategy.

Apart from the intrinsic value of being educated, education has long been viewed as a major determinant of economic well-being (Hanushek & Wößmann, 2010). The relationship between education and labour market outcomes has been documented in various studies with data showing that there are improved labour market outcomes for the individual as educational attainment rises (lonescu, 2012; OECD, 2012).

Through education, individuals gain skills which enhance their productivity at the workplace. This is usually associated with enhanced job opportunities. Apart from the improved access to employment, as well as protection against unemployment, a higher level of education is associated with higher salaries and more satisfactory terms of employment (Gammarano & Perardel, 2016). Schultz (1975) also notes that education increases individual's ability to deal with changing conditions, thereby enhancing employability in times of rapid technological changes.

The economic benefits are not limited to individuals. It is generally agreed that several positive externalities are associated with education with benefits spilling-over to benefit others in the society (Draghi, 2006; McMahon, 2010). Woessmann (2014) notes that education is bound to alleviate poverty, reduce social exclusion and cut inequality in society. On the other hand, empirical evidence on the impact of education on economic growth is more mixed, often reflecting measurement problems (Hanushek & Wößmann, 2010). In case of Malta, Pirotta et al. (2022) believe that economic growth is intrinsically linked to human resources given the absence of natural resources on the island.

To attain the objective of this paper, statistical evidence is presented to capture the changes in the Maltese labour market and to illustrate the factors that led to gender gaps. When appropriate, reference to the literature on these issues is made to support the arguments put forward. The data used in this study are mainly sourced from the Labour Force Survey (LFS), a quarterly survey carried out by the National Statistics Office (NSO). The survey is carried out in all European Union (EU) countries with the aim of providing a continuous assessment of the labour market, including information on employment trends and occupational structure. It also provides information on socio-demographic characteristics such as sex, educational attainment and household characteristics. Data from LFS are comparable across EU countries, and over time, and are sourced from Eurostat.

The article is organised in four sections as follows. Section 2, which follows the introduction, presents an overview of the main trends in educational attainment between 2010 and 2021, outlining the significant improvement recorded by females. Section 3 analyses how educational attainment influences labour market decisions. Furthermore, it seeks to evaluate the effects of parenthood on employment rates for men and women, respectively. At the same time, it will look at the developments in the occupational structure over the past decade. Section 4 concludes the study and puts forward some implications derived from the results presented in the previous sections.

2 An overview of the main trends in educational attainment

2.1 Student enrolment and graduates

Figures on the educational attainment of the Maltese population, obtained from the LFS, show that Malta's educational attainment has improved substantially since 2010, in some cases exceeding the national targets as part of the Europe 2020 strategy.¹ By 2021, the share of the population, aged between 15 and 64 years, having a low level of education decreased to 34.0%, from 59.6% in 2010. At the same time, the share of the population with a tertiary level of education has increased to 29.3%, from 14.2%. Nonetheless, Malta still lags in educational attainment when compared to most other EU member states in



Figure 1: Percentage distribution of tertiary students by ISCED level and sex for academic year 2020-2021. *Source: NSO - Education Statistics.*

terms of tertiary education with countries such as Ireland, Luxembourg and Cyprus having more than 40% of their population with a high level of education.

In general, females tend to do better than males at almost every educational level (Buchmann & DiPrete, 2006; van Hek et al., 2016). This is also the case in Malta. For example, the latest OECD's Programme for International Student Assessment (PISA) which measures 15-year-olds' ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges shows that girls in Malta outperform boys across all three categories (OECD, 2019).² While there is a tendency for girls to outperform boys in reading and in science across the OECD countries, Malta proves to be an interesting case whereby girls outperform boys across all three categories and often at a greater margin than the OECD average. Females are also less likely to leave school early, again a common characteristic amongst EU countries, with the early school leaving rate for girls in Malta standing at 9.3% in 2021, as opposed to 12.0% for boys (Eurostat, 2022).

The reasons behind early school leaving are various. Studies have found that the unemployment rate has a positive impact on enrolment in post-secondary education (Clark, 2011; Pissarides, 1981). This is in line with the opportunity cost argument whereby high rates of unemployment reduce the cost of remaining in education and

¹As part of Europe 2020 strategy, the EU set-out two educationrelated targets to be reached by 2020 - (i) for the share of early school leavers to be reduced to 10% and (ii) for at least 40% of people aged 30 to 34 to have completed tertiary or equivalent education. These targets were then translated into national targets, reflecting different situations and circumstances. Malta adopted the same target in respect of early school leavers but set out the target in respect of tertiary educational attainment for 30- to 34year-olds to 33% which it exceeded in 2017. For further information see Gauci (2021). In 2021, a new set of targets were set with the aim that, by 2030, the share of early school leavers should be less than 9% and the share of 25- to 34-year-olds with tertiary education attainment being at least 45%.

²PISA assesses the extent to which students, near the end of their compulsory education, have acquired key knowledge and skills that are essential for full participation in modern societies (OECD, 2016). The assessment focuses on the core school subjects of science, reading and mathematics. In general, the 2018 study shows that Maltese students attain lower scores than the OECD average in the three subjects. When analysing scores by gender, the study shows that girls outperformed boys in reading literacy by 49 score points, in mathematics by 13 score points and in science by 21 score points.



Figure 2: Percentage distribution of tertiary graduates by ISCED level and sex for academic year 2020-2021. *Source: NSO - Education Statistics.*

so increase post-compulsory enrolment. In recent years, unemployment rates in Malta fell to record lows given the strong growth experienced by the Maltese economy. In such circumstances, the incentive to invest in one's education may have declined, in part explaining why the rate of early school leavers has remained high in Malta. Even though leaving school with a basic level of education, which has economic and social costs, most early school leavers in Malta were still employed suggesting that early school leavers may still possess skills that are relevant for the labour market (Gauci, 2021).

It is not yet clear why there are gender differences in early school leaving. Literature shows that there are two sets of determinants in understanding this phenomenon, what are described as "push" and "pull" factors, introduced by Jordan et al. in 1994. "Push factors" originate from the school itself while "pull factors" operate from outside the school (Portela-Pruaño et al., 2022). In a study on Italy, a typical Southern-European country which is also characterized by high early school leaving rates, Borgna and Struffolino (2017) found that boys' higher propensity to drop out is due to scholastic performance at school (push factor) but also due to better employment opportunities in the formal and informal labour market (pull factor).

At the tertiary level, the number of female students enrolled in higher education in Malta has consistently exceeded that of males since at least 2013. Students enrolled in tertiary level courses amounted to 18,336 during academic year 2020-2021, with females comprising over 59% of total students. Figure 1 shows the distribution of tertiary level students across ISCED levels, using education statistics sourced from the NSO. The share of female students outnumbered their male counterparts at all levels with gender parity achieved even at a doctoral level (ISCED 8) where the number of male students has



Figure 3: Share of population aged 25 to 64 years with a tertiary level of education for the period 2010-2021. *Source: Eurostat - LFS Statistics.*

traditionally exceeded that of females.

Around two-thirds of students were enrolled in a fulltime course with the remaining third opting for a parttime course, with most of these part-time students being females. Whilst the reasons for choosing to follow a part-time course may be various, it may indicate that there is a larger tendency for females to combine studies with other work-life commitments. As more females invested in their education, the country has benefited from a surge in female graduates enlarging the country's pool of graduate talent. In fact, in 2021 females accounted for 60% of all tertiary graduates, an increase of 4 percentage points since 2013. Figure 2 shows the distribution of tertiary graduates. Similar to the distribution of tertiary students, the largest difference amongst genders is observed for short-cycle studies (ISCED 5) with the gap between the genders narrowing as ISCED level increases.³

Figure 3 shows that the share of women aged between 25 and 64 years with a tertiary level of education has more than doubled between 2010 and 2021, reaching 34.5% up from 15.2%. Since 2012, the share of females with a tertiary level of education has consistently exceeded the male counterpart, with the gap between the two genders widening even further in recent years. The improvement in educational attainment of females stems from the younger cohorts, namely those aged between 25 and 44 years old, in line with the emancipation of women with the most significant changes occurring in the past 20 years.

Indeed, Chircop (2020) notes that that the new millennium acted as a catalyst of change in Maltese society with many Maltese acquiring more liberal views. In

³Given that the absolute number of Doctoral graduates in Malta is low, careful attention must be paid when analysing these numbers as small changes in numbers can translate to large changes in percentage terms.



Figure 4: Tertiary educational attainment by gender and age in Malta and in EU 27 in 2021. Source: Eurostat - LFS Statistics.

this context, social norms began to change moving away from the traditional patriarchal society. The advancement of females' educational attainment, and consequently the increase in female employment, was facilitated by several government policies including fiscal incentives, longer maternity and adoption leave, the introduction of free-child care facilities as well as the provision of after-school care services.⁴

In fact, almost half of females aged between 25 and 34 years are tertiary graduates. This contrasts sharply with the share of male graduates in that same age bracket which stands at 36.5% (see Figure 4). The share of female graduates in this age cohort also exceeds the share of female graduates in the EU27 which stands at 46.8%. For those aged between 35 and 44 years, the share of female graduates is close to the EU 27 average at around 43%. For older cohorts, those aged 45 years and over, the share of men with a high level of education exceeds that of females. On the other hand, in the EU27, the share of female graduates exceeds, or is at par with, that of males even in older age groups.

2.2 Fields of study and gender gaps

Despite the progress in educational attainment, gender gaps persist in terms of the fields of study pursued. It is noted in OECD (2017) that even though young females obtain more years of schooling than young men, they are less likely to study science, technology, engineering and mathematics (STEM) subjects, a situation which is also prevalent in Malta. Although there has been a decline in the gender differential in the take-up of medical sciences and law, as noted by Reimer and Pollak (2010), differences in the mathematics-oriented STEM fields are still striking (Legewie & DiPrete, 2014; Mostafa, 2019). Stoet and Geary (2018) believe that students may choose their field of study based on their comparative strengths, rather than on their absolute strengths.⁵

Education statistics also give information about the number of graduates by their field of study. Figure 5 shows that the share of female graduates in computer studies, engineering and natural sciences in Malta, in 2021, stood at 7.2% whilst the respective figure for males was 27.0%. For the EU 27 countries, the share of female graduates in these fields amounted to 14.1% while that of males to 39.4%. Thus, while gender differences are a common occurrence in several countries, such disparity is larger in Malta. In 2021, over 70% of female graduates graduated in business, administration & law (27.3%), education (24.5%) and health (18.6%). Almost 19% graduated in social sciences, arts and humanities. In the case of males, the largest share of graduates was also in business studies (35.8%). However, these were followed by graduates in ICT (13.6%). The share of male graduates in engineering, manufacturing & construction amounted to almost 10%, which by European standards is also low.

The share of female graduates in STEM fields has declined over time, a drop of 5.9 percentage points between 2013, the first data point available for Malta, and 2021, although this also holds true for men with the drop being even higher for males. The European Commission (2022) notes that the Maltese public research system suffers from under-funding while research & innovation by firms remains limited. Consequently, attracting and retaining skilled talent for research and development is a key challenge which may partly explain the drop in STEM graduates.

Data shows that business studies remain the most pop-

 $^{^{4}}$ For an exhaustive list of the main government policies implemented to raise the female participation see Micallef (2018) and Borg Caruana (2023).

⁵According to Stoet and Geary (2018), many high-performing girls may not pursue a career in science, even if they have the capability to do so, because they are likely to be top students in other non-science subjects too. Consequently, they believe that tackling boys' under performance in reading may be just as important



Figure 5: Share of graduates in Malta by field of education in 2021. *Source: NSO - Education Statistics, author's calculations.*

ular field amongst tertiary students, accounting for almost a third of all graduates. These trends are also apparent in the number of students registered as at scholastic year 2020-2021, giving an indication of future graduates, with almost 68% of female students enrolled in business studies, education and health and less than 9% enrolled in STEM subjects.

The difference in educational choices pursued by males and females is likely to play a significant role in the choice of occupations pursued by the two genders. As a result of the under-representation of women in STEM fields of study, women tend to remain under- represented in scientific and technical fields in the labour market (European Commission Directorate-General for Research and Innovation, 2021). The low proportion of women in these fields translates into biased research output together with a loss of talent and of growth opportunities (Gabriel, 2021). Women still account for a minority of researchers, and, in Europe, most countries are still far from reaching gender parity. In case of Malta, data as of 2018 show that less than one in three researchers were females (UNESCO Institute for Statistics, 2020). This negatively affects the labour market making it harder for companies to fill highdemand positions in IT and engineering and may also lead to differences in pay between genders (European Institute for Gender Equality, 2017).

In view of the globalization and technological change going on in advanced economies, including Malta, the structure of labour markets and skills requirements are rapidly changing, requiring the workforce to be adaptable and flexible. Going forward the demand for lowskilled employees is set to decline further, in part due to the on-going automation of occupations, while more opportunities will exist for those with medium and high qualifications (CEDEFOP, 2023). Moreover, advanced technologies propel the need for advanced IT and programming skills accompanied with higher cognitive skills such as creativity, critical thinking and complex information processing (Bughin et al., 2018). Firms in Malta have often highlighted their difficulties in finding skilled workers (Central Bank of Malta, 2023) and resorted to importing foreign talent to fill-in vacant positions. To minimize these mismatches, an appropriate skills governance is necessary including regular skills forecasting exercises and greater coordination among stakeholders amongst others (M. Debono, 2017).

3 Educational attainment and labour market participation

3.1 Educational attainment and gender gaps

The factors behind the increase in female participation rate are various, reflecting both policy initiatives, as mentioned earlier, as well as other structural factors. Micallef (2018) notes that higher education, lower fertility, changes in social norms and the availability of more flexible work practices have all contributed to the increase in the female participation rate. In this paper, the focus is on educational attainment, tertiary education study options pursued by women and parental obligations.

While better educational levels help employability for both men and women, the influence of education on employment participation is particularly strong for women (Thewlis et al., 2004). This is likely to be related to the persistence of traditional gender roles with women who are expected to stay home with the aim of taking care of a family having less incentive to obtain formal education and thus being more likely to have a low level of education. The more investment a woman makes in study, the more likely she is to exploit that investment in work in the labour market (Woodhall, 1973). Eckstein and Lifshitz (2011) posit that education possesses the capacity to augment an individual's earning potential in contrast to other obligations, such as domestic tasks, consequently enhancing the probability of labour force participation. This point is also made by Pissarides et al. (2005) who notes that the employment rate of highly educated women is higher than for those with a lower level of education. Moreover, it is also acknowledged that while gender employment gaps exist across all levels of education, they are the widest among men and women with low levels of education (OECD, 2017).

Figure 6 shows that the gender gap in employment rates in Malta for two different age groups - those aged between 25 and 54 years, considered the prime working age, and those over 55 years of age. While a gender gap is present across all levels of education, it narrows as educational



Figure 6: Employment rates by gender and educational attainment for prime-age workers and older workers in 2021. *Source: Eurostat - LFS Statistics.*

attainment increases. LFS data shows that employment rate, for those aged between 25 and 54 years of age and with a low level of education, stood at 90.8% for men in 2021 while that of women was 60.8%. This implies that the gender employment gap among men and women, aged between 25 and 54 years, with low educational attainment stood at 30.0 percentage points in 2021, more than three times the gap among highly educated men and women (8.0 percentage points). For older workers, the gender gap by educational attainment is less pronounced.

So far, the analysis has mainly focused on the educational aspect to explain gender gaps in employment. However, other factors are at play which will be reviewed in the coming section.

3.2 Effects of parenthood on labour market decisions

While educational attainment is an important factor in labour market decisions, demographic factors also play a crucial role. Marital status, childbearing and caring for the elderly raise the value of home production, relative to market work (Christiansen et al., 2016). Parenthood and related obligations tend to affect the employment rates of men and women differently. LFS data show that, in all EU countries, the employment rate for men with children is higher than that of those without indicating that the presence of children seems to positively impact the employment of men (see Figure 7). This is not reflected in the case of women as in most countries there's a higher employment rate for women without children than for those with children. It is acknowledged that motherhood can lead to interruptions in career paths for women and increased time spent on unpaid work at home (Pew Research Center, 2013).

Figure 7 shows that the employment rate for women in Malta aged between 25 and 54 years with children, stood at 71.3% in 2021, 15.7 percentage points below the employment rate of women without children (87.0%). The difference varies significantly between countries, with the widest variances recorded in Eastern European countries and in Malta. Although Malta has recorded a remarkable increase in the employment rate of women in the 25 to 54 years cohort, from 47.5% in 2010 to 79.1% in 2021, the gap between working women with and without children remained large.

On the other hand, Figure 7 shows that Sweden, Portugal, Croatia, Slovenia, Denmark and Netherlands recorded a higher employment rate for women with children as opposed to those without. The vast availability of family-friendly measures in these countries played an important role in this regard with Sweden, Portugal, Denmark and Slovenia being ranked amongst the top ten countries in the league table of national, family-friendly policies (Chzhen et al., 2019).

Looking at the family-friendly measures of these countries, one notes that in Slovenia fathers have the right to 30 days of paternity leave. This contrasts with the situation in Malta with paternity leave remaining limited at 10 working days. In case of Portugal, the country has moved from the concept of maternity and paternity leave to parental leave. It ranges between 120 and 150 days and can be taken either by the mother or father or shared between them. In Sweden, parental leave is also the most relevant type with each parent being eligible for up to 240 days



Figure 7: Effects of parenthood on employment rate of primeaged workers in 2021. *Source: Eurostat - LFS Statistics.*

parental leave. Parental leave in Malta currently stands at four months per parent.

Another factor worth noting is that, in Portugal, employees with children under eight years of age are entitled to request a telework arrangement though subject to work type and the employer's ability to accommodate the request. This is also the case in Sweden which also allows for the care of sick family members.

3.3 Methodology

Figure 8 shows the employment rates by gender, educational attainment and number of children.⁶ While, in general, the employment rates of women are lower for those with children across all categories of educational attainment, the decline is larger for those women with a low level of education. For example, the employment rate for a female with a low level of education and having two children goes down to 42.7%, a drop of almost 20 percentage points, compared to women with the same level of educational attainment but without children. On the other hand, for those females with a medium and high level of education the drop is smaller at 6.2 percentage points and 8.6 percentage points, respectively.

