A HEDONIC INDEX FOR PRIVATE SECTOR RENTS IN MALTA
by Nathaniel Debono, Reuben Ellul and Brian Micallef
This article introduces a novel dataset that has been developed using big data methods from publicly available sources to construct quality-adjusted indices of advertised private sector rents in Malta using hedonic methods.

A SECTORAL MODEL EXTENSION TO STREAM
by Noel Rapa
This article describes a new integrated model that serves as a sectoral extension to STREAM, the Bank’s main macro-econometric model, by using information from input-output tables. A number of simulations are presented that provide a sectoral disaggregation of aggregate simulation results, and to produce aggregate results following sectoral shocks.

HOUSEHOLD FINANCE AND CONSUMPTION SURVEY 2017: A COMPARISON OF THE MAIN RESULTS FOR MALTA WITH OTHER PARTICIPATING COUNTRIES
by Valentina Antonaroli and Warren Deguara
This article compares the main findings from the third wave of the Household Finance and Consumption Survey for Malta with those for the other participating countries. The survey provides detailed information on households’ real and financial assets, their liabilities, net wealth, income and consumption.

HOUSING DEMAND SHOCKS, FOREIGN LABOUR INFLOWS AND CONSUMPTION
by William Gatt Fenech and Germano Ruisi
This article proposes a Structural Vector Autoregression identification strategy using a combination of zero and sign restrictions to disentangle domestic and foreign housing demand shocks, and their effects on private consumption in Malta. The model is estimated using Bayesian methods on five macroeconomic variables over the period 2000-2019.
FOREWORD

The year 2020 will be remembered for the onset of the COVID-19 pandemic and the devastating impact it had on economic activity across the globe. The challenges presented are far-reaching and unprecedented in modern times. For economists, particularly those working in central banks, it required an expansion of the analytical toolkit, particularly to assess better the impact of sector-specific economic restrictions and their impact on the broader economy.

In fact, one of the four articles included in this third edition of the Central Bank of Malta’s Research Bulletin describes the modelling framework that was developed to try to cater for the partial lockdown effected in Malta. The other three cover a broad range of research areas and showcase the increasing diversity in the topics, datasets and models used by the Bank’s economists.

The first article introduces a novel dataset that has been constructed using Big Data methods from publicly available sources to get a better understanding on the evolution of private sector rents. The resulting database comprises almost 22,000 listings of advertised rents collected on a regular quarterly basis since 2017. This rich dataset is used to construct quality-adjusted rent indices using standard hedonic methods that include advertised rents and a set of observable characteristics – such as the property type, its size and location. Since 2019, the database has been augmented with additional property attributes, such as the availability of a garage, garden or pool facilities, and whether the dwelling enjoys countryside or sea views. The resulting models can be used both for valuation purposes and to construct the growth rates of advertised private sector rents over time. Concerning the latter, the results presented in this article show that the growth in advertised rents was slowing down during 2019, albeit still remaining relatively high, while in 2020, they contracted sharply, reflecting the impact of COVID-19.

The second article describes a new integrated model that serves as a sectoral extension to STREAM – the Bank’s main macroeconometric model. This input-output module was developed to shed light on the large asymmetric effects on the different sectors of the economy brought about by COVID-19, which an aggregate model such as STREAM was ill-equipped to address. The approach adopted in this article differs in two main ways when compared to existing integrated models commonly found in the literature. First, the model uses three modules and two different integration strategies, making it extremely flexible and able to address a range of policy-oriented questions. For instance, it allows for the quantification of both the aggregate effects of sector-specific shocks while taking into consideration indirect effects, as well as a decomposition of aggregate effects into sectoral deviations. It is also possible to internalise both macro and sectoral information within the Bank’s projections, while, at the same time, it can produce sectoral gross value added results that are consistent with gross domestic product (GDP) expenditure aggregates. Second, this model utilises STREAM, a fully-fledged macroeconometric model in its error-correction module, thus allowing for more realistic dynamics when compared to the single equation models used in the literature.

The third article describes some of the results of a large-scale survey that is held on a regular basis among a number of countries in Europe. This article compares the main findings from the third wave of the Household Finance and Consumption Survey (HFCS) for Malta with those for the other participating countries. The Maltese results are based on a sample of around 1,000 households, while the total sample in all participating countries consisted of more than 91,000 households. The HFCS is a valuable source of information on households’ balance sheet, income, wealth and expenditure components, and is increasingly being used for both economic research and financial stability purposes. The results show that in 2016 – the reference year for the Maltese survey – the median Maltese household held more real and financial assets, and more total liabilities, than households in most other countries, although there were fewer indebted households than in most European countries. Nevertheless, the debt-to-asset ratio indicates that Maltese households have a significantly higher amount of assets to back their debt. Largely reflecting the higher prevalence of homeownership and, to a lesser extent, investment in other property, the median net wealth in Malta was estimated to be significantly higher than most other European countries, while inequality in households’ net wealth was notably lower. At the same time, gross income of Maltese households stood lower when compared to a number of other countries, though the share of Maltese households stating that their regular expenses were lower than their income was comparable to that in countries like Germany and France.
The final article applies state-of-the-art techniques in one of the traditional models used by macroeconomists – Vector Auto-Regressions (VARs) – on Maltese data to study the linkages between house prices, foreign labour inflows and private consumption. The model is estimated using Bayesian inference methods and the two housing demand shocks of interest – a domestic and a foreign one – are identified through a mix of zero and sign restrictions. The proposed identification strategy is intended to disentangle the effects of the two housing demand shocks to capture the potentially different channels, such as the wealth and collateral channels, through which they might propagate. The article finds that domestic housing demand shocks contributed significantly to the evolution of house prices, mortgage credit and private consumption in Malta. Moreover, foreign housing demand shocks also played an important role on house prices and consumption.