As mentioned above, there is a higher opportunity cost for those who invested in their self- development through education leading them to retain their jobs. Another possible reason for the higher employment rates of women with higher levels of education may be related to the advantages that arise with further educational attainment including greater job flexibility. In most instances, work of employees with a high level of education can be done remotely making it easier to combine work and family commitments. On the other hand, occupations which require only a basic level of education often entail workers to



Figure 8: Employment rates by gender, educational attainment and number of children in 2020. *Source: Eurostat - LFS Statistics.*

be physically present at the workplace making it more difficult to combine motherhood and employment. Debono (2021) notes that employees working in low-skilled jobs, most often having relatively low levels of education, tend to work the highest number of overtime hours making it even more difficult to ensure a work-life balance.

3.4 Gender gaps and the occupational structure

Data from the LFS, on the occupational structure of Malta shows that the composition of the workforce has changed considerably over the years. Higher educational attainment has contributed to a more educated pool of employees resulting in a greater share of workers occupying professional and managerial positions. Whereas in 2010, 36.1% of all workers were employed as managers, professionals and technical staff, the share of workers employed in these occupations stood at 46.1% in 2021. At the same time, there was a decline in the percentage of workers working in elementary occupations, as well as a drop in machine operators and craft and related trades workers. Indeed, the share of those engaged in elementary occupations, machine operators and craft and related trades dropped by 9.4 percentage points to 22.8%.

Looking at the occupational structure by gender shows that more than half of female workers were employed either as services and sales workers (27.5%) or professionals (26.7%). The share of the latter has increased markedly over a decade ago, rising by 9.4 percentage points up from 17.3% in 2010 (see Figure 9). Around 16% of the female workers were employed as clerical support workers while technicians account for around 11% of workers. These four occupations employed over 80% of females. The occupational structure of males was more diversified than that of females. Whilst the largest share

 $^{^{\}rm 6}{\rm Data}$ refers to 2020 as data for 2021 was marked as unreliable in some instances.



Figure 9: Employment by occupation and sex in 2010 and 2021. Source: Eurostat - LFS Statistics, author's calculations.

of males were also employed as professionals (17.7%), almost one in six males was employed in the craft and related trades sector. Technicians accounted for 14.7% of all those employed while 12.8% were service and sales workers.

Despite the ever-increasing pool of female graduates, gender parity has not yet been reached when it comes to managerial positions. The share of women occupying managerial positions is still low, compared to that of males, at 8.1% in 2021 up from 5.8% in 2010, whilst the share of men occupying the top position stood at 13.6%. Studies, such as for example that by the European Commission (2018), have shown that higher education is a necessary, but not sufficient, condition for good labour market performance. In several instances, the female advantage in education fails to translate into more favourable labour market performance for women with females unable to advance past a certain point in their occupations and professions, or unable to break through the glass-ceiling, regardless of their qualifications or achievements (Purcell et al., 2010).

4 Conclusion and policy considerations

As explained above, Malta has registered significant improvement in tertiary education with the number of graduates growing steadily over the years. In general, women have outperformed men when it comes to higher educational attainment. As a result, there has been convergence in employment rates between the genders but pronounced gender gaps still exist in the Maltese labour force. In this paper, two major factors that would seem to effect gender gaps in labour force participation rates were considered, namely parenthood and related obligations and choice of study areas at tertiary levels.

One implication of this study is that women are more likely to experience longer out-of- work spells than men, because of the unbalanced division of housework and care activities between men and women in households (Ferrant et al., 2014; Pew Research Center, 2013). Consequently, differences in human capital between the genders are bound to increase with age. Moreover, career interruptions may entail negative consequences for females' careers paths, although the repercussions of these decisions vary depending on the length of the interruptions (Aisenbrey et al., 2009; Bächmann & Gatermann, 2017). It has also been observed that after childbirth, men and women often return to a more traditional division of roles (Bühlmann et al., 2010; Drobnič et al., 1999).

It follows, therefore that work-life balance initiatives are crucial for decreasing the gender gap in the labour force. Such initiatives should not only focus on women with young children but rather should be more open to encompass both men and women in fulfilling their caring responsibilities. While it is widely acknowledged that the number of measures introduced by the Maltese government to entice women to remain in the labour market, including the availability of free child-care for parents who are either in employment and/or in education, were beneficial, some limitations remain. In this regard, further effective measures to address the gender gap in the labour force are needed and these may include the availability of free child-care irrespective of parents' employment status, more flexible work arrangements and the availability of leave for parents when a child is sick. Ideally, such measures are designed for all workers irrespective of gender.

As explained above, despite the considerable progress in educational attainment, the pool of STEM graduates in Malta remains limited, indicating the need to steer education and training provision towards these areas of study. This is even more so for women, with female graduates from STEM fields being less than 9% of total female graduates. Progress can be achieved by addressing the issue of gender division across study-fields as early as possible, while facilitating women's transition to the labour market in STEM related occupations.

Given that the changes in the labour market are largely technologically-driven, females who follow non-technical study areas tend to find themselves at a disadvantage when it comes to career advancement possibilities. The share of women in STEM occupations is often depleted even further through what is known as the "leaky pipeline" syndrome whereby women move away from STEM jobs, and opt for teaching professions for example, because of challenges such as finding a work-life balance, amongst others (European Institute for Gender Equality, 2017).⁷

One solution to encourage women to opt for STEM areas of study is to move towards more flexible and less segregated study options. It is suggested that STEM subjects are merged with the arts and humanities (STE(A)M) with the objective of making STEM studies and careers more attractive for women (European Institute for Gender

Equality, 2017). Supporters of STEAM education posit that adding the art component responds to industry's need for creativity and innovation in STEM fields which may strengthen the appeal of scientific careers.

Also, providing opportunities to students to change their core subjects as they progress in their education pathway could possibly widen their career choices as too often education systems direct students onto a certain educational path for a specific job, which might turn to be too costly to change.

Finally, it is important to note that while the EU-LFS statistics have overall high quality, like any survey, they are based upon a sample of the population. Consequently, the results are subject to the types of errors associated with random sampling. Future research could provide further insights on the extent educational attainment affects gender disparities by incorporating a higher level of analytical analysis, as this study has focused on statistical evidence. Another possible strand of research would be to analyse how careers, and job characteristics such as working hours, industry or sector, differ before parenthood and after giving birth.

 $^{^7{\}rm The}$ authors note that the ease of finding a work-life balance between STEM and the more traditional fields differs as women in STEM fields tend to work longer hours than women in other occupations.

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Research Article



Estimates of the exchange rate pass-through to consumer prices in Malta

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Abstract. The Exchange Rate Pass-Through (ERPT), commonly defined as the extent to which exchange rate changes are reflected in the price levels of an economy, has important implications in a number of policy-relevant areas. Despite this, estimates of ERPT in the Maltese economy are scarce and do not take into account changes in the monetary regime pertaining to the adoption of the euro. We use local projections to estimate linear and nonlinear ERPT to consumer prices in Malta after adoption of the euro. In line with literature, results point at incomplete ERPT to headline consumer prices, peaking at around 20% by the end of the first year after the exchange rate shock. ERPT to overall Harmonised Index of Consumer Price (HICP) inflation is largely driven by the goods component while ERPT to services prices is largely insignificant across the horizon considered. Allowing for nonlinearities, we find evidence of asymmetric pass-through with larger changes to, as well as depreciations in, the nominal effective exchange rate being consistent with larger pass-through estimates.

1 Introduction

Exchange Rate Pass-Through (ERPT) is commonly defined as the extent to which exchange rate changes are reflected in the price levels of an economy, most commonly import and consumer prices. The relation-ship between changes in exchange rates and local prices has very important implications both from theoretical and policy perspectives. Theoretically, incomplete ERPT estimates might indicate deviations in relative purchasing power parity (PPP) which predicts that changes in prices of goods should be the same across locations when all prices are converted to a common currency (Burstein & Gopinath, 2014). This in turn has important implications

on the extent of firm market power, on the market structures operating in an economy as well as on the efficiency in the allocation of goods across countries.

The study of ERPT to local prices also has important implications for monetary policy, especially in an open economy setup. On the one hand, exogenous shocks to the nominal effective exchange rate are a source of inflation fluctuations which need to be stabilised through monetary policy. On the other hand, changes in monetary policy in response to inflationary shocks which are exogenous to exchange rate shocks, have an indirect effect on the nominal effective exchange rate which could help stabilise inflation further. Thus, the extent of ERPT to local prices, especially in open economy setups can be both a source and a stabilising force for inflation which needs to be internalised in the monetary policy decisions of monetary authorities.

The transmission of exchange rate movements to consumer prices can be categorised into three distinct channels. First, exchange rate shocks can be directly transmitted to the overall consumer price level through changes in the prices of imported final consumer goods. Secondly, a movement in the exchange rate is expected to affect the prices of imported intermediate production used for domestically produced commodities which then indirectly affect consumer prices. Finally, developments in the exchange rate also affect the price competitiveness of domestic products on international markets, thus leading to changes in domestic output levels, factor demands and consequently factor prices which are ultimately transmitted to the prices of final domestic production which is consumed locally.

We use local projections (LP) to produce ERPT estimates for consumer prices in Malta after its accession to the European Monetary Union. A key advantage of LPs, which will be further explained in section 3, is their flexibility in allowing for non-linearities.¹ Indeed, in our specifications, we also allow for non-linear pass-through estimates both in terms of the size and direction of the change in Malta's nominal effective exchange rate. In line with literature, results point at incomplete ERPT estimates for consumer prices, peaking at around 20% by the end of the first year after the shock. Secondly, ERPT to overall HICP inflation seems to be largely driven by the goods component (in particular by the food and energy sub-indices) while ERPT to services are largely insignificant across the horizon considered. Thirdly, we find evidence of asymmetric pass-through with larger changes to as well as depreciations in the nominal effective exchange rate being consistent with larger pass-through estimates.

Our work makes multiple contributions to the study of ERPT in the Maltese economy. The two available estimates in the literature are based on data samples which encompass different monetary regimes. We therefore expect to obtain more reliable estimates by using data from 2008 onwards. Second, in contrast to available literature, we estimate ERPT to prices at increasingly disaggregated levels, in order to build a more comprehensive picture of what forces drive the headline estimates.

The rest of the paper is structured as follows. Section 2 provides a discussion on the main factors impacting ERPT estimates and existent estimates for euro area economies. Section 3 describes the methodology utilised in this study. Finally, section 4 provides results for linear and non-linear ERPT estimates for headline HICP and subcomponents together with a battery of robustness tests, while section 5 summarises and concludes.

2 Literature Review

2.1 Factors impacting ERPT

Literature identifies several structural factors that can impact the extent of ERPT to prices in a particular economy. All other factors kept constant, the greater the extent of openness to imports of an economy, the greater is the potential exposure of its prices to exchange rate impacts (Ortega & Osbat, 2020). For euro area countries, this is particularly the case with openness to extra-euro-area trade (Campa & Gonzalez Minguez, 2006). However, the larger degree of ERPT in open economies is usually attenuated by other factors such as currency of invoicing chosen by foreign exporters, integration in Global Value Chains (GVCs) as well as market power and competitive structure of firms. Both theoretical and empirical evidence suggest that when a large share of the inputs used in the production of exports is sourced from the destination market, the pass-through of exchange rate fluctuations to import (and consequently export) prices will be low. Indeed, a change in the bilateral exchange rate of the export market currency has two counteracting effects, in essence acting as a hedging mechanism for both foreign and local exporter from deviations in their profit mark-ups, ultimately contributing to lower ERPT estimates (Ortega & Osbat, 2020).

The degree of competition and market structures, both in the import and export markets, also impact the extent of ERPT. Smaller importers with weaker bargaining power are less able to limit ERPT to import prices, all else equal, but the extent of pass-through also depends on the conditions faced by exporters (Özyurt, 2016).

Closely tied to this is the currency of invoicing of imports. The literature typically distinguishes between producer currency pricing (PCP), where imports are priced in the currency of the producer, and local currency pricing (LCP), where imports are priced in the currency of the destination market. With PCP, prices are adjusted in the producer's currency, which theoretically leads to full pass-through since the products automatically become relatively more or less expensive in the currency of the buyer as the exchange rate adjusts. On the other hand, prices quoted in the currency of the buyer will not adjust by default given changes to the exchange rate, with the impact being absorbed by the exporter's mark-up (Ortega & Osbat, 2020).

Since exchange rate pass-through tends to vary by sector (Campa & Goldberg, 2002), the aggregate ERPT for an economy is also affected by the composition of its imports. In turn, sectoral pass-through tends to vary with the degree of homogeneity of the products in question, with ERPT being higher for more homogenous products and lower for highly differentiated products (Ben Cheikh & Rault, 2017).

An aspect which has gained increasing attention in the ERPT literature is the presence of non-linearities. In particular, the size and dynamics of ERPT differ according both to the sign of exchange rate changes (sign nonlinearity) and to the magnitude of exchange rate changes (size non-linearity). The former type of non-linearity is a consequence of factors leading to downward price rigidities, mainly driven by the competitive structures that exporting firms are operating in, which drive their pricingto-market decisions. For instance, in imperfectly competitive structures, the higher an exporting firm's market power in the destination market, the lower the incentive to pass-through exchange rate appreciations, meaning that depreciations result in higher ERPT than appreciations (Brun-Aguerre et al., 2016; Delatte & López-

¹Additionally, LP methods are usually more robust to misspecifications of the Data Generating Process (DGP) when compared to AR or VAR setups as they directly estimate impulse responses at all horizons.

Villavicencio, 2012).

Literature rationalises size non-linearities through the existence of menu costs and the presence of switching costs in import markets (Ben Cheikh, 2012; Bussière, 2007). In the presence of costs associated with price adjustments, exporters may choose to adjust prices only after relatively large exchange rate changes. Conversely, if domestic consumers face costs in switching to rival products, exporters can allow their prices to vary in the importer's currency as long as the variation does not exceed the switching costs, implying greater pass- through for smaller exchange rate changes.

Another growing branch of the ERPT literature is that relating to shock dependence in ERPT. Shock dependence is the proposition that the degree of ERPT depends on the nature of the underlying or structural shock causing the exchange rate movement in the first place. Shock dependence can therefore provide an explanation to why the degree of pass-through can vary over time for a particular economy. An early contribution to this literature is the work carried out by Shambaugh (2008), who employs a VAR model with long-run restrictions to relate the changes between consumer and import prices and exchange rates to several structural shocks.

More recently, structural VARs have been applied by Comunale and Kunovac (2017) and Forbes et al. (2018) whilst Local Projections have been used by Comunale (2019), to provide evidence on shock dependence in ERPT to prices in the euro area, the UK and Baltic states respectively. A more structural approach to shock dependent ERPT estimates has been used by Burlon et al. (2018) who estimate shock-dependent ERPT through a DSGE model.

2.2 ERPT estimates in the literature

In general, ERPT is found to be 'incomplete', in the sense that both import and retail prices tend to change lessthan-proportionately following exchange rate adjustment. Menon (1995) provides a survey of ERPT pass-through studies conducted over a broad sample period spanning from 1974 to 1994. Most studies surveyed yield incomplete pass-through estimates for exchange rate deviations on both import and consumer prices both in the long and short run. Moreover, the survey has identified significant inter- and intra-country differences in ERPT estimates highlighting the importance of country-specific factors in shaping the extent of ERPT in both short and long run.

More recent literature focusing on the euro area shows that ERPT to import and consumer prices for the euro area and its member states are incomplete both in the short and long run. On impact ERPT to import prices for the euro area as a whole vary from 0.20, as reported in

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Colavecchio and Rubene (2020), to 0.64 in Ben Cheikh and Rault (2017). ERPT to import prices is found to generally increase to between 0.33 in Colavecchio and Rubene (2020) and 0.80 in Comunale and Kunovac (2017) in the first year after the shock. The former study also finds that the response of import prices to exchange rate fluctuations peaks after 1 year, giving rise to a 'hump-shaped' pattern that is found for almost all individual euro area states. ERPT estimates to consumer prices are found to increase monotonically after the exchange rate shock and are generally found to be lower than those for import prices in all euro area states. For the euro area as a whole, ERPT to consumer prices after 1 year is of 0.04 (and not significantly different from zero) in Colavecchio and Rubene (2020) and ranges between 0.01 and 0.04 in Ortega and Osbat (2020). Using structural models, Comunale and Kunovac (2017) estimate a coefficient of less than 0.2 a year, whilst Burlon et al. (2018) estimate ERPT to retail prices at around 0.04 per guarter (for non-oil imports from the rest of the world). Colavecchio and Rubene (2020) and Ortega and Osbat (2020) further show that these euro area-wide estimates hide considerable cross-country heterogeneity which is in turn driven by the different structural characteristics of euro area countries.

There have been fewer studies specifically focusing on the issue of non-linear ERPT. Most studies find evidence of both size and sign non-linear ERPT to both consumer and import prices. However, evidence is quite mixed and shows a substantial level of heterogeneity across countries and studies. For instance, Ben Cheikh (2012) finds strong evidence of size non linearities across all euro area states, with larger exchange rate adjustments being consistent with larger ERPT to consumer prices. The same study however finds less clear-cut evidence for sign nonlinearities. On the other hand, Colavecchio and Rubene (2020) have no clear-cut results, with the effects of both size and sign non-linearities being extremely heterogeneous across countries and not present in all euro area members. Meanwhile, Delatte and López-Villavicencio (2012) examine sign asymmetry in pass-through to consumer prices for four major countries, the US, the UK, Germany and Japan, finding strong evidence that depreciations are passed through more strongly than appreciations in both the short run and long run in all countries in the sample. Brun-Aquerre et al. (2016) find, for a panel of 19 developed and 14 emerging market countries, that depreciations are generally passed through more than appreciations, with no significant differences between the two groups.

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2.3 The case for Malta

The Maltese economy is highly trade-open and characterised by firms which are small by international standards, despite the presence of some multinational firms. As of 2019, Malta's total imports of goods and services as a share of GDP stood at 118.6%, one of the highest values in the euro area. More importantly, as seen in Figure 1, Malta's share of extra-euro area imports as a proportion of GDP is the second-highest in the euro area. All else equal, these factors point at considerably large exposures of local import and consumer prices to exchange rate fluctuations. Nonetheless, a deeper look at Maltese trade data uncovers that approximately half of all extra-euro-area imports of goods in the Maltese economy are invoiced in euro, again one of the highest in the euro area, as shown in Figure 2. In theory this should act as a counterbalancing factor to the high degree of openness of the economy, thus reducing the expected pass-through to domestic prices.



Figure 1: Share of extra EA total Imports in GDP. *Source: Authors' Calculations.*

A similar conclusion may be reached when looking at ERPT from a sectoral perspective. Namely, listing imports by SITC category, one can note that the vast majority of goods imports for Malta are made up of categories 3 (Mineral fuels, lubricants, and related materials) and 7 (machinery and transport equipment). Looking at sectoral ERPT findings estimated by Ben Cheikh and Rault (2017), one can note that while ERPT estimates for goods falling under SITC category 3 are usually very close to 1 (i.e. perfect pass-through), ERPT for sector 7 goods is often found to be statistically not different from zero. Thus, similar to the previous discussion, it is very likely that even when looking at the sectoral composition of goods imports for Malta, there are compensating forces that on the one hand contribute positively to a high degree of exchange pass-through, while on the other serve to attenuate the effects of exchange rate fluctuations to aggregate domestic prices.

In their cross-country comparisons, Colavecchio and

Rubene (2020) and Ortega and Osbat (2020) find that Malta's estimates for ERPT to consumer prices are quite in line with euro area economies peaking at around 0.1. Interestingly, the former study finds that Malta's ERPT to consumer prices is lower than other very small and open economies such as Luxembourg. Moreover, contrary to virtually all other euro area states, Malta's ERPT to consumer prices peaks in the first year after the shock, with the second year showing point estimates very close to zero which are also statistically insignificant.

However, it is important to note that both these papers make use of data spanning from 1999 to 2017, a period during which Malta was under two different monetary regimes. The adoption of the euro and consequently of a floating exchange rate regime led to a clear break in the variability of the exchange rate series. We believe that results gleaned from datasets which encompass the different monetary regimes could be affected by this feature of the data and must therefore be treated with a degree of caution. In this light, we attempt to control for this change in monetary regime by starting our estimation period from 2008, the year of Malta's accession to the European Monetary Union. Moreover, in our study we estimate ERPT estimates for HICP subcomponents in an effort to uncover the main drivers behind overall results.



Figure 2: Shares of invoicing currencies of imports from outside the EA. *Source: Authors' Calculations.*

3 Methodology

3.1 Overview of the model

We make use of an LP specification largely based on the model of Colavecchio and Rubene (2020). LP methods, originally proposed by Jordà (2005), yield estimates of impulse response functions of the variable of interest over chosen forecast horizons. This is achieved by regressing the dependent variable at time t + h given the information set at time t for each value of h, where t = 1, 2, ..., T denotes the time dimension of the data

and h = 0, 1, 2, ..., H < T denotes each forecast horizon. As illustrated below, the response of the dependent variable at a given forecast horizon to a shock in the variable of interest is given by the path of the estimated coefficient of the explanatory variable in question in each successive regression, pertaining to each value of h.

LP models possess certain advantages over more other techniques used to estimate IRFs, such as VAR models. The method is more robust to misspecification of the DGP, estimating a new set of coefficients at each forecast horizon. More precisely, LP models directly estimate the pointwise estimates of IRFs, contrary to VARs, which do so through an iterative process that compounds any errors in the parameter estimates as the horizon *h* increases (Jordà, 2005). Moreover, LP models are considerably more accommodative of non-linear specifications, making them very useful and therefore popular in applied macroeconomic work.

These characteristics make LP estimation particularly suitable for our purposes, although one must also be wary of its weaknesses. The main drawback of LP models is their data consuming nature. While VARs consume degrees of freedom across the lag and number of variable dimensions, LP models actually reduce the sample size as h increases (Caselli & Roitman, 2019). Therefore, LP estimates tend to become more uncertain over longer time horizons h. This loss of efficiency can be addressed by expanding the information set through including in each regression the error term from the previous horizon estimation (Carriere-Swallow et al., 2016; Teulings & Zubanov, 2014). Our model takes the following form:

$$p_{t+h} - p_{t-1} = \alpha(h) + \phi(h) \Delta e_t + \sum_{i=0}^{k} \mathbf{x}'_{t-i}(h) \gamma_i(h) + u_{t+h}(h)$$

where p_t and e_t are the natural logs of the HICP and the nominal effective exchange rate (NEER) indices respectively, \mathbf{x}_t is a vector of control variables and u_{t+h} is the error term in each regression pertaining to each forecast horizon h. The dependent variable therefore measures the cumulative change in the price level between t-1 and the forecast period t+h. The impulse response of cumulative price inflation at each forecast horizon given an exchange rate change at time t is then given by:

$$IR_{h,t} = E(p_{t+h} - p_{t-1} | \Delta e_t \neq 0) - E(p_{t+h} - p_{t-1} | \Delta e_t = 0)$$

=\phi(h)

Therefore, an impulse response function (IRF) of price inflation responses over all forecast horizons given an exchange rate change at time t is obtained by running a

collection of *H* regressions and plotting the path of $\phi(h)$ over all horizons.

Our control variables are the output gap, as a measure of economic slack, and the index of foreign prices evaluated in foreign currencies (in log differences) to account for domestic and imported sources of price pressures, lagged values of inflation and log-differenced exchange rates to control for serial dependence, as well as the previous-horizon error terms. The appropriate lag length *k* for each of our control variables at each forecast horizon is selected by means of an algorithm that minimises the Akaike Information Criterion (AIC) for each estimated regression. This process excludes the lagged error terms, where only the previous horizon residuals are included in each equation.²

To provide a comprehensive analysis of the characteristics and dynamics of ERPT to consumer prices in Malta, we first use headline HICP as our dependent variable, and subsequently dig deeper by re-estimating the model for different HICP sub-indices. In the final part of this study, we allow for the possibility of non-linear responses of ERPT to headline consumer price inflation, as detailed in the following sections.

In all these instances, for the purpose of interpreting our results, it should be noted that since our NEER index is defined in terms of foreign currency per euro, an increase in the NEER signifies an appreciation of the euro, such that a priori our ERPT coefficients are expected to be negative. We estimate our model using data from 2008 Q1 to 2019 Q4. We choose 2008 Q1 as the start of our sample period in order to account for Malta's adoption of the euro on 1 January 2008. The adoption of the euro signified a change in Malta's monetary regime from a fixed to a floating exchange rate and as expected, materially affected the volatility of the NEER, with a clear break in volatility before and after the start of our sample. Encompassing such volatility within a longer sample would necessarily impact the reliability of our results; hence, we provide estimates using solely data pertaining to 2008 and later. On the other hand, we choose to stop our estimation in 2019 Q4 so that we do not include the COVID-19 period in our estimation sample, as this could potentially create biases in the results obtained.

3.2 Data

Our reference exchange rate variable is the Nominal Effective Exchange Rate (NEER) on the import side as sourced from the Eurosystem Macroeconomic Projection Database. This NEER index is an arithmetic single-

²Additionally, we perform a battery of sensitivity tests by augmenting our model with additional control variables including Brent crude oil prices, migrants' share of the labour force and the unemployment gap.

weighted effective exchange rate with weights reflecting the importance each of the 36 countries has in the Maltese import basket. We rebase this measure in terms of foreign currency per euro such that an increase in the index shows an appreciation of the NEER. The foreign prices variable is an index of extra euro area competitor's prices on the import side defined in national currency, that is, excluding exchange rate movements, obtained from the same Eurosystem database. As our baseline pricing level, we use the Harmonised Index of Consumer Prices for all goods and services (HICP). We further compute exchange rate pass through estimates for core inflation estimated as either HICP excluding energy or HICP excluding energy and food, as well as for HICP goods and HICP services separately. We then subsequently delve deeper into the exchange rate pass-through estimates to the subcomponents making up the HICP goods index, that is Industrial Goods (decomposed into energy and non-energy industrial goods) and food. All consumer price indices are sourced from Eurostat. We use the percentage difference between actual and potential output (the Output Gap) as estimated internally by the Central Bank of Malta as our baseline measure for slack.³ HICP indices as well as the index of foreign prices and oil prices are seasonally adjusted using the Census X12 procedure.

4 Results

4.1 Linear ERPT to consumer prices

In this section we present linear ERPT estimates. Figure 4 shows the estimated ERPT to overall (headline HICP) prices together with the 95% confidence bands. Results imply that ERPT is statistically significant at forecast horizons of one to three quarters after impact. Being insignificant on impact, our point estimate of ERPT increases progressively up to an absolute value of 0.22, or 22%, one year after the shock. However, the estimated coefficient diminishes slightly thereafter and is no longer statistically significant at the conventional 5% level. This result is consistent with the common findings in the literature that ERPT is incomplete, and that pass-through to consumer prices tends to be low. That said, the coefficients above are slightly higher than those found in the literature surveyed. Indeed, results show a stronger estimate for the peak ERPT than those found in Colavecchio and Rubene (2020), with the latter estimating a peak range of pass-through at 13% for the euro area.

We take a deeper look at the main drivers of these results by analysing ERPT to subcomponents of overall HICP. As a first step, we disaggregate overall HICP into goods and services prices. Our results show that



(change in price index relative to exchange rate adjustment: forecast horizon in quarters)

Figure 3: ERPT to headline HICP. *Source: Authors' Calculations.*

pass-through to goods prices is significantly larger than that to services prices. This is in line with expectations given that import content of services consumption is by its nature much lower than that for goods. We find ERPT to goods prices to be statistically significant at all forecast horizons except on impact, with the effect beyond one year after the shock being estimated at close to 40%. ERPT to services prices is, to the contrary, insignificant throughout except at a horizon of two quarters. This result is likely driven by the significantly low import content of consumer services that fall under the recreation and personal care (including the accommodation and catering services subindices), which in turn makes up around 54% of the HICP services subindex. Price dynamics of these consumer services are mainly driven by changes in wages, and thus are more dependent on the local labour market developments. These patterns tie in with the path of overall ERPT, which is strongest at the horizons where ERPT to goods and services prices are cumulatively relatively larger. Subsequently, the aggregate measure declines at later horizons, despite the continued strength of ERPT to goods prices, as that to service prices turns highly insignificant with its point estimates inverting sign. The finding that pass-through to goods prices is prolonged and significant up to two years following an exchange rate adjustment is particularly noteworthy, since it is an effect which is masked when analysing the effect on aggregate prices. The projected paths of ERPT to goods and services prices are shown in Figure 4 below.

In terms of pass-through to core inflation, we find markedly weaker results when compared to the specification using overall or headline HICP. In fact, as shown in Figure 5 below, we find no significant pass-through at any horizon when our dependent variable is HICP exclud-

³Potential output is estimated using a Cobb-Douglas approach



Figure 4: ERPT to goods and services prices. *Source: Authors' Calculations.*

ing energy, whilst when we regress HICP excluding energy and food, the relevant coefficient is only significant two quarters after impact. One implication of this outcome could be that our initial finding is somewhat driven by the behaviour of the energy and food components.



Figure 5: ERPT to core inflation. *Source: Authors' Calculations.*

This is confirmed following a deeper analysis of the HICP goods sub-index which can be decomposed into Industrial Goods and Food subcomponents. Results depicted in Figure 6 show that both sub-indices have significant pass-through of exchange rate fluctuations. Results for the food sub-index are statistically insignificant for the first year following changes in the exchange rate with very subdued point estimates. From the second year onwards however, exchange rate shocks lead to considerable and statistically significant pass-through to food prices in Malta.

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(change in price index relative to exchange rate adjustment; forecast horizon in quarters)



Figure 6: ERPT to goods subcomponents. *Source: Authors' Calculations.*

Industrial goods results feature a similar profile, with pass-through on impact being statistically insignificant before turning considerably negative between the second and fourth quarter in consideration. Looking more closely at industrial goods inflation in Figure 7, we can see that this profile is nearly wholly driven by developments in the energy subcomponent with the non-energy industrial good subcomponent featuring some weakly significant results only at around a year after the initial shock. This result is interesting on two grounds. Firstly, despite the fact that the vast majority of non-energy industrial goods in Malta are imported, exchange rate pass-through estimates for the non-energy industrial goods subcomponent are fairly low. This result is not surprising when looking at Direction of Trade (DoT) statistics. Indeed, one can note that only half of manufactured goods (SITC categories 5-8, making up around 98% of non-energy non-food imports in Malta) are imported from outside the euro area. Moreover, out of these, 60% are invoiced in euro implying that at a maximum of 20% of imported manufactured goods are exposed to currency fluctuations. Moreover, one needs to keep in mind that DoT data covers a more comprehensive subset of goods than that entering the non-energy industrial goods HICP basket. In fact, while the latter includes only finished consumer goods, trade data also includes semi-finished manufacturing products (such as production of semi-conductors) which have a greater tendency to be invoiced in US dollars. Moreover, such semifinished goods are usually part of Global Value Chains, a factor which has been shown by literature to considerably reduce exchange rate pass-through. In this light, the nonenergy industrial goods HICP sub-index might be in fact covering a basket of goods which is even less exposed to exchange rate fluctuations than suggested by the above

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otherwise.

direction of trade figures.

Secondly, energy prices feature considerable exchange rate pass-through despite the fact that currently energy prices are largely administered by Government. From 2014 onwards, in a bid to offer greater stability to energy prices and reduce uncertainty surrounding the pri of fuels and electricity, the Government has significant reduced the frequency of energy price adjustments. This has culminated in a policy of annual adjustments in energy prices that took place between 2016 and 2019. Still, the results shown in Figure 7 need to be interpreted while taking into consideration that for a substantial part of the estimation sample, energy prices in Malta (while still being largely administered by Government) were still experiencing fluctuations. For instance, between 2008 and 2013, energy prices in Malta were adjusted on a monthly frequency. Moreover, despite the greater element of price stability that ensued in 2014 and 2015, energy prices still featured some intra-year changes that roughly occurred at a quarterly frequency.

Figure 7: ERPT to industrial goods subcomponents. Source: Authors' Calculations.

4.2 Testing for non-linearities

Following the estimation of linear ERPT, we augment our model with relevant indicator variables to test for sign and size non-linearities.⁴ We define an indicator variable, δ_t , which takes state-dependent values as follows. In the case of sign non-linearity:

 $\delta_t = \begin{cases} 1 \\ 0 \end{cases}$

$$\delta_t = \begin{cases} 1 & \text{if the exchange rate adjustment is large} \\ 0 & \text{otherwise.} \end{cases}$$

if the exchange rate appreciates

Meanwhile, when testing for size non-linearity, we define a change in the exchange rate to be 'large' if the absolute value of the change in e_t in a given period exceeds one standard deviation of the series of Δe_t over the sample, in line with Colavecchio and Rubene (2020).⁵ Once again, Δe_t denotes the quarter-on-quarter change in the log of the NEER index.

We include the indicator variables in our model as follows:

$$p_{t+h} - p_{t-1} = \alpha(h) + \phi_0(h)[(1 - \delta_t)\Delta e_t] + \phi_1(h)[\delta_t \Delta e_t] \\ + \sum_{i=0}^k \mathbf{x}'_{t-i}(h)\gamma_i(h) + u_{t+h}(h)$$

Therefore, our non-linear model yields separate estimates of ERPT depending on the value of δ_t . Specifically, $\phi(h)$ yields the estimate of ERPT at each horizon *h* when the exchange rate depreciates (if testing for sign non-linearity) or when the change in the exchange rate is 'small' (if testing for size non-linearity), while $\phi_1(h)$ accordingly yields ERPT when the exchange rate appreciates or when the change is 'large'. This permits us to obtain separate IRFs for each state pertaining to each value of the binary indicator δ_t .

In terms of sign non-linearity, our results indicate that higher pass-through is observed in episodes of exchange rate depreciation, compared with appreciations. As seen in the left-hand panel of Figure 8, the coefficient for appreciations is statistically insignificant at all horizons, whilst that for depreciation episodes is significant from one quarter after impact to one year after the shock. The projected path of ERPT for depreciations follows a similar pattern to overall pass-through and its coefficient is, as expected, notably higher than that of the aggregate measure, which is dampened by the negligible effect



⁴Sign non-linearity refers to a context where the magnitude and the dynamics of ERPT differ according to whether the exchange rate change in question is an appreciation or a depreciation, while if ERPT varies depending on whether the magnitude of the exchange rate adjustment is large or small, this is referred to as size nonlinearity.

⁵Nevertheless, following from the absence of a clear theoretical definition as to what constitutes a 'large' change, we employ different definitions in subsequent sensitivity analysis. Results are not sensitive to changes in the definition of a 'large' change in the exchange rate.

of appreciation episodes. Pass-through for depreciation episodes is in fact estimated to be in excess of 40% at its highest, four quarters after the shock, while overall ERPT peaks at around 22% in the same quarter. As noted in the literature review, results for sign non-linearity in the literature tend to exhibit heterogeneity between countries, yet greater pass-through for depreciations is a relatively more common finding.

(change in price index relative to exchange rate adjustment; forecast horizon in quarters)



Figure 8: ERPT allowing for sign and size non-linearities. *Source: Authors' Calculations.*

Our results on size non-linearity are also in line with much of the literature, in that we find that large exchange rate changes are passed through to a greater extent than relatively small changes. No significant ERPT is found for small changes at all projected horizons, whilst large changes show a relatively stable pass-through which is significant up to the one-year horizon. With the exception of the impact time period and the subsequent quarter, pass-through in such instances exceeds 20%.

5 Conclusions

Exchange rate pass-through is a key metric in gauging the relationship between exchange rate adjustments and prices in an economy. ERPT estimates have several uses, not least in gauging market conditions, inflation forecasting and as an input to monetary policy decisions. This paper uses Jordà (2005) local projections to estimate ERPT to consumer prices in Malta post- euro adoption, accounting for linear and non-linear ERPT to overall consumer prices as well as to a number of price sub-indices.