Overall, the selection of these four research articles, which constitute only a snapshot of the type of research and analysis conducted by the Bank’s economists, provides an overview of the economic policy questions facing policymakers. The challenges brought about by the rapid structural changes of the Maltese economy were further amplified in 2020 by the strong impact of the COVID-19 pandemic on economic activity. For this reason, traditional modelling approaches have to be complemented by alternative indicators, datasets, surveys and new analytical tools to be able to adequately monitor economic developments. Furthermore, traditional methods of data collection are increasingly being complemented by technological advances such as big data methods, machine learning and artificial intelligence. These techniques bring a number of advantages, including access to data that were previously not readily available from official sources. However, there are also challenges associated with these advances, mostly technological, in terms of storage capacity and processing power, and human, as these methods require strong programming capabilities and analytical skills. The Bank is committed to continue investing in both technology and human capital to remain at the forefront of economic research in Malta, as well as to contribute in an active way to the policy debates, both nationally and at a European level.

Dr Aaron G. Grech
Chief Officer, Economics
A HEDONIC INDEX FOR PRIVATE SECTOR RENTS IN MALTA

Debono Nathaniel, Ellul Reuben and Micallef Brian

While homeownership remains the predominant housing tenure in Malta, the private rental market has expanded rapidly over the last decade. This article introduces a novel dataset that has been constructed using big data methods from publicly available sources to get a better understanding on the evolution of private sector rents. The database comprises of 21,883 listings of advertised rents collected over the period 2017 Q4-2020 Q2. Quality-adjusted rent indices are constructed using standard hedonic methods that include advertised rents and a set of observed characteristics. The latter include property type, its size and its location. The resulting models can be used both for valuation purposes and to construct the growth rates of private sector rents over time. Concerning the latter, the results show that growth in rental rates was slowing down during 2019, albeit still remaining relatively high, while in 2020, advertised rents contracted sharply, amplified by the effects of COVID-19.

Introduction

While homeownership remains the predominant housing tenure in Malta, the private rental market has expanded rapidly over the last decade. This growth was driven, among other factors, by the strong influx of foreign workers, evolving trends in the tourism industry, as well as changes in socio-demographic and lifestyle preferences. Recognising that the policy framework that shaped the private rental market since the liberalisation of the sector in 1995 was no longer adequate to deal with 21st Century realities, the Government enacted new legislation on 1 January 2020 that was designed to regulate rental contracts and introduce a number of responsibilities for both landlords and tenants that are overseen by the Housing Authority. However, the publication of official statistics on this sector lagged behind these developments and, as at 2020, no official rent index has been published in Malta.

In this article, we compile a hedonic index for private sector rents using advertised prices that are collected from publicly available sources using big data techniques. Hence, this study contributes to the small but growing literature on the rental market in Malta (Gatt & Grech, 2016; Ellul, 2019; Micallef & Debono, 2020) and, methodologically, on the application of hedonic approaches to housing variables (Falzon & Lanzon, 2013; Ellul et al., 2019). The proposed index is computed using standard hedonic equations to account for observable characteristics such as property type, location, size and other attributes that have an impact on the price. In terms of the time dimension, we have been collecting this dataset on a regular basis since 2017 and hence are able to assess trends in rental prices prior to the introduction of the rent legislation and the subsequent impact of COVID-19 on this sector in 2020.

"In this article, we compile a hedonic index for private sector rents using advertised prices that are collected from publicly available sources using big data techniques"

The rest of this article is organised as follows. First, we describe the properties of the database and the methodology used. Subsequently, we present the empirical analysis with illustrations of quarterly and annual growth rates using a variety of indices. Finally, we conclude and provide avenues for further research.
Characteristics of the database

Our database comprises publicly-available information about residential properties advertised for rent, collected using big data techniques on a quarterly basis since 2017 Q4. Until 2018 Q4, the database consisted of solely two housing types – apartments and maisonettes – along with information about the locality in which the property is located and the number of bedrooms. As part of a continuous effort to enrich this database, starting in 2019 Q1, this information was supplemented by the collection of data about penthouses, additional localities that were previously not incorporated and other observable property characteristics besides location and number of bedrooms. In particular, we started to collect information on attributes such as the availability of a garage, garden or pool facilities and instances where a property is advertised as being on or close to a seafront or enjoying some view.¹

“This database now comprises 21,883 listings made up of apartments, maisonettes and penthouses, covering all localities in Malta and Gozo”

Following these improvements and a data cleaning process to remove outliers and duplicates, this database now comprises 21,883 listings made up of apartments, maisonettes and penthouses, covering all localities in Malta and Gozo. As shown in Chart 1, apartments (80%) constitute the largest proportion of listings, followed by maisonettes (11%) and penthouses (9%). The number of listings averaged around 1,700 per quarter until 2019 Q2 but increased substantially thereafter, averaging around 2,500 per quarter. In 2020 Q2, data was collected on 2,752 advertised properties (see Chart 2).