The results we obtain can be summarised as follows. Estimating ERPT to headline HICP prices, we indeed find relatively high ERPT in the shorter-term horizon, which however tapers off after a year. In general, therefore, changes in currency exchange rates are reflected in local prices for up to a year after they occur; for every 1%

change in the NEER, prices change by close to 0.25% in the twelve months that follow. Nevertheless, this aggregate estimate seemingly conceals deeper heterogeneity in the transmission of exchange rate shocks to consumer prices, which is uncovered when estimating pass-through to core inflation and to goods and services prices, and also when allowing for non-linear responses to the size and direction of the exchange rate adjustment. We note that pass-through to core inflation is relatively weaker than that to overall prices, whilst as expected, we find that pass-through to goods prices is the main driving force behind overall ERPT. Passthrough to goods prices also results to be more persistent over time: exchange rate changes feed through to prices after one guarter and remain relevant even up to two years after the change. In turn, pass-through to goods prices is driven by energy, whose prices were frequently adjusted over the first half of the sample. Similarly, it results that it is mainly episodes of depreciation and changes of a relatively larger magnitude that are transmitted into inflation, with effects mostly sustained over an eight-guarter forecast horizon, whilst effects for appreciations and small changes are negligible. Our results are also mostly consistent with theory and with the empirical literature for euro area countries.

This paper therefore provides an initial set of reducedform ERPT estimates for the Maltese economy using a robust methodology and accounting for changes in the monetary regime. In so doing, our work also serves as a benchmark for the calibration and estimation of macroeconomic models of the Maltese economy. Future studies can build upon this work by delving into ERPT to import prices, and also potentially exploring methodologies to obtain a longer time series of estimates. Lastly, in line with the latest developments in the literature, future studies can employ structural models to explore the prevalence and characteristics of shock-dependence in ERPT in the Maltese economy. Using these structural models, it would be of interest to consider the structural role of exchange rate shocks in the current inflationary environment.

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Research Article



The Maltese labour market through the lens of the Beveridge curve

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Abstract. This study examines labour market developments in recent periods of rapid economic growth. The shifts in the Beveridge curve, which shows the relationship between unemployment and job vacancies, are analysed to isolate transient changes in the relationship between vacancies and unemployment and the efficiency of labour market matching. The inflow and outflow risk rates are estimated for the period 1998-2022. The results show, among other things, that the matching efficiency — how effectively job seekers are paired with suitable job opportunities — improved while the job separation rate — the frequency at which workers leave their jobs - decreased over the years. The study also looks at searching externalities to show that the congestion effects caused by firms are greater than those caused by workers. The paper shows that in recent years, the negative externality caused by firms themselves has not materialised into a higher natural unemployment rate, as it has also been demonstrated that matching efficiency has increased too.

1 Introduction

Between 2013 and 2016, the Maltese economy grew remarkably well. Real GDP grew at an average rate of 7.3% per year, accompanied by dynamic job creation that brought unemployment to a record low of 4%. From 2010 to 2016, the relationship between unemployment and job vacancies, known as the Beveridge curve, appears to have shifted inward (Baldacchino & Cassar, 2022), suggesting improvements in matching efficiency, i.e., how effectively job seekers are paired with suitable job opportunities. The decline in the unemployment rate to a record low has prompted debates as to whether the underlying positive trends in the labour market are structural (Vella & Vella, 2015) and, if so, whether the low unemployment rate could persist once economic momentum weakens. The magnitude and speed of growth as well as the labour market tightness has led many to question whether it has become even more difficult to match the remaining pool of unemployed with new jobs (Ellul, 2018). It is unclear in which direction and to what extent the matching efficiency of the Maltese labour market has developed in recent years and where it stands today.

Against this background, this paper attempts to shed light on the matching efficiency in the Maltese labour market by considering the Beveridge curve and the matching efficiency process from 1993 to 2022. The hypothesis to be tested is that the rapid economic growth recorded in recent years has had a major impact on the labour market, such that the Maltese labour market is characterised by a significant increase in efficiency in matching workers and employers. This suggests that the Beveridge curve has shifted inward in recent years. To test this hypothesis, the paper estimates job entry and exit rates from the administrative data. The matching process is assumed to follow a Cobb-Douglas function with constant returns to scale.

Furthermore, the relationship between job vacancies and unemployment is discussed within the context of search externalities, about which we know little so far. In times of high unemployment, many workers engage in job searches simultaneously, which can either lead to a situation where one worker's search efforts reduce the chances of others finding a suitable match (congestion), or conversely, where one worker's search activity enhances the likelihood of a successful match for other workers (positive spillover). Conversely, in times characterised by high job vacancies, many firms engage in recruitment efforts, potentially displacing opportunities for other firms to find suitable matches. Alternatively, the heightened intensity of their search efforts can increase the likelihood of successful matches for other firms. To the knowledge of the present author, this is the first time that the natural rate of unemployment has been presented using unemployment inflows and outflows, and discussed in the context of search externalities.

The article is structured as follows. Section 2 introduces the conceptual framework adopted in the analysis of Beveridge curve shifts. Section 3 analyses the behaviour of the Beveridge curve, while Section 4 presents the estimation of matching efficiency and analyses Beveridge curve shifts that are likely to be of structural nature. Section 5 investigates the dimension of labour market mismatch. Section 6 concludes and discusses implications for policy.

2 The conceptual framework of the Beveridge curve

2.1 Unemployment and search externalities

The Beveridge curve, which depicts the inverse correlation between unemployment and job vacancies, is often used to classify the various types of shocks that might affect the labour market. Its justification is based on the job search hypothesis (e.g. Pissarides, 2000), which underlines the inflows and outflows of people to or from unemployment.

In the context of job searching, unemployment is in equilibrium when there are equal inflows and outflows from it. The dynamics of unemployment are therefore explained as follows:

$$U_{t+1} - U_t = EU_t + NU_t - UE_t - UN_t$$

where E denotes employed persons, U denotes unemployed persons and N denotes the non-participation state. In a situation characterised by unemployment and employment (two-state world), by normalising the labour force to one, movements in unemployment can be expressed as:

$$\Delta u_t = s_t (1 - u_t) - f_t u_t \tag{1}$$

where s is the inflow rate (or the job separation rate) and f is the outflow rate (or the job finding rate). The job separation rate is the probability that workers will become unemployed over a given period of time, usually measured on a monthly or annual basis. The job finding rate, on the other hand, is the probability that unemployed workers find new jobs in a given period of time. If $\Delta u_t = 0$, the steady-state unemployment rate is the point at which unemployment inflows and outflows balance one another, suggesting that equilibrium unemployment is dependent on these two rates:

$$u^* = \frac{s}{s+f} \tag{2}$$

Equation (2) shows the long-term natural tendency of the economy's unemployment rate. By comparing the rate at which people find work with the rate at which jobs are separated, one can calculate the natural unemployment rate. At any one time, people are either employed or unemployed. The long-term unemployment rate stabilises when inflows and outflows are equal. The unemployment at full employment is calculated as the total of frictional and structural unemployment. This is the average unemployment rate that is expected in an economy and without cyclical unemployment. Equation (2) provides the basis of the Beveridge curve.

According to the Diamond (1981), Mortensen and Pissarides (1994) and Pissarides (2000) regarding job search hypothesis, labour market frictions make it costly for both employees and employers to find suitable partners. Workers take time to apply for and interview jobs, while firms invest resources in advertising job openings and conducting interviews.¹ In order to analyse the behaviour of the Beveridge curve throughout the course of the business cycle, Cardullo and Guerci (2019) extend the standard mismatch model by constructing an agent-based computational model of the labour market with heterogeneous workers and firms. According to this concept, search frictions occur because it costs money and time to fill a position, whereas productivity mismatch comes from firms' imperfect information about the value of the workers before the job interview takes place. Cardullo and Guerci conclude that because of these frictions, despite an increase in job openings, unemployment can still remain high.

The matching function implies that there are externalities in the matching process, as suggested by Diamond (1981) and Mortensen (1982). Thick market externalities refer to the positive effects that arise from having a large number of buyers and sellers in a market. When a market is thick, there are more opportunities for buyers and sellers to find each other, which can lead to more efficient matching and lower search costs. For example, in a thick labour market, there may be more job opportunities available for job seekers, which can lead to faster and more efficient job matching. This suggests that the job finding rate of employees is expected to be positively correlated with the hiring rate of companies, everything else remains constant. Hence, by searching more intensively, the individual firm increases the rate at which it fills a job, and if the worker searches for a job more intensively, firms will fill their vacancies more easily. This is called as an externality because recruitment efforts have spill over effects on the counterpart in the labour market that are not internalised until a match is found.

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¹The conceptual framework of matching has been developed for other domains such as the housing market, from which a novel concept of unemployment for the rental and condominium markets is emerging (loannides & Zabel, 2018).

Congestion externalities, on the other hand, refer to the negative effects that arise from too many buyers and sellers in a market. When a market becomes congested, the search costs and congestion costs for buyers and sellers can increase, leading to less efficient matching. For example, in a congested labour market, the high demand for workers can lead to higher wages, making it more difficult for employers to find and retain workers and vacancies remaining unfilled, despite a theoretically large pool of unemployed or underemployed workers. A similar congestion could develop during periods with substantial job openings, when firms themselves make it more costly for other firms to hire (Cardullo & Guerci, 2019), increasing the wages provided and, consequently, the cost of hiring new employees.

In search and matching theory, thick market externalities are generally seen as positive, while congestion externalities are seen as negative. The challenge for policymakers and market participants is to find ways to promote thick market externalities while avoiding congestion externalities. This is due to the possibility that falling hiring activity as a result of a slower rate of job finding could be the cause of unemployment. This kind of unemployment results from congestions in the matching process, irrespective of the reservation wage, and is still there when the market wage is clearing the labour market.

Diamond (1981) goes on to demonstrate that when thick market externalities are sufficiently strong, the matching function can exhibit increasing returns to scale, making it possible for there to be multiple steady-state unemployment rates.² There could be a high or low levels of activity, meaning that as the number of job seekers and job openings in the market increases, the number of matches between job seekers and job openings increases at an even faster rate. This means that it is more likely that a match will be made the more unemployed people and firms there are on the market. Along the trajectory path towards the high-level equilibrium, firms and workers put more resources in search, driving up the returns from search available, hence the positive expectations become self-fulfilling. Conversely, if the number of employees and employers falls, job opportunities decline more quickly, and as a result, the labour market may reach a low-level equilibrium. It is feasible for both steady states to exist, but which equilibrium materialises depends on what economic agents anticipate. Thus, the search externalities explain cyclical fluctuations in unemployment by alternating waves of optimism and pessimism that cause the economy to oscillate between the various equilibrium levels,

nd 2.2 Conceptualising the Beveridge curve

independent of wages.

The matching process between employees and firms is typically summarised and can be represented by a matching function where it is assumed that the job finding rate depends on unemployment, job vacancies and matching efficiency. The process is assumed to follow a Cobb-Douglas function with constant returns to scale, $m(u, v) = u^{\alpha}v^{(1-\alpha)}$, as follows:

$$f_t(\theta) \equiv M(u, v)/u = m(1, \theta) = \frac{\mu u^{\alpha} v^{1-\alpha}}{u}$$
$$f_t(\theta) = \mu \theta_t^{1-\alpha}$$
(3)

where θ denotes the labour market tightness measured as the ratio of vacancies to unemployment, μ_t is the efficiency of the matching process and $\alpha \in (0, 1)$, which measures the job finding elasticity with respect to unemployment. $1 - \alpha$ captures represents how labour market tightness translates into job finding rate, f, for any given level of matching efficiency. Higher u is associated with more matches since there are more applicants for each job $(\partial M/\partial u > 0)$, everything else remaining constant. Likewise, holding everything else constant, more vacancies is associated with more matches, $(\partial M/\partial v > 0)$.

The matching probability for a worker is thus $p_w = \mu \theta^{1-\alpha}$ and the matching probability for a firm is $\rho_c = \mu \theta^{-\alpha}$. With $\alpha = 0$, the matching function is degenerated in the sense that more vacancies do not lead to more job occupations in the aggregate.

Equation (3) constrains the Beveridge curve to be negative and convex to the origin, which captures the relationship between the unemployment rate and the job vacancy rate. Movements along the Beveridge curve are usually associated with changes in market tightness, as measured by the ratio of job vacancies to unemployment, and interpreted as business cycle fluctuations. For example, during an economic recession, the job vacancy rate falls because firms are posting fewer vacancies, which in turn means higher unemployment rates. The underlying intuition behind the negatively sloping curve is that, for a given level of α , in times of high unemployment it takes the number of vacancies to decrease to match the high rate of job separation, thereby balancing between the inflow rate s and the outflow rate f according to equation (2) is restored. Conversely, at a given level of α , when unemployment is low, more vacancies are required to ensure that f is again equal to s. This implies that, with regard to the movement on the Beveridge curve, each point on the Beveridge curve represents a labour market equilibrium where the number of job vacancies matches

²Although the complementarity between firm and worker actions still exists at constant returns to scale, it is unable to support multiple equilibrium levels due to increasing marginal search effort costs.

the number of unemployed workers, i.e., the job finding rate is equal to the job separation rate. This means that at that particular point, there are no excess job vacancies or unemployed workers, and the labour market is in a state of balance.

In contrast, shifts in the Beveridge curve occur when there is a change in the relationship between job vacancies and unemployment in an economy. This can happen due to a variety of factors, such as changes in matching efficiency or job separation rates. Matching efficiency refers to the ability of the labour market to match unemployed workers with available job vacancies. Given a level of labour market tightness, any improvement in matching efficiency shifts the Beveridge curve to the left, implying that at a given unemployment rate, balancing s and f would require a lower rate of job vacancies in the economy. Similarly, when the job separation rate decreases, it causes a shift inward in the Beveridge curve. This means that there are fewer job vacancies available for the same level of unemployment, indicating that the labour market is becoming more efficient at retaining workers and reducing job losses and fewer vacancies are required to balance s with f, everything else remaining constant.

2.3 Cyclical and structural shocks

But where does the equilibrium structural unemployment lie on the Beveridge curve? The incentives for firms to hire must be considered in order to determine the equilibrium. In Figure 1, the Job Creation (JC) curve is a representation of the incentive to fill vacancies, which is dependent on the conditions of labour demand. Here, the higher the unemployment rate, the more incentive there is for firms to post job opportunities since the downward pressure on wage rates increases the profitability of job creation. As can be seen in Figure 1, the intersection of the BC and JC curves at point 'b' marks the location of equilibrium unemployment.

Cyclical and structural shocks describe changes in the steady-state unemployment rate. On the one hand, a positive unexpected labour productivity shock tilts the JC curve up, because a higher marginal product of labour leads to a higher net rate of return for the firm, thus increasing both wages and labour market tightness (increasing job vacancies, reducing unemployment), everything else remaining constant. This causes a movement along the Beveridge curve from point 'a' to point 'b', indicating a reduction in unemployment for the same level of job vacancies.³ This occurs because the increase in job vacancies has made it easier for unemployed workers to



Figure 1: Hypothetical Beveridge and Job Creation Curve.

find employment, resulting in a decrease in the number of job vacancies that remain unfilled. Such movements are associated with changing incentives for firms to advertise vacancies, which in turn are related to cyclical fluctuations in the labour demand.

On the other hand, shifts in the Beveridge curve are generally related to structural changes in the labour market, and can also describe changes in steady-state unemployment. This could be explained by changes in job separation rates and matching efficiency, which are structural in nature and mainly caused by changes in institutions or policies. Shifts in the Beveridge curve could also stem from cyclical shocks, simply because a tighter labour market makes it easier to find a job when times are good.

Distinguishing cyclical, demand-driven shocks from structural movements raises a number of issues. First, it is commonly observed in empirical data that a labour demand shock causes a counter-clockwise loop in the space between job vacancies and unemployment without causing a lasting shock in the Beveridge curve, thereby causing a temporary deviation from the curve. For example, adjustment to a positive labour demand shock is generally followed by a transient increase in job vacancies (e.g. Blanchard & Diamond, 1989; Hansen, 1970). As illustrated in Figure 1, a positive labour demand shock reduces the expected cost of maintaining a vacancy, makes it more attractive for firms to post vacancies, and tilts the JC curve upwards due to higher labour market intensity (movement from point 'a' to point 'b''). An increase in the intensity of the labour market in turn shortens the duration of unemployment and increases the expected value of unemployment. Through the negotiated settlement between workers and firms, firms compensate workers for a share of the reduction in the expected cost of keeping a job vacant. As wages rise, vacancies adjust downward. However, as labour market intensity increases, so does the job

³Wage determination is typically specified according to Nash's solution to a negotiated solution problem in which workers' bargaining power is less than 100%.
finding rate; reducing unemployment until the economy is repositioned at a different point on the original Beveridge curve (movement from point 'b'' to point 'b').

Second, it can be difficult to distinguish between temporary and structural changes in job finding and job separation rates. These movements are illustrated in Figure 1 where a movement from point 'a' to 'b' is associated with cyclical labour demand shocks. However, a movement to point 'c' is associated with structural improvements and represents a permanent shift in the Beveridge curve. In light of cyclical fluctuations, I make use of the matching function in order to assess the permanent shifts in the Beveridge curve as explained in the next section.

3 Beveridge curve for Malta

Figure 2 plots the job vacancy rates against the unemployment rates in Malta for the period between 1993 and 2022. The job vacancy rate is constructed as the ratio of the number of vacancies to the sum of all wage earners plus the number of unfilled vacancies. The job vacancy rate measures the frequency of open but unfilled jobs in the economy.⁴ Baldacchino and Cassar (2022), using data from 2002 to 2019, claim that the Beveridge curve saw two inward shifts, the first in 2012 and the second, larger shift, in 2016. The second inward shift was also affected by a positive output gap. Both changes were brought on by the entry of foreign workers and, to a lesser extent, by the acceleration of active labour market measures.

In general, identifying persistent shifts in the Beveridge curves requires a longer time series. However, from the available data, we can still see possible break in the relationship that corroborate these arguments. As expected, this shows that there has been both a leftward movement and an inward shift over the years, suggesting an improvement in matching efficiency coupled with a decrease in NAIRU. A notable break can be seen during the pandemic as the job vacancy rate fell sharply and the unemployment rate rose only slightly, causing the Maltese Beveridge curve to shift inward. The inward shift was driven by a low job separation rate due to unprecedented fiscal interventions and uncertainty, leading to a decline in the job vacancy rate. 2021 was followed by a recovery in the vacancy rate and a slight decline in the unemployment rate. The year 2022 was also marked by a decrease in vacancy along with a decrease in overall unemployment.

How do the Maltese Beveridge curve changes compare to those in other countries? Arpaia et al. (2014) are



Figure 2: Beveridge Curve.

one of the studies to track the changes in the Beveridge curves across the post-crisis period from a cross-country perspective. Overall, it was found that there is significant variability amongst EU member states in terms of Beveridge curve shifts. In reality, evidence of a structural decline in labour market adjustment was mostly found in euro area countries that were hit by the debt crisis, whereas evidence from certain other countries, particularly Germany, shows to increased adjustment effectiveness. The study also revealed that skill inequality worsened in most EU countries as demand for unskilled labour continued to decline and was insufficient to absorb the existing workforce, while demand for skilled labour fell even further. Similar to this, Consolo and Da Silva (2019) found that the Beveridge curve for the euro area appears to have dramatically shifted outwards, indicating that aggregate matching efficiency has drastically declined since the start of the Great Recession and the debt crisis. The increasing mismatch between skill supply and demand and the growing disparity in unemployment rates among countries, according to the authors, are the two key causes of the fall in matching efficiency. The interesting thing about this is that it was noticed before the Covid-19 pandemic made matching inefficiency worse during the post-lockdown recovery. Kiss et al. (2022) revealed that there was a slight upward shift in the EU Beveridge curves during 2020, which was partially reversed in 2021. Despite the fact that there was some worsening of skill mismatches in the aftermath of the COVID-19 pandemic, this decline seems to have had a minimal impact on the matching efficiency. In summary, various factors indicate that the coexistence of both labour market slack and shortages was likely a temporary phenomenon. The shortages in labour appear to be primarily a result of the labour market recovery rather than obstacles in reallocating la-

⁴The definition adopted by this study is the same as that used by Daly et al. (2012), but differs from the Eurostat definition. Eurostat defines the job vacancy rate as the proportion of total posts that are vacant expressed as a percentage of the sum of occupied posts and number of job vacancies.

bour resources.

The increase in unemployment in the EU during the 2008 crisis was cyclical rather than structural, according to comparisons with the US (e.g. Chen et al., 2011; Daly et al., 2012; Dickens & Triest, 2012; Elsby et al., 2010, 2013), or structural mismatches of a temporary nature (Daly et al., 2011; Lazear & Spletzer, 2012). Analysis of the primary factors influencing matching efficiency between 2000 and 2013 reveals that skill mismatch, welfare dependency, and prolonged unemployment are the main causes of the EU's declining matching efficiency (e.g. Arpaia et al., 2014).

Furthermore, the majority of the literature on the subject agrees that, in comparison to other developed countries, unemployment exit rates in European nations are more substantial than unemployment inflow rates. According to Elsby et al. (2013), 85% of the change in unemployment in Anglo-Saxon economies is attributable to job finding, with 15% of the change attributable to the separation rate. It has been noted that the split between inflows and outflows into unemployment is substantially closer to a 45:55 ratio for the countries of continental Europe and the Nordic region.

4 Method and Data

Job finding rates (outflows from unemployment) and job separation rates (inflows into unemployment) are estimated to provide insight into the Beveridge curve shifts (e.g. Barnichon & Figura, 2010; Daly et al., 2012; Şahin et al., 2014). These rates provide a quantitative explanation of the significance of inflows and outflows in influencing how unemployment behaves over the business cycle. It then estimates discrepancies in the pattern of job finding and job separation rates that might be associated with structural adjustments in labour market flows. The degree of labour market tightening (i.e., the correlation between the unemployment rate and the job vacancy rate) and its effects on unemployment flows are used to monitor structural changes. The methodology, which has its roots in the labour market's search and matching framework (e.g. Pissarides, 2000), enables one to account for the fact that it is simpler to find a job in good times simply because there are more openings compared to the number of jobseekers.

4.1 Job finding and job separation rates

Let F_t be the job finding probability which measures the probability that a jobseeker will find a job in a given time period and let S_t be the job separation probability which measures the probability that an employed person will be unemployed in a given period of time. Using data on the number of unemployed persons, U_{t+1} , and on the number

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of unemployed of less than d months, $U_{t+1}^{< d}$, I first construct yearly outflow rates series as in Shimer (2005) and Elsby et al. (2013). d is defined as "less than one year" based on the duration that is indicated in the administrative data sources. Specifically, the probability that an unemployed worker exits unemployment within d months, F_{t+1} , can be calculated from

$$F_t = 1 - \frac{U_{t+1} - U_{t+1}^{< d}}{U_t} \tag{4}$$

from which the outflow rate f_t can then be derived as:

$$f_t^{(5)$$

 f_t is the monthly job finding rate (hazard rate) associated with the probability that an unemployed worker at time *t* completes his spell within the subsequent *d* months. Here, *d* is equal to 12 months.⁵

The separation rate can be calculated using a similar approach. However, due to lack of data on employment duration, the job separation rates need to be estimated indirectly, using the evolution of unemployment over time: $U_{t+1}^d = E_t S_t$, meaning that whenever an employed person loses his job, he becomes unemployed (Shimer, 2005). However, this entails a significant time-aggregation bias. When a worker loses his job, he has on average half a month to find a new job before the person is recorded as unemployed. Hence, the short-term unemployed can be approximately written as:

$$U_{t+1}^{s} = E_t S_t (1 - F_t)$$
(6)

The separation probability can then be measured, by solving equation (6):

$$S_{t} = \frac{U_{t+1}^{s}}{E_{t}(1 - F_{t})}$$
(7)

Likewise, the separation rate is:

$$s_t^{< d} = \frac{\ln(1 - S_t)}{d} \tag{8}$$

4.2 Measuring matching efficiency and natural rate of unemployment

In order to disentangle temporary and structural changes, it is common to model the matching function, which describes a stable relationship between labour market intensity and the job finding rate. Assuming a Cobb-Douglas matching function, the elasticity of the job-finding rate

⁵The workers' job finding rate can be modified in the given framework to reflect the vacancies' worker finding rate, or the percentage of all vacancies in a given month that find workers in the next month, by dividing the monthly job finding rate by the labour market intensity.

with respect to labour market tightness (i.e., the ratio of job vacancies to unemployment) can be estimated, derived from Equation (3), as follows:

$$\ln f_t = \beta_0 + \beta_1 \ln \theta_t + \epsilon_t \tag{9}$$

where β_0 is commonly used as an estimate of the matching efficiency parameter, μ , β_1 provides an estimate of the elasticity parameter $1 - \alpha$ and ϵ_t is the random error, capturing the matching efficiency parameter. The estimation of Equation (9) is performed using the ordinary least squares (OLS) and two-stage least squares (2SLS) methods on the logs of the Cobb-Douglas matching function. For the 2SLS method, lags of the vacancy and unemployment rate have been used as instruments. Because of the small sample size, I also report the wild bootstrap standard error (Roodman et al., 2019).

Furthermore, from Equation (2) it can be shown that the matching efficiency has a direct effect on u^* :

$$u^* = \frac{s}{s + \mu \theta_t^{1-\alpha}}$$

where,

$$\mu_t = \left(\frac{s_t}{u_t^*} - s_t\right) \left(\frac{1}{\theta_t}\right)^{1-\alpha} \tag{10}$$

All else equal, Equation (10) implies that reduced matching efficiency will raise the frictional or structural level of unemployment, hence the natural rate of unemployment.

According to Pissarides (2000) and Petrongolo and Pissarides (2001), the job finding and job separation rates can be seen as a representation of the externalities that the total pool of unemployed people and job vacancies have on the probability that an unemployed person or firm would find a job and fill a vacancy. This is so because during the individual level search process, vacancies and unemployment are assumed to be taken as given. From Equation (3), one can solve for the elasticity of job finding with respect to the aggregate unemployment as $\alpha - 1$. The absolute value of $\alpha - 1$ reflects the strength of the negative congestion effect of the unemployed pool on an individual job seeker's likelihood of finding a job. In other words, the greater the absolute value of $\alpha - 1$, the harder it is for an unemployed person to match with a job vacancy. By contrast, α captures the degree of the thick market effect of the pool of unemployed on the job finding likelihood of an employer. That is, the greater the absolute value of α , the easier it is for an employer to find a job seeker.6

The positive spill over impact of vacancies is the converse of the congestion externality, as noted by Petrongolo and Pissarides (2001). Particularly, the elasticity of job finding with respect to vacancies is $1 - \alpha$. This means that as the number of job vacancies increases, it becomes easier for workers to find a suitable job. By contrast, $-\alpha$ measures the congestion effects of firms on each other, in that more job vacancies makes it harder for other firms to find a suitable job seeker for their open positions.

The underlying intuition of this externality concept is that, independent of a job seeker's own activities, the chances of finding a job decrease as the total number of unemployed rises. The probability that a job seeker will fill a vacancy again regardless of his activities grows with a larger pool of open positions. As a result, this approach makes the estimation of the matching function — which is simply represented by the coefficient under the assumption of constant returns to scale — essential for determining the magnitude of these labour market congestion externalities.

To that end, I use Equation (9) that suggests a loglinear relationship between job finding rate and labour market tightness in the estimation of matching function for Malta. Petrongolo and Pissarides (2001) found that the estimated unemployment elasticity is about 0.7 and the job vacancy elasticity is 0.3, implying that the congestion effects caused by firms are larger than those caused by workers.

5 Results

5.1 Unemployment inflow and outflow rates

Figure 3 shows the annual outflow and inflow rates for the years 2022 to 2022 expressed on a monthly basis. Between 2002 and 2013, marked by structural fiscal efforts by the authorities and a period of recession in the second half of the noughties, the job finding rate appears to have fluctuated between 4% and 6% and to have steadily declined for three consecutive years between 2007 and 2013. 2009 and 2010-2013. Indeed, despite the potential economic gains in favour of Malta's EU accession in 2004, Malta's catching-up process has been less positive as the income gap compared to the EU15 countries widened rather than closed in the first decade of EU accession (Vella, 2015). For the period 2014-2019, the job finding rate retained sustained moderate-to-high levels as the Maltese economy was tied to a process of robust economic growth, largely driven by the service sector. This growth led to a significant increase in the demand for labour and, as a result, the number of unemployed fell. The finding rate significantly rebounded to a record high in 2021 following the Covid-19 pandemic. This is because the Maltese economy saw a stronger and faster recovery in jobs than almost everyone expected for 2021 and 2022.

Interestingly, the rate of job separation suggest that

⁶For a full discussion see Kanik, Sunel and Taşkin (2013).

after 2005, job destruction began to decrease, only to increase again year-on-year between 2008 and 2010. After 2010, the job separation rate improved considerably, indicating strong labour demand and structural improvements in the labour market.



Figure 3: Job finding and separation rates.

5.2 Labour market tightness

The relationship between job vacancies and unemployment summarises the tightness of the labour market and illustrates the demand and supply conditions. The labour market tightness is measured as the ratio of job vacancies to unemployment.

As can be seen in Figure 4, the job vacancy-tounemployment ratio fell during the 2009 recession and has since recovered, with the exception of 2020. The easing in 2020 was due to a drop in job vacancies and slightly higher unemployment seen during the recession, a time of the pandemic. The job-finding rate also tends to be proportional to the intensity ratio (Figure 5). The number of data points below the trend line and to the right of the vacancy/unemployment ratio may indicate that the economy has not enough created new occupations, despite employers' desire to hire more workers. In fact, years of high vacancies like 2017-2019 could have led to bottlenecks in finding workers and negative externalities for companies, also known as congestion externalities.



Figure 4: Labour market tightness.



Figure 5: Job finding rate and labour market tightness.

5.3 Search externalities and matching efficiency

The elasticities of the matching function with respect to labour market tightness are presented in Table 1. These results are derived from the OLS and 2SLS estimates of Equation (9), using the lagged values of vacancies and unemployment as instrumental variables.⁷ In both estimates I also set a dummy variable is set takingthat takes on the value 1 on 2020.

The results indicate that $1 - \alpha$ is estimated to be positive and statistically different than zero at 1% significance level. The estimated coefficient implies that a 1% increase in vacancies (unemployment) increases (decreases) the job finding probability by about 0.13%.

The implication of Cobb-Douglas specification for the matching function and constant returns to scale are that the elasticity of the job finding rate is approximately 0.88 for unemployment and 0.13 for job vacancies. The value of α (0.88) indicates that the thick market externalities are much higher from workers to firms than from firms to workers. The findings, therefore, indicate an increase in job opportunities in the Maltese labour market when the pool of unemployed people increases. The corollary of such an argument is, of course, that other things being equal, the greater the number of unemployed, the less costly it is for firms to fill their vacancies, thereby creating opportunities to expand job creation. The fact that policies are much more responsive to unemployment than to job openings (for example, active labour market policies), which intensify job seekers' search efforts, is likely the cause of the thick market effects strength among workers. Additionally, during periods of low economic activity, there may be a major improvement in the flow of information regarding potential work prospects and the usage of referral systems during high unemployment

 $^{^7 \}rm Wooldridge's$ score test does not reject the null hypothesis that vacancy-to-unemployment ratio is exogenous at the 5% level. I also do not reject the null hypothesis that the instruments are valid at the 5% significance level.

	OLS	2SLS
Unemployment $(lpha)$	0.875*** (18.50)	0.864*** (14.16)
Vacancies $(1 - \alpha)$	0.125*** (2.64)	0.136** (2.23)

Table 1: Estimates of the matching equation. Notes: t-values are reported in parentheses. The t-values are generated from wild bootstrap-values (Kline & Santos, 2012) with 999 replications (Roodman et al., 2019). *, **, and *** denote statistical significance at 10, 5, and 1%, respectively

periods.

In contrast, the estimated value of α suggests that the congestion effects on firms are much larger than those on workers. This means that the cost of creating new jobs increases as more companies enter the labour market or expand their operations, causing market congestion. Indeed, the negative externality caused by firms on each other amount to -0.87, whereas the negative externality by workers is -0.13. That is consistent with what is commonly seen that, during periods of high labour market intensity in Malta, it has become more challenging to fill positions with people due to labour market frictions. Firms would search harder for workers and stay in the market longer due to the increased rewards they receive from filling new job openings, which would exacerbate the externalities of labour shortages faced by other firms. The empirical evidence is also consistent with the idea that corporations have stronger congestion effects than workers (e.g. Petrongolo & Pissarides, 2001).

The matching efficiency extracted from the estimated function is shown in Figure 6. The movements in the efficiency rate reflects the natural rate of unemployment as derived from Equation (2) and unemployed as sourced from administrative data only. A number of remarks are in order. After the Great Recession, the NAIRU has decreased, as can be shown. Around this time, similar developments were seen in the Baltic, Nordic, and Southern European nations. The matching efficiency has increased since, reaching a peak in 2022. This shows that after 2014, significant inward shifts in the Beveridge curve were observed, and this is supported by expectations that lower inflow rates and higher outflow rates cause the Beveridge curve to shift inwards and the natural rate of unemployment to drop gradually. It is important to note that the NAIRU estimates should be interpreted with great caution because it is only estimated for registered unemployed, while NAIRU estimates typically include people who are not eligible for benefits or who choose not to register with the labour authorities and are driven primarily by structural indicators.

One also has to consider that the ability to sustain a



Figure 6: Matching efficiency and NAIRU.

reasonably high job-finding rate, even in a labour market with high tightness, may be partially attributed to the influx of foreign labour. When a country imports labour, it expands the pool of potential job seekers, potentially resulting in a higher job-finding rate due to the increased labour supply. This situation could potentially obscure the true extent of structural enhancements in the lab or market for native workers since the increased labour supply might lead to higher rates of job matching. Indeed, while the pool of unemployed individuals has decreased, the increase in foreign labour may have affected the matching efficiency for native populations. For foreigners (in particular third-country nationals), this might not be an issue, as they typically require employment for residency, which could imply optimal matching. Consequently, the overall matching efficiency could have had mixed effects, potentially deteriorating for natives but improving for foreigners. Unfortunately, the data at hand did not permit testing this hypothesis directly. Nonetheless, a robustness check was conducted to assess structural changes before and after 2012/13, particularly considering the heightened dependence on imported labour during the latter period. The findings remained relatively consistent. In addition, according to recursive estimates, the congestion effects on firms also suggest to be more substantial than on workers. When excluding data from the post-2013 period, congestion effects were observed at approximately 0.73.

6 Conclusions

This paper has argued that the rapid economic growth recorded in recent years has had a major impact on the labour market, such that the Maltese labour market is characterised by a significant increase in efficiency in the matching between workers and employers. This suggests that the Beveridge curve has shifted inward in recent years. The hypothesis was tested using the estimated job entry and exit rates from the administrative data.

The results also show, among other things, that despite the record high intensity of the labour market, Malta has still managed to maintain a sufficiently high job finding rate. However, the results also suggest that the economy has not created enough new occupations, despite employers' desire to hire more workers. In fact, years of high vacancies like 2017-2019 and 2012-2022 could have resulted in congestion effects created by the companies themselves, increasing search costs and thereby reducing the firms' returns from hiring additional workers, everything else remained constant. Small domestic suppliers are limited in size and therefore the search for companies is likely to crowd out other firms' chances of finding a suitable employee. So far, this negative externality has not translated into a higher natural unemployment rate, as it has also been shown that matching efficiency has also increased, likely reflecting the heavy reliance of immigration on the needs of the economy and the use of active labour market measures. However, when examining the sectoral level, one may find that if a substantial portion of imported labour is concentrated in specific industries or occupations, it could contribute to the perception of overall congestion. This sectoral congestion, in turn, might limit the extent to which structural improvements in the labour market contribute favourably to a low natural rate of unemployment.

The results presented in this study are subject to certain caveats that must be acknowledged. First, the paper analysed the main features of the Maltese Beveridge curve by estimating the annual hazard rates for inflows and outflows. The behaviour of the Beveridge curve is sensitive to changes in labour market conditions, and thus the unavailability of more frequent data makes it difficult to relate changes in adjustment efficiency to structural rather than cyclical changes in the labour market. Second, the study follows the general literature by assuming a twostate level, namely unemployment and employment. Data constraints limit efforts to also account for transitions in and out of inactivity. It is important to recognise that given the rapid convergence of the employment rate towards the EU-27 average, this transitional state was very important and the job finding rate could be even higher if the middle-aged inactive cohorts were considered as the

natural unemployed. Furthermore, future research could assess the different search externalities per sector, as it is likely that there is a high degree of heterogeneity between sectors. Matching efficiency is also somewhat abstract, and this deserves a closer look at what drove matching efficiency over the years.

Future studies can consider the role of imported labour when interpreting the observed improvements in the job search outcomes. The influx of labour from abroad could have significant effects on various fronts, potentially improving job finding rates and matching efficiency, then with the consequence on the natural rate of unemployment. For example, the observed labour immigration over the recent years indeed contributed to filling labour market gaps, and in this context, it is important to consider whether the increased matching efficiency could be partially driven by the ease of finding suitable employees from abroad. In such a case, the estimated natural rate of unemployment could be artificially low. This might obscure the assessment of the effectiveness of certain domestic labour market policies and structural changes especially those targeting the native population.

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Research Article



House purchase affordability for first time buyers in Malta

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Abstract. Malta is a nation of homeowners but there is increasingly widespread preoccupation that housing is no longer affordable. With a homeownership rate of around 80% that has remained stable for more than a decade, any metric of affordability should focus on the distribution of outcomes across households rather than relying on economy-wide averages. In this regard, firsttime buyers tend to be among the most affected group. Housing affordability for first-time buyers has mainly two components-the ability to access sufficient credit from a bank (purchase affordability) and, subsequently, the ability to maintain mortgage repayments (repayment affordability). This paper develops an affordability index that is specifically targeted for first-time buyers for the period 2000-2022. The focus on purchase affordability recognizes that bank lending policies and conditions play an important role for first-time buyers. In this paper, property prices refer to a two-bedroom finished apartment in selected localities across Malta using realistic assumptions about bank lending policies. The paper shows that affordability differs significantly by locality. This heterogeneity by locality could explain the subjective perceptions about the deteriorating housing affordability in Malta as firsttime buyers with low-to-medium levels of income are likely to face difficult trade-offs in this regard.

Keywords: Housing affordability, house prices, first-time buyers, Malta.

1 Introduction

Despite being a nation of homeowners, there is increasingly widespread preoccupation that housing in Malta is not affordable. This concern conflicts with statistics showing that the homeownership rate in Malta has re-

ments over the duration of the mortgage. This paper extends the analysis in Micallef (2022b) by developing a housing affordability index that is specifically targeted for first-time buyers. The index refers to the ratio of household income to the minimum income required to qualify for a mortgage to purchase a property.

The latter is a function of five key parameters: property prices, bank lending rates for mortgages, years to loan repayment, loan-to-value (LTV) ratio and the debtservice-to-income (DSTI) ratio. Hence, the index focuses

mained relatively stable at around 80% over the last decade and that Maltese households have among the lowest housing overburdened rates, defined as those spending more than 40% of their disposable income on housing, among the EU countries (Frayne et al., 2022). Any metric of affordability should thus depart from economywide averages and instead focus on the distribution of outcomes across households, with the young and those on low-income being among the most affected. Firsttime buyers—those that have yet to climb on the property ladder—especially those with low-to-medium levels of income, clearly fall within this category.

This paper is concerned with housing affordability for first-time buyers. For this category, housing affordability has two components. The first is defined as 'purchasing affordability' and refers to the ability to borrow sufficiently from a bank to purchase a property. This notion of affordability recognizes the presence of credit constraints in mortgage markets that can arise, for instance, due to insufficient income or inadequate savings for the deposit (Micallef, 2022b). Of crucial importance is the deposit for the down-payment, which serves two purposes (Meen, 2018). First, the deposit is required by banks to account for adverse selection under asymmetric information and, second, for financial stability purposes to satisfy the regulations by financial regulators. The second component of affordability refers to 'repayment affordability' and it involves the ability of the borrower to maintain the repayments over the duration of the mortgage.

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specifically on purchase affordability, recognizing that for many first-time buyers, the challenge of getting a mortgage, especially the accumulation of sufficient funds for the deposit (and other housing-related expenses), tend to be much more onerous than repaying the loan over several years. In doing so, it recognizes that whilst economists, analysts and policy makers commonly refer to the 'housing market', in practice this market consists of several sub-markets—of which the entry level market targeted by first-time buyers is just one—that are best analyzed separately. Another contribution of the paper refers to the analysis of purchase affordability over the business cycle since the index is calculated over a long period, covering the period between 2000 and 2022.

The rest of the article is structured as follows. Section 2 provides a brief review of the literature. Section 3 describes the methodology and the data used in this study. Section 4 discusses the results while Section 5 provides a sensitivity analysis to test how the baseline results change to alternative assumptions about the main parameters used in the model. Section 6 discusses the results and concludes.

2 Literature review

Housing affordability expresses the relationship between households' income and its housing costs. A common metric to assess affordability is the house price-to-income ratio (Meen, 2018). The main advantage of this approach is that it relies on data that are readily available for most countries, which facilitates international comparisons. In turn, this indicator forms the conceptual basis for the ratio method of affordability, which is typically defined as housing expenditure-to-income ratio (Edmiston, 2016). The intuition behind this approach is that expenditure on housing should not exceed some threshold of household income. The threshold for being cost-burdened is commonly defined as 25% or 30% of household income (Brooks, 2022; Edmiston, 2016).

Most applications of the ratio method of affordability focus entirely on the aggregate position of the economy and are thus inadequate to capture the position of specific groups such as first-time buyers. Indeed, this method fails to make a distinction between purchase affordability (i.e., the ability of borrowers to obtain the necessary funds to purchase a property given bank regulations and conditions) and repayment affordability (i.e., the overall burden of repaying the mortgage over its lifetime). Gan and Hill (2009) make this distinction by drawing on the Valueat-Risk concept that takes into consideration the entire distribution of house prices and income rather than just the median. These authors show that due to the skewness in the house price and income distributions, the housing affordability problem may be significantly worse for lower income households than suggested by standard median measures. Another limitation is that it fails to account for other macroeconomic trends, such as the long-term decline in nominal interest rates or developments in the financial sector. For instance, lower interest rates allow households to purchase more expensive dwellings for a given level of income, thus over-stating the affordability problems during a low interest rate environment (Meen, 2018).

A common application of the ratio approach is the Housing Affordability Index (HAI) proposed by the National Association of Realtors (NAR) in the United States (NAR, 2022). The HAI computes the ratio of the median family income to the income required to qualify for a mortgage assuming a 20% down payment (NAR, 2022). While this approach is well-suited to assess purchase affordability, most applications for Malta focus on the median household instead of first-time buyers (D. Camilleri, 2011; Darmanin, 2008; KPMG, 2022).

The literature on first-time buyers in Malta is relatively scarce, mostly due to the lack of data on this category. Recently, however, the Housing Authority made available statistics on the profile of first-time buyers in Malta, which was collected from the government scheme that gave \in 1,000 every year for 10 years to first-time buyers (Times of Malta, 2023). According to the data, most first-time buyers purchased a property in St. Paul's Bay, Zurrieq and Birkirkara, with Mosta, Zabbar, Zebbug, Qormi, Zejtun, Marsascala and Mellieha also being popular localities. With few exceptions, these localities tend to be different from the most popular localities for rental accommodation (Malta Housing Authority, 2022).

The average age of first-time buyers stands around 30 years, with most of them purchasing an apartment. While the range of property values is quite wide, most first-time buyers spend between €150,000 and €300,000 on their property, with the range depending, among several factors, on whether they are single borrowers or a couple. Indeed, around half of first-time buyers in 2022 purchased a property on their own, which is somewhat contradictory from studies that focus on the affordability of young borrowers in Malta (Briguglio & Spiteri, 2022). One reason for this discrepancy can be due to the assumptions made about borrowers' income since data from the Labour Force Survey focuses on the basic salary, which excludes overtime payments, bonuses, as well as income earned from part-time employment. Using the property database of a commercial bank in Malta, Bray and Ellul (2023) suggest that, at the micro level, property affordability reflects individual choices based on several factors, including the property type, size, neighborhood, and loc-

HAI = 100	Income for FTB is exactly sufficient to purchase a property
HAI > 100	Income for FTBs is greater than the minimum income required to purchase a property
HAI < 100	Income for FTBs is insufficient to purchase a property

Variable	Source	Time-variation	Value for 2021	
Average income	National Statistics Office, own calculations	Yes	€ 20,390	
Couple factor	Own assumption	No	1.9	
Property prices	Calculations based on CBM advertised property dataset	Yes	€ 217,375	
Loan-to-Value ratio	Own assumption	No	90%	
Interest rate	Central Bank of Malta	Yes	2.87%	
Years to repayment	Own assumption	No	35	
Debt service-to- income ratio	Own assumption	No	25%	

Table 1: Thresholds for the Housing Affordability Index.

 Table 2: Data sources and assumptions.

ality, which can be masked at the macro level.

3 Methodology and data

The HAI is calculated according to the following formula:

$$HAI = \frac{\text{Household income for first-time buyers}}{\text{Qualifying income}}$$
(1)

In general, identifying persistent shifts in the Beveridge curves requires a longer time series. However, from the available data, we can still see possible break in the relationship that corroborate these arguments. As expected, this shows that there has been both a leftward movement and an inward shift over the years, suggesting an improvement in matching efficiency coupled with a decrease in NAIRU. A notable break can be seen during the pandemic as the job vacancy rate fell sharply and the unemployment rate rose only slightly, causing the Maltese Beveridge curve to shift inward. The inward shift was driven by a low job separation rate due to unprecedented fiscal interventions and uncertainty, leading to a decline in the job vacancy rate. 2021 was followed by a recovery in the vacancy rate and a slight decline in the unemployment rate. The year 2022 was also marked by a decrease in vacancy along with a decrease in overall unemployment.

The household income in the numerator is calculated as the income for a typical first-time buyer multiplied by the average number of persons taking out the mortgage.

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The qualifying income in the denominator refers to the minimum income required for a household to qualify for a mortgage to purchase a property (Micallef, 2022b). This is a function of 5 key parameters: house prices, bank lending rates for mortgages, years to loan repayment, loan-to-value (LTV) ratio and the debt-service-to-income (DSTI) ratio. The HAI ratio is multiplied by 100 to yield an index number. Table 1 stipulates the thresholds for the HAI (NAR, 2022). For instance, a HAI index exceeding 100 implies that the income of first-time buyers (numerator) exceeds the qualifying income required for a mortgage (denominator).

The HAI is calculated over the period between 2000 and 2022. The data sources and assumptions for the main parameters in the model, which are summarized in Table 2, are described in more detail below:

Household income: Income is sourced from National Accounts statistics, which is preferred from other sources due to its long time series. In the absence of granular statistics on income, the average salary is defined as the ratio of wages and salaries to the number of employees. Statistics from the National Accounts are preferred to the Labour Force Survey because, as discussed above, income statistics from the latter only refer to the basic salary. Some adjustments are made for first-time buyers that rely on elasticities calculated by Debono (2021). According to

Cluster	Key localities in the cluster	Average property price in 2021	Population in 2021	Share of total population
В	Gzira, Msida, Ta Xbiex	€ 237,923	26,010	5%
E	St Paul's Bay, Mellieha	€ 222,576	44,780	9%
F	Birkirkara, Floriana, Hamrun, Pieta, Qormi, San Gwann, Santa Venera, Luqa	€ 201,311	92,624	18%
G	Cospicua, Vittoriosa, Senglea, Kalkara, Fgura, Paola, Tarxien, Zabbar, Zejtun, Ghaxaq, Gudja, Marsascala, Birzebbugia	€ 195,311	125,430	24%
Н	Zurrieq, Dingli, Qrendi, Rabat, Mgarr, Siggiewi, Zebbug	€ 229,401	70,639%	14%

Table 3: Clusters included in the calculation of property prices.

this study, the income for a typical non-tertiary educated individual (AGE 25-34, ISCED 4-5 education) stood 23% lower than those aged 35-44 with a tertiary level of education (ISCED 6) and 4% lower of those aged 45-54 with a similar level of education (ISCED 4-5). Taking the most conservative estimate and rounding upwards, an individual first-time buyer is assumed to earn 25% lower than the average salary, which amounted to €20,390 in 2021.² The couple factor is assumed to be 1.9. This reflects the high activity rates of females aged 25-49 years and a gender wage gap of 10% in 2020 (Eurostat, 2022b).

Property prices: House prices reflect the interplay of demand and supply in the housing market. Estimates of property prices are determined by applying a hedonic approach using the advertised house price database maintained at the Central Bank of Malta (Brincat & Ghigo, 2022). The hedonic model estimated over the period 2019Q1-2022Q3 and controls for the property type, the size of the dwelling, the location—defined in terms of 10 clusters as in Micallef and Gauci (2022)—and other characteristics such as the availability of a garage, garden or pool facilities, proximity to a seafront or the presence of views. The methodology is based on Micallef et al. (2022) and Micallef (2022b) using a total of 70,466 observations. Estimates of house prices in euro are obtained

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Figure 1: Property prices for a two-bedroom finished flat in Euro.

using the rolling time dummy method with Q=2 years.

For the purpose of this study, a typical property purchased by first-time buyers is assumed to consist of a two-bedroom finished apartment with no additional characteristics. The focus on apartment is in line with the type of properties sought by first-time buyers in Malta (Times of Malta, 2023). In terms of localities, the average of five clusters—B, E, F, G and H—is assumed (see Table 3 for details). These clusters include localities that are situated in the North, Central, Western and Southern part of the Maltese Islands and together account for almost 70% of the Maltese population in 2021. Excluded from calculations are some clusters, including the localities in the business, retail, and tourism hubs of Sliema, St Julian's and Valletta. The exclusion of these localities tallies with the information on the locality-choices of first-time buyers in Malta (Times of Malta, 2023). Given

²This approach yields close estimates to other available income statistics for comparable categories. The average basic salary in the Labour Force Survey stood at €19,590 in 2021 (this figure excludes allowances, bonuses, and overtime payments). The gross salary for a single individual earning 80% of the average salary from the Net Earnings Survey stood at €19,160 in 2021. The median disposable income for a household in the 16-34 age bracket from the Household Finance and Consumption Survey (HFCS) stood at €38,200 in 2020 (mean: €39,800)



Figure 2: Housing Affordability Index for first-time buyers.

the relatively cheaper prices, the sister island of Gozo is also excluded to avoid biasing the property price estimates downwards. According to this approach, the average property price stood at \in 217,000 in 2021 and \in 230,000 in 2022 (rounded to the nearest \in 1,000). Estimates for 2022 are well within the range of properties purchased by first-time buyers in Malta (Times of Malta, 2023). Property prices prior to 2019 were calculated using the Central Bank of Malta advertised index for apartments.

Figure 1 plots the evolution of house prices as defined above over the period 2000-2022. It is important to note that the estimates derived from this approach stand on average 18% higher than the corresponding property price transactions published by the NSO for the period 2019-2022Q3. For instance, the average property transacted in the first three quarters of 2022 stood at \in 206,400. While transacted data is preferable to advertised listings, the publicly available information from NSO is only available at a highly aggregate level and does not even allow for a distinction between property types and sizes. Furthermore, it includes all residential transactions, including for airspaces, boathouses, or garages, which might explain the relatively lower value compared to the advertised prices. As a result of these limitations, advertised listings were deemed to be superior to the aggregate transacted information.

LTV ratio: This ratio stipulates the value of the loan given by the bank relative to the value of the property and is influenced both by bank lending practices and macro-prudential regulations. Within the context of the borrower-based measures introduced in Malta, LTV ratios for first-time buyers stand at 90% (Central Bank of Malta, 2019). The LTV ratio is thus assumed to be 90%, which implies a down-payment of 10%. This ratio is assumed to be time-invariant.

Retail interest rates: Interest rates refer to bank lending rates on mortgages and sourced from the Central Bank of Malta website. These rates depend on macroeconomic forces, such as the monetary policy stance and on bank-specific characteristics, such as solvency, liquidity, and credit risk (Micallef et al., 2016). Bank lending rates follow a downward trend during this period, declining from 6.5% in 2000 to 2.8% in 2022.

Years to repayment: The years to repayment depend on the age of the borrower. Mortgage repayments are typically capped until the retirement age, which in Malta stands at 65 years. The years to repayment are assumed to be 35 years. This implies that a prospective borrower is 30 years old and thus has 35 years to repay the mortgage. This assumption is in line with the average age of first time buyers in Malta (Times of Malta, 2023) and also consistent with survey statistics on the average age that young people in Malta leave their parental household (Eurostat, 2022a). This is assumed to remain unchanged during the entire period.

Debt service-to-income ratio: This is the ratio of the monthly debt payments to the borrower's gross monthly income. The DSTI ratio is influenced by internal bank risk management and lending practices. Typical values applied by retail banks in Malta stand between 25% and 30% (Central Bank of Malta, 2019). This means that the monthly repayment should not exceed 25% or 30% of the borrower's gross monthly income. For this exercise, a rather conservative DSTI ratio of 25% is assumed. This ratio is time-invariant.

4 Results

4.1 Aggregated results

Figure 2 plots the HAI for the period between 2000 and 2022.³ The index follows a cyclical pattern around the threshold but does not exhibit a clear trend. Four episodes could be identified during this period. Housing was affordable in the early 2000s with an average HAI of 109 between 2000 and 2003. During this period, property prices were still relatively low compared to incomes, despite the high interest rate environment prevailing in the early 2000s. Figure 3 shows that property prices stood slightly less than four times the average annual salary for a first-time buyer couple. For single individuals, property prices averaged 7.2 times their salaries during this period.

A deterioration in housing affordability was recorded during the period 2004-2008. The HAI index averaged 90 during this period. Similar increases were also recorded in

³Figures for 2022 are still preliminary. Property prices for 2022 refer to the first three quarters of the year. Since only 2022Q3 data from the National Accounts were available at the time of writing, compensation per employee is projected to increase by 4.1% in 2022 in line with CBM projections in 2022Q4.



Figure 3: House price-to-income ratio.

the property price to income levels. The price of property as a result stood at about 5.2 times the average annual salary of a couple and to almost 10 times for a single individual. This deterioration occurred as the increase in property prices far outstripped the gains in wages, despite the slightly lower interest rates on mortgages. This finding is consistent with other studies of house price misalignment in Malta during this period (Gatt & Grech, 2016; Micallef, 2018).

Affordability improved significantly in the aftermath of the Great Recession. Between 2009 and 2016, the HAI averaged 127. This improvement was driven by two factors. First, house prices have not increased during the first part of this period and, by 2013, they were still slightly lower than the pre-recession peak of 2007. Overall, property prices and salaries moved broadly in line during most of this period although house prices started to register double digit growth from 2016. The second important factor behind the improvement in affordability was the sharp decline in interest rates following the monetary easing by the European Central Bank in the aftermath of the Great Recession and the European Sovereign Debt crisis. Bank interest rates to households for mortgages have declined by around 2 percentage points between 2008 and 2016, from 5.1% to 3.2%. As a result of these factors, property prices stood around 4.5 times the annual salary for a first-time couple. The corresponding ratio for a single buyer stood at 8.5.

The final period refers to post-2017 with a decline in housing affordability although the HAI index remained above 100. The HAI average 106 between 2017 and 2022, having declined to 100 in 2018 before recovering to 108 in 2021 and 2022. The deceleration in the index was mostly driven by sharp increase in house prices, which rose by double digit rates between 2016 and 2018, despite the continued downward trend in bank lending rates for mortgages. During the COVID-19 period, house prices

increased at a slower pace compared to incomes, which explains the slight pick-up in the HAI index after 2020. Overall, the drop in the HAI index during the 2017-2022 period compared to 2009-2016 is reflected in rising house price to income ratios. Since 2017, the average property price for a first-time buyer couple and single individual stood around 5.7 and 10.7 times their annual salaries, respectively.

These calculations only focus on the income required to qualify for a mortgage but do not take into consideration the additional costs associated with this process. One of the largest upfront expenses that require cash in hand is the initial deposit, which tends to be around 10% of the value of the property for first-time buyers in Malta. Given the average property price of around €230,000 in 2022, a prospective borrower should have accumulated savings of €23,000—10% of the value of the property for the down-payment. Savings for the down-payment can be a considerable barrier to homeownership for lowto-median income first-time buyers, especially those that cannot rely on others', such as their parents, financial assets for assistance. In addition to the downpayment, there are also other fees associated with the purchase of a property, such as notary and architect fees, home/life insurance policies and stamp duty.

Finally, additional funds are needed to furnish the property and make it habitable. In the absence of savings, these funds for furnishings will have to be borrowed from the bank. The interest rate on furnishings tends to be higher than the mortgage rate—in 2022, the average interest rate charged by local banks on consumer credit stood at 4.6%, around 1.8 percentage points higher than the mortgage interest rate.

4.2 Aggregated results

In addition to the aggregate HAI index, the results can be computed at a regional level according to the clustering of localities adopted in this study. Estimates of the benchmark property type—two bedroom finished apartment with no additional amenities—differ substantially across the clusters. In 2021, the estimates from the hedonic model range from €378,344 in cluster A that comprises the localities of Sliema, St. Julian's and Valletta to €154,796 in Gozo.

Table 4 illustrates the heterogeneity in housing affordability by cluster for a two-bedroom finished apartment in 2021. For comparison purposes, the last row of Table 4 reproduces the results for the aggregate HAI in 2021. Except for property prices, the other assumptions in the model remain unchanged. The locational disparity in affordability is in line with Bray and Ellul (2023). The results indicate that the HAI stood below 100 in four clusters

Cluster	Key localities in the cluster	Property price	HAI
А	Sliema, St Julian's, Valletta	€ 378,344	62.3
В	Gzira, Msida, Ta Xbiex	€ 237,926	99.1
С	Ibragg, Madliena, Pembroke, Swatar, Swieqi	€ 326,152	72.3
D	Attard, Balzan, Ghargur, Iklin, Lija, Mosta, Naxxar	€ 253,761	92.9
E	St Paul's Bay, Mellieha	€ 222,576	105.9
F	Birkirkara, Floriana, Hamrun, Pieta, Qormi, San Gwann, Santa Venera, Luqa	€ 201,311	117.1
G	Cospicua, Vittoriosa, Senglea, Kalkara, Fgura, Paola, Tarxien, Zabbar, Zejtun, Ghaxaq, Gudja, Marsascala, Birzebbugia	€ 195,662	120.5
Н	Zurrieq, Dingli, Qrendi, Rabat, Mgarr, Siggiewi, Zebbug	€ 229,401	102.7
I	Gozo	€ 154,796	152.3
HAI	Aggregate HAI	€ 217,375	108.4

Table 4: HAI for a two-bedroom finished apartment by cluster in 2021.

in 2021: cluster A (Sliema, St Julian's and Valletta), cluster B (Gzira, Msida and Ta Xbiex), cluster C (including, among others, Swieqi, Ibragg, Madliena and Pembroke) and cluster D (including, among others, Attard, Balzan, Lija, Mosta and Naxxar). Taken together, these four clusters account for around 28% of the Maltese population according to the estimates from the 2021 Census.

In Malta, housing remains mostly affordable in cluster G (including localities such as Fgura, Zabbar, Paola, Zejtun, Marsascala, Marsaxlokk and the 3 cities of Vittoriosa, Cospicua and Senglea), cluster F (including localities such as Birkirkara, Floriana, Hamrun, Pieta, Qormi and San Gwann) and cluster E (including St Paul's Bay and Mellieha). The HAI is close, though above, 100 in cluster H that includes, among others, localities like Rabat, Siggiewi, Mgarr and Zurrieq. This exercise involves some inevitable degree of aggregation and that, even within these localities, properties in some neighbourhoods may still be outside the budget of first-time buyers, especially for properties near the seafront or with views. Housing remains the most affordable in Gozo, with an HAI index of 152 in 2021.

The heterogeneity observed in property prices—and hence affordability—by cluster could explain the divergence between objective indicators and subjective evaluation of affordability (Sunega & Lux, 2016). Despite the aggregate affordability, prospective first-time buyers, especially those with low-to-medium levels of income, are likely to face difficult trade-offs, for example, in terms of location, property type and size. In the absence of financial assistance from their parents, some will find it difficult to purchase a property in the locality or neighbourhood in which they were born and raised. This could influence subjective perceptions of affordability, especially if borrowers evaluate such affordability in relative terms, that is, in relation to some reference group or historical experience (such as the properties of their parents or friends).

5 Sensitivity analysis

This section provides a sensitivity analysis to assess how the findings are affected by changes in key assumptions. The analysis focuses on estimates for 2021, which is the last year for which full year data for property prices and income is available. Table 5 describes the sensitivity scenarios, while Table 6 shows how the baseline HAI, which stood at 108.4 in 2021, changes in response to these different scenarios, each one affecting one key variable in the model whilst keeping the other parameters constant.

The sensitivity analysis for the three time-varying variables—income, property prices and interest rates—consist of adverse scenarios. Since the model is symmetric, favourable developments in these variables from the perspective of borrowing households (e.g., higher incomes or lower property prices) would have a positive impact on the HAI index. Scenarios for the other time-invariant parameters reflect realistic situations that could face first-time buyers. These consist of a lower LTV ratio (which translates into a higher down-payment requirement from

Parameter	Description		
Income	Decline in income from €20,390 to €18,500		
Couple	Decline in couple factor from 1.9 to 1.0		
Property price	Increase in property prices from €217,375 to €235,000		
Down-payment	Increase in down-payment from 10% to 15%		
Interest rate	Increase by 1 percentage point from 2.87% to 3.87%		
Years to repay	Increase in years to repayment from 35 years to 40 years		
Debt-service-to-income (DSTI)	Increase in DSTI ratio from 25% to 30%		

Table 5: Description of sensitivity analysis

10% to 15%), an increase in the years to repayment from 35 to 40 years (implying prospective buyers of 25 years of age instead of 30 years as in the baseline model) and a higher debt-service-to-income ratio, from 25% to 30%, applied by the banks. A final scenario switches off the couple factor to proxy a situation with a single buyer instead of two wage-earners.

The results are illustrated in Table 6. Referring to column 2, an annual income of €18,500 for the main reference person in the household would leave insufficient income to qualify for a mortgage loan, as shown in final row with an HAI slightly below 100, as the total householdincome is below the qualifying income. As expected, a single buyer with an annual salary of \in 20,390 (column 3) would not qualify for a mortgage as the resources fall way short of the qualify income of \in 35,731. This is in line with other recently published studies that point to the difficulty for single individuals on relatively low-to-medium levels of income to get on the property ladder (Briguglio & Spiteri, 2022; Grant Thornton, 2022). These borrowers would have to find a less expensive property than the one considered in the baseline scenario. Column 4 illustrates that the baseline household income leaves enough resources for a household to purchase a property of €235,000. A 1percentage point increase in the interest rate, from 2.7%to 3.7% (column 6), would lower the HAI index to below the 100-mark threshold. Assuming that borrowers having sufficient savings for the downpayment, a decline in the LTV ratio (column 5) improves the HAI index as it lowers the size of the mortgage. As expected, longer years to repay the mortgage (column 7) and a more generous coverage ratio (column 8) result in improved housing affordability. In the last two scenarios, the HAI stands between 117 and 130.

6 Discussion and conclusion

This paper has calculated a housing affordability index for first-time buyers in Malta over the period 2000-2022. The relatively long period considered allows for an assessment of how housing affordability has evolved over the business cycle. Property prices refer to a two-bedroom finished apartment in selected localities across Malta using realistic assumptions about bank lending policies for prospective buyers, computed for both co-buyers and single individuals. This approach is deemed to be superior to the original HAI indicator (NAR, 2022) and subsequent applications for Malta (D. Camilleri, 2011; Darmanin, 2008; KPMG, 2022), which are computed for the median household, many of whom are already homeowners. The baseline assumptions are broadly in line with the profile of first-time buyers in Malta in terms of type and value of property purchased and the age of the borrowers (Times of Malta, 2023).

The main limitation of the framework used in this paper is that it is based on a partial equilibrium assessment. The sensitivity analysis relies on the 'ceteris paribus' assumptions—holding everything else constant—but some of the variables, especially the time-varying ones, are clearly endogenous. For instance, an increase in interest rates can also have an impact on household income and property prices (Borg et al., 2020). Hence, while the model is well-suited to explain historical developments, as done in this paper, one should be careful in using this framework to conduct 'what if' scenario analysis.

The historical analysis suggests that property price-toincome ratios have been trending upwards over the past two decades. For a two-wage earner couple, the ratio of property prices to the household income has increased from 3.7 in the early 2000s to 5.7 during 2018-2022. For single individuals, property prices have risen from around 7 times their income to almost 11 during the same period. For the latter, it is becoming increasingly difficult to purchase property unless they can rely on external assistance. A caveat in this regard is the assumption about income, which in the absence of granular statistics, refers to the average for the typical first-time buyer. It is unlikely that this measure adequately captures the extent to

		Assumed Changes						
	1	2	3	4	5	6	7	8
	Baseline in 2021	Lower Income	Couple to single	Property price	Down payment	Interest rate	Years to repay	Increase in DSTI
Average income*	€20,390	€18,500	€20,390	€20,390	€20,390	€20,390	€20,390	€20,390
Couple factor	1.9	1.9	1	1.9	1.9	1.9	1.9	1.9
Household income*	€38,741	€35,150	€20,390	€38,741	€38,741	€38,741	€38,741	€38,741
Property price	€217,375	€217,375	€217,375	€235,000	€217,375	€217,375	€217,375	€217,375
Down payment	10%	10%	10%	10%	15%	10%	10%	10%
Interest rate	2.87%	2.87%	2.87%	2.87%	2.87%	3.87 %	2.87%	2.87%
Years to repayment	35	35	35	35	35	35	40	35
DSTI ratio	25%	25%	25%	25%	25%	25%	25%	30%
Qualifying income	€35,731	€35,731	€35,731	€38,629	€33,746	€41,190	€33,147	€29,776
HAI	108.4	98.4	57.1	100.3	114.8	94.1	116.9	130.1

Table 6: Sensitivity to key assumptions. Notes: *Average income refers the income for a single borrower. Household income refers to the total income for the household, which is calculated as the product of the average income and the couple factor.

which some young borrowers strive to supplement their main source of income, for instance, through overtime or part-time employment. Indeed, recently available statistics show that around half of the first-time buyers in 2022 have purchased a property on their own (Times of Malta, 2023). These statistics indicate that the value of property purchased by single borrowers tends to be lower than in the case of two-wage earners, reflecting the trade-offs that ultimately must be made to suit one's budget.

Price-to-income ratios do not take into consideration financing costs, which until 2022, have been trending downwards over the past two decades. Hence, despite the rise in the price-to-income ratios, the HAI has remained above the threshold value of 100, for which the household income would be exactly equal to the income required to qualify for a mortgage. The only exception was the period between 2004 and 2008, when the HAI declined below 100, indicating that affordability was under strain. This finding is in line with other studies that show that property prices in Malta were misaligned from their fundamentals during this period (Gatt & Grech, 2016; Micallef, 2018).

The HAI index stood around 108 in 2021 and 2022. This result differs from recently published studies on housing affordability. For instance, KPMG (2022) points a more dire picture of affordability despite using a similar methodology, with the HAI index standing below 100 since 2017, even for apartments. It is difficult, however, to triangulate the result of such low purchase affordability, lasting more than 5 years, with other data sources, including surveys such as the EU-SILC that focus on income, housing and living conditions, among others. For instance, such a persistently low HAI index should have caused either a decline in the homeownership rate or an increase in the share of young adults still living with their parents. Recent trends in both these indicators do not support this conclusion. The homeownership rate has remained relatively stable at around 81% over the past decade (Zerafa, 2023). Similarly, statistics from the EU-SILC show that the share of young adults aged 25-29 years and 25-34 years living with their parents has remained broadly stable at around 64% and 46% respectively, and recent estimates are in line with their long-term (Eurostat, 2022a).

While the HAI index remained above 100 as at 2022, property prices differed significantly by locality. This is hardly surprising given the oft-repeated mantra of 'location, location, location' in real estate circles. The analysis by clusters indicates that property prices might not have been affordable for the typical first-time buyer household in four of the nine clusters considered in this study. The least affordable cluster includes the localities of Sliema, St Julian's and Valletta. Together, these four clusters account for slightly more than a quarter of the Maltese population in 2021. On the contrary, properties remained by far the most affordable in the sister island of Gozo. It is important to point out that even within the clusters included in the index, not all properties might be affordable to first-time buyers. For instance, some properties in these clusters might still be of out of reach for first-time buyers that are in certain neighbourhoods or with desirable amenities such as with views or close to the seafront. Location matters a lot when it comes to housing (Bray & Ellul, 2023).

This heterogeneity by locality could explain the subjective perceptions about the deteriorating housing affordability in Malta as first-time buyers with low-to-medium levels of income are likely to face difficult trade-offs. Such trade-offs could involve, for instance, decisions about location, property type and size. Some buyers might not be able to afford purchasing a property in the same locality of their parents. These trade-offs could exacerbate perceptions of an affordability crisis especially if borrowers evaluate affordability in relation to some reference group or historical experience, such as their parents or friends. Less commonly mentioned in this regard, though no less relevant, is the different conditions that existed in the past, in most instances involving significant and generous government intervention to encourage homeownership, compared to today's environment (A. Camilleri, 2000; Mifsud, 2000).

Another fundamental consideration is the importance of having sufficient funds saved for the down-payment. An implicit assumption of the HAI is that a prospective borrower has the required savings but accumulating these resources takes time and is no easy feat, especially in the absence of parental support. To give an example, a 10% deposit on a property of €217,375 amounts to \in 21,737—this represents more than a year's salary in the baseline case considered in this study and more than half of the minimum income required to qualify for a loan. This is not the only savings required and, as indicated above, the calculations abstract from other property-related expenses such as stamp duty, notary and architect fees, and insurance policies. The Maltese Government is aware of this constraint and, starting from 2020, the Housing Authority launched a scheme to assist prospective homeowners who despite being eligible for a mortgage do not have the necessary liquidity to pay the down-payment on the signing of the promise of sale.

One of the key variables in the framework presented in this paper is the interest rates on the mortgage. Interest rates have been on a declining trend over most of the period considered in this study, especially in the aftermath of the Great Recession of 2009. Since 2022, however, a combination of factors—such as supply chain disruptions due to the COVID-19 pandemic, high commodity prices, the war in Ukraine and tight labour markets—have led to significantly higher inflation rates. To combat these inflationary pressures, monetary authorities have started to tighten monetary policy by gradually raising interest rates. While in Malta policy rates tend to imperfectly and sluggishly passed to the bank retail rates (Borg & Cassar, 2023; Micallef et al., 2016), the estimates illustrated in the sensitivity analysis section implies that, ceteris paribus, higher interest rates will exert additional pressure on housing affordability.

Going forward, assessments of affordability should move away from simply considering median or averages and instead emphasize the distribution of housing and incomes (Gan & Hill, 2009). This paper is intended to be a step in this direction by moving away from the median household and instead tailor instead the analysis to first-time buyers. The information on first-time buyers from the Government Scheme is a rich data source that has only recently become available. More detailed studies, however, require additional granular data, some of which may not be available. For instance, detailed housing surveys that collect regular information on people's housing circumstances and the conditions of their housing, like the English Housing Survey, are not available in Malta. This information is crucial to ensure that housing policies in Malta are based on sound and accurate information and, equally importantly, designed to target those that truly require assistance.

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Research Article



Further evidence on core inflation in Malta: A dynamic factor model approach

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Abstract. A good core inflation measure is best placed to explain the true price pressures seen in an economy, rather than the overall index of consumer prices. This is especially so in periods of heightened inflation caused by short-lived or transitory shocks. This study defines a core inflation measure for Malta based on harmonised indices of consumer prices data from January 2006 to August 2022, using a dynamic factor model. The measure indicates that price inflation experienced in Malta post-March 2021 was not transitory in nature, and the current high rate of overall inflation is consistent with a period of persistent and generalised inflation. An understanding of the difference between core and headline inflation is particularly important for a small, open economy like Malta. The inflation rate presented in this paper is well-behaved, with a number of desirable properties: It is stable, unlike headline HICP inflation, and unbiased. The core inflation measure appears to be a good signal for policymakers and social institutions with an interest in price pressures and wage bargaining.

Keywords: Malta, core inflation, dynamic factor model.

1 Introduction

This study aims to define a measure for core inflation for Malta, that informs policymakers and is able to lead to better understanding of inflationary pressures within the Maltese economy. This is achieved in a dynamic factor model framework. A core inflation measure ought to be a timely and accurate tool for policy design. A key element of the model is the disaggregation of the inflation indices between the underlying inflationary pressure (which is defined as "core inflation") and other components that incorporate volatile or short-lived shocks to inflation indices. Typically, these tend to be found in components such as energy products or fresh food. The idea behind this framework is that core inflation is best placed to explain the true price pressures seen in the economy, rather than the overall index of consumer prices which may include the temporary effects of energy or food price shocks. These effects will, by definition, be caused by extraneous shocks to the underlying price dynamics.

The importance of core inflation is all the more evident in the current inflationary environment. In a way, interest in the concept of core inflation increases in periods of high volatility in inflation rates. This is similar to the current environment, where higher energy, transport and food prices have been largely responsible for the upward pressures seen in inflation rates in Europe.

This upheaval resulted from the lengthening of the international geopolitical crisis following the Russian invasion of Ukraine, which affected the prices for many raw materials, such as oil, but especially natural gas. Together with supply chains reeling from the effects of the COVID19 pandemic, core inflation measures surged across the world—indicating a radically different scenario for inflation than was otherwise projected up until a year ago.

Over the past two years, the non-technical bystander has had to contend with surging prices for basic foodstuffs, and other frequent out of pocket purchases. In many cases, this environment has been very difficult to navigate.

Consumer price indices published in Malta remained stable for longer than the inflation perceptions of households. Prices do appear to rise in official indices, but not as strongly as the increase experienced by households. This study's first contribution is to try and see whether a generalised increase in prices occurred using a dynamic factor model framework. Furthermore, many other core inflation measures end up excluding such volatile components purely because of the magnitude of the price increase—even if that price increased may have mattered a lot to consumers. In this case, this study's second contribution is a benefit of the methodology, namely to retain these components, even if other measures exclude them.

The disconnect between observed and measured inflation results from methodological and definitional issues behind consumer price indices, which are very difficult to communicate and explain to laypersons. Typically, inflation indices are based on individual price changes to many components, which are weighted in price baskets, that are refreshed periodically to reflect household consumption patterns. Nonetheless, the difference between what is measured by statisticians and what is faced by consumers remains stark. And one is implicitly always assuming that the underlying guality of the good being measured remained the same over time. This may not always be the case in the real world. Taken together, all these pressures and pieces of information may affect how consumers form their price expectations months, or even years, ahead. Unfortunately, while prices for some items may rise strongly, overall inflation itself also has the tendency to be affected by volatility across its subcomponents. A surge in food prices may be offset by lower inflation contributions brought about by changed spending patterns, or even offset by simultaneous shifts to disinflation in inflation indices that are not frequently purchased by households.

In this sense, it is crucial to leverage as much data, at its most granular form, and apply quantitative methods to understand price dynamics. Methods that include all possible price signals—rather than those that exclude or trim volatile time series—have the distinct advantage of including all the series that matter to consumers. Crucially, any findings relating to core inflation ought to be communicated regularly to supplement the formation of price expectations by consumers.

The concept of core inflation therefore lies at the heart of monetary policy. Policymakers need to have good measures for the underlying inflationary pressures in the economy. Such measures help predict future inflation developments, allow for informed policy design, and have a recognised role in discussions dealing with collective wage bargaining, and in other social dialogue fora.

Malta, as part of the Eurosystem, follows from the European Central Bank's monetary policy decisions. The Maltese economy thus benefits from the ECB's inflation targeting regime, which focuses on annual changes in the harmonised index for consumer prices (HICP). Another important indicator for inflation in Malta is the Retail Price Index (RPI), which is the basis for the country's cost-of-living adjustment mechanism.¹

However, in reality, monetary policy is conducted using various inflationary measures, rather than just the overall index. This is because the HICP includes both persistent—or core—inflationary pressures, as well as temporary effects caused by such things as exchange rate movements, tax changes, as well as short-lived inflationary shocks linked with the prices of raw materials, or energy. These transitory inflation effects, that are temporary in nature, are usually ignored in the formation of monetary policy.

While core inflation is an important instrument in the monetary policy toolbox, there is no generally agreed definition for it. Thus, there are many different measures of core inflation. Those published for the Maltese economy be defined to be either statistical or exclusionary in nature. The exclusionary measures are calculated by Eurostat, which computes a monthly measure of inflation that excludes volatile subcomponents such as energy, food and others. These indices may also be thought of to reflect supply shocks, as well as those prices that are regulated by government. Finally, the statistical measures remove volatile subcomponents from the HICP based on some statistical ranking or ordering, typically over the span of a month.

2 Literature review

The literature on core inflation is wide-ranging in terms of definitions, applications and use for this particular term. Going back to Eckstein (1981), core inflation was identified as the change in prices that happens when an economy is on its long-run growth path. A monetarist perspective, followed by Bryan and Cecchetti (1994), links core inflation with money supply growth rate patterns. Quah and Vahey (1995), on the other hand, relate core inflation with the part of observed inflation which has no medium or long run effect on real output.

Blinder (1997) defines the durable element of measured inflation as "core inflation", suggesting that is an important component to forecast overall inflation rates. Wynne (1999) suggested a series of desirable properties that ought to be part of an ideal core inflation estimate. This study suggests that a core inflation measure should be unbiased, in that it only removes the volatile or transitory element from the inflation rate.

The measure should be timely, that is, computable in real-time and easily comparable with the overall inflation rate. In that regard, it should be stable over time and not overly sensitive to vintages of data—unless the underlying data is changed significantly. Finally, the core inflation measure should be easily understood by the general public. Ideally, it should also be reproducible without unduly complex computations. Fuhrer (2009) provides a further

¹For an in depth discussion on the differences and similarities between the HICP and the RPI, refer to NSO (2008).

definition for core inflation, by using a Phillips curve-based model with rational expectations, and splits inflation persistence using intrinsic, extrinsic and expectations-based definitions.

Turning to Malta, Ellul (2011) proposed a trimmed mean core inflation measure for Malta, while Gatt (2014) carries out an evaluation of different core inflation measures for the Maltese economy. Micallef and Ellul (2020) look into the discussion of the persistence of prices in Malta, compared to the rest of the euro area.

An established measure for core inflation is found in the factor model literature. Using disaggregated indices, an underlying component which is common to all subindices is extracted, and this in turn will represent general inflation developments. Various academics and central banks have applied these methods. Kapetanios (2002) builds a dynamic factor model to estimate a common inflation component for the UK.

Cristadoro et al. (2005), apply the same approach for the euro area, and Giannone and Matheson (2007) define one for New Zealand. Kim and Ahn (2012) study a dynamic factor-based measure for South Korea, while Einarsson (2014) constructs a core inflation measure for Iceland. More recently, Bańbura and Bobeica (2020) build a persistent and common component measure of underlying inflation in the euro area using a dynamic factor model.

3 Data

The HICP and its subindices are published monthly by the National Statistics Office and Eurostat. Once series with discontinuities or having missing values are removed, a total of 76 subindices remain. For the purposes of this study, the time period is limited to January 2006 to August 2022. The overall HICP inflation is excluded in the panel for the computation of core inflation. The model is estimated using the annual change in the index, which is then standardised by subtracting its mean and dividing by the standard deviation, before estimation.

Annual inflation, as measured by the HICP, averages 1.9% in the 200 months from January 2006 to August 2022, with a standard deviation of 1.50. Before 2022, the maximum observed for overall HICP is 5.7% in October 2008, while the minimum is - 1.1% in April 2007. Likewise, the pattern for inflation as measured by the RPI is similar to the annual inflation in the HICP. It averages 1.8% for the comparable period, with a standard deviation of 1.38.

4 Methodology

This model assumes that HICP inflation, π_t , can be split in two components that are orthogonal to one another.

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Figure 1: Inflation in Malta.

One is a core component of inflation, π_t^C , while the other is a non-core component, π_t^{NC} , or mathematically:

$$\pi_t = \pi_t^C + \pi_t^{NC} \tag{1}$$

and π_t^C captures all the underlying pressures of inflation caused by 'core', generalised or persistent inflation, while π_t^{NC} refers to transitory changes in prices, which are exceedingly short-lived and reflect non-core inflationary pressures. The use of a factor model can be justified if one assumes that π_t^C or core inflation is that part of inflation that is common across all sub-categories of the HICP, and π_t^{NC} is idiosyncratic. Factor models describe changes within a number of variables in terms of the sum of one, or multiple, variables which mirror the co-movement of the variables themselves-along with an error term that captures the idiosyncratic effect, that remains unexplained. Furthermore, by assuming some sort of distributed lag relationship within the panel and cast the variables, their co-movement and the error term, in a time series dimension, one is able define a dynamic factor model. To simplify, for a group of inflation series derived from multiple sub-indices, π_{it} , a simple dynamic factor model can be defined as:

$$\pi_{it} = L_i F_t + e_{it} \tag{2}$$

and F_t is the common factor—which changes over time while L_i are the factor loadings for each inflation sub-index *i* in the panel. Moreover, F_t follows an AR(2) process, such that:

$$F_t = c + \rho_1 F_{t-1} + \rho_2 F_{t-2} + v_t; \quad V(v_t) = Q \quad (3)$$

 e_{it} is assumed to follow an AR(1) process, such that:

$$e_{it} = \alpha_i e_{it-1} + \epsilon_{it}; \quad V(\epsilon_{it}) = R_i \tag{4}$$

The same concept was applied in Ellul and Ruisi (2022) to GDP data, with the factor model estimated here shar-

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Figure 2: Core inflation in Malta.

ing a very similar estimation methodology.² The inclusion of the Kalman filter in the model introduces a drawback due to the revision of the estimation. As the HICP index, however, is very rarely revised, the revisions are expected to be minimal in nature, and linked with the end-bias problem, rather than with the model's estimation method. By combining (1) and (2) above, it can be shown that core inflation is the multiple of the factor loading L_i for overall inflation and the common factor. Implicitly, this means that the transitory component will be subsumed in the idiosyncratic error term.

5 Results

The core inflation series, resulting from the dynamic factor model, is presented in Figure 2 along with the HICP overall inflation and that derived from the RPI. One can see immediately that the core inflation measure follows very closely developments in HICP and RPI, butcrucially-does not have the sharp volatility seen in the other time series. In fact, the only time it diverges significantly from the other two indices occurs from mid-2020 onward. While the HICP and the RPI tracked down, the core inflation measure remained in the region of 1.5%. It then accelerated sharply from March 2021, with the RPI inflation catching up to it only in July 2021 and HICP inflation in February 2022. The three inflation rates remain in close proximity thereafter, meaning that inflation has become more persistent. The largest difference with respect to core inflation occurs in April 2007 for the HICP inflation series (2.8 percentage points) and in December 2009 for the RPI (2.4 percentage points). Both periods where characterised by sharp and short-lived price shocks caused by the prices of energy and other raw commodities. Interestingly, the period of decelerating and negligible price inflation seen in official statistics from March 2020 to early 2021 appears to be missing from the dynamics of core inflation completely. In fact, the core inflation measure remains steady in this period at around 1.5%. It then begins a sharp upward increase, together with the inflation as measured by the RPI, and then—finally—joined by the overall HICP annual inflation rate.

5.1 Evaluation

The correlation between the core inflation measure and HICP inflation stands at 0.79, while that with respect to RPI inflation is 0.86. One has to be careful when constructing tests to check for core inflation's ability to track generalised price developments. As noted above, overall inflation has elements within it that are by definition excluded from core inflation. It should not be expected that the inclusion of core inflation in an equation with headline inflation will bring a meaningful improvement in residual mean square errors (RMSEs).³ The approach discussed in Cogley (2002) remains the benchmark in the literature. In fact, the same, or a similar framework for predictive evaluation is applied in various studies on core inflation or stickiness in prices, such as Reiff and Várhegyi (2013) for Hungary, Erlandsen (2014) for Norway, Einarsson (2014) for Iceland, and Amstad and Potter (2009) for the US. In this approach, to test the core inflation index's ability to track headline inflation, two equations are estimated at varying steps ahead, that is:

$$\pi_{t+h} - \pi_t = \alpha + \beta(\pi_t - \pi_t^c) \tag{5}$$

$$\pi_{t+h}^C - \pi_t^C = \gamma + \zeta (\pi_t^C - \pi_t) \tag{6}$$

where π_t is overall HICP inflation and π_t^C is the core inflation measure discussed above. The first equation tests if the core inflation rate specified in the dynamic factor model "forecasts" future inflation. The definition used here is a check on whether the difference between head-line inflation and core inflation forecasts the headline inflation rate over a step ahead of *h*. In this framework, the coefficient for β has to be statistically significant and negative. Moreover, if one cannot reject that $\alpha = 0$ and $\beta = -1$, the core inflation measure will be an unbiased predictor for inflation at step *h*.

The second test specified in this framework is a weak exogeneity test on the difference between the core inflation rate against the headline inflation rate over a step

 $^{^{2}\}mathsf{The}$ model presented in this study, however, is estimated in Python 3.10.

³In fact, adding core inflation lagged by one period to track headline inflation does not lead to significant RMSE improvements. Relative RMSEs with respect to a simple autoregressive model for headline inflation equal unity only at the 12-step ahead horizon. Relative RMSEs stand at 1.6 in the 1-step ahead horizon, 1.4 in the 2-step horizon, and stand in a range between 1.1 and 1.2 for the 3 to 11 step ahead scenarios, before reaching unity in the 12-step ahead horizon.

		Equa	tion (5)	Equation (6)	
		α	β	γ	ζ
3-	Coefficient	-0.04	-0.35	0.07	0.02
month	<i>t</i> -Statistic	-0.54	-4.89	2.50	0.59
	Standard error	0.07	0.07	0.03	0.03
6-	Coefficient	-0.03	-0.82	0.11	-0.06
month	t-Statistic	-0.29	-8.06	2.14	-1.07
	Standard error	0.10	0.10	0.05	0.05
9-	Coefficient	0.01	-1.38	0.12	-0.23
month	t-Statistic	0.06	-12.26	1.78	-3.35
	Standard error	0.11	0.11	0.08	0.08
12-	Coefficient	0.00	-1.82	0.12	-0.39
month	t-Statistic	0.04	-16.32	1.60	-4.98
	Standard error	0.11	0.11	0.08	0.08
18-	Coefficient	0.00	-1.74	0.14	-0.53
month	t-Statistic	-0.84	-14.50	1.60	-5.74
	Standard error	0.11	0.12	0.08	0.09
24-	Coefficient	-0.11	-1.30	0.13	-0.42
month	t-Statistic	-0.93	-10.18	1.41	-4.21
	Standard error	0.12	0.13	0.09	0.10

 Table 1: Estimates for coefficients - Predictive ability and weak exogeneity.

ahead period *h*. This is done by testing if $\gamma = 0$; $\zeta = 0$. The results for these tests are presented in Table 1.

Equation (5) and Equation (6) are estimated for six *h*-horizons, namely the 3-month, 6-month, 9-month, 12-month, 18-month and 24-month ahead scenarios. Focusing on the α parameter from Equation (5), it is never statistically significantly different from zero. The β is always negative, and statistically different from zero.

A check on the weak exogeneity of the core inflation measure can be carried out by looking at the rightmost columns of Table 1. The parameter γ is either not statistically significantly from zero, or the coefficient is very close to zero (0.07 in the 3-month ahead period, 0.11 in the 6-month ahead). On the other hand, the ζ parameter indicates that while no bias is seen in the 3-month to 6-month ahead horizons, a negative bias of between -0.2

and -0.5 may be occurring in the core inflation measure with respect to overall HICP. This may be explained by the post-March 2020 observations, and the sharp downward swings seen in Maltese overall HICP rates.

The measure appears to benefit from a set of desirable properties as a measure of core inflation. It tracks well inflationary developments, and is a more smooth and unbiased measure of inflation in Malta. This confirms broadly the same findings for the euro area as a whole from Bańbura and Bobeica (2020).

6 Conclusion

The core inflation rate measure discussed in this study appears to be able to provide an unbiased and weakly exogenous forecast for overall inflation in the short to medium term. Factor modelling is admirably suited to extract common trends from HICP sub-indices. The core inflation measure appears to have a number of desirable properties for policymakers. For example, the inflation rate presented by the core inflation dynamic factor model does not have the sharp upward or downward swings found in Maltese overall HICP data, and it appears to be a good signal for policymakers and social institutions with an interest in price pressures and wage bargaining. It is not only smoother, but also unbiased.

The results confirm that underlying inflation in Malta remained high through out 2020, while all other official inflation statistics showed lower inflation rates. This means that households in Malta have been experiencing inflationary pressures for a far longer period than official statistics suggests. This matters because any collective wagebargaining based on official statistics that do not capture these inflationary biases will discriminate in favour or against households—depending on the deviation of official statistics with respect to core inflation.

Some potential avenues for further research and drawbacks of this approach have to be highlighted. An extension of the core inflation exogeneity and unbiasedness tests with other measures for core inflation, such as trimmed mean indices, persistence weighted or exclusion measures can be a valid contributor to this area of research. Finally, the Kalman filter element within the dynamic factor model defined here may lead to some revisions in the core inflation rate at the end-points, as additional data are added.

In any case, the dynamic factor model-based core inflation measure is able to describe the true, underlying inflationary pressures in the Maltese economy, and highlights the unique nature of the inflationary environment from March 2021 onward, and the implications to Maltese households

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