Our database captures properties available for rent in 103 different localities and areas across Malta and Gozo. In the empirical analysis, these localities are grouped in ten different clusters to account for the substantial rent heterogeneity that exists among these areas while, at the same time, ensuring a sufficient number of observations in each cluster. The localities included in each cluster are listed in Table 1. Advertised rents in high-end complexes are classified separately.

Chart 3 plots the number of adverts by individual localities in Malta and Gozo in the full dataset.² Almost one third (30%) of all properties advertised since 2017 Q4 are

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¹ Properties classified as having a garage include only those whose access to a garage is included with the rent. A property is classified as having a garden or pool only if such facilities (private or communal) can be enjoyed within the property. Views may include country, town and sea views.

² The locations listed in the advertisements were matched with those of the administrative localities, as defined in Chapter 363 of the Laws of Malta. Special care was given to ensure adverts are consistent with these definitions, in so far as the limitations of the data allow.
found in the Northern Harbour area of cluster A, mainly comprising Sliema, St Julian’s and Valletta. This is followed by the cluster E in the north that incorporates St Paul’s Bay area (17%) and cluster B that includes the localities of Gżira, Msida and Ta’ Xbiex (11%). Around 4.5% of all properties in the database are located in Gozo.

In terms of size, most of the properties advertised for rent are two-bedroom (40%) and three-bedroom (46%) properties. Around 12% of listings have only one bedroom while a very limited number of properties (close to 2%) come with four or more bedrooms. Properties available for rent that are advertised with access to a garage, garden or pool are quite limited. Since the first quarter of 2019, when such data were first collected, the number of listings which were advertised as having a garage, garden or pool amounted to 3%, 1% and 2%, respectively. In comparison, the number of properties advertised as being on or close to a sea front over the same period amounted to 18% while 27% were described as properties which enjoy country, town or sea views.

**Methodology**

The methods to compute rental price inflation described in this article follow closely those discussed in Ellul et al. (2019), but are applied to advertised rental prices rather than mortgage property prices. The simplest form of a hedonic regression is depicted in (1), where \( r_{t,t} \) refers to the rental price of a property listing \( l \) at time \( t \) along with a matrix \( X \) of hedonic characteristics. The random error term \( u_{t,l} \) is the unexplained component of rental prices.

\[
\ln r_{t,l} = Xb_{l} + u_{t,l} \tag{1}
\]

This study considers a number of hedonic approaches. These are the time dummy variable (TDV) approach, the rolling time dummy (RTD) method and the average characteristics method. A detailed explanation on each of these methods can be found in Hill (2013) and Eurostat (2017).
The accuracy of such exercise depends on the model specification considered. We use Model 2 due to its consideration of property characteristics not incorporated in Model 1. Their inclusion improves the goodness-of-fit of the model and therefore provides a more accurate estimation of particular characteristic over time although this is unlikely to be the case in our dataset given the short time dimension.

The RTD method is based on the TDV method but extends it by estimating multiple regressions in a rolling time window procedure, with Q being the time window’s length. A regression is estimated using the first Q periods, which are used to compute the price indices. Thereafter, regressions are estimated by shifting the window Q by a period, with each successive new period entering the window, the rate of increase of the index is calculated and then used to update the previous sequence of index values. The choice of window length Q is arbitrary, although O’Hanlon (2011) argues that in smaller economies with data limitations, a longer window choice may improve model robustness. However, choosing a shorter window would allow more frequent updates to the estimated coefficients. In our analysis, growth rates based on the RTD method are calculated using a window length of two periods (i.e. Q = 2).

While the TDV method adds new periods to the single regression model, and hence creates revisions when new periods are included, the coefficients in the RTD method will be free from such revisions (unless new observations are included for past periods). As a new regression is estimated every period, the vector of coefficients in the RTD method will change over time. This is an advantage over the TDV method in periods when the rental market is undergoing rapid change. On the other hand, the TDV may be more robust, with significant advantages over the RTD method in smaller datasets, as the single regression uses all available data.

Another method used to calculate a hedonic index is the average characteristics approach. A separate hedonic model is estimated every period, ensuring that the coefficients of the rental listings are updated constantly. On the basis of these coefficients, the average characteristics method then imputes a price for the ‘average’ rental listing, for a given set of characteristics. The price index is then calculated as the ratio of the imputed rental price of the ‘average’ listing in period \( t + 1 \) to the imputed rental price of the same ‘average’ listing at time \( t \). The index is then chained, using either one of the Laspeyres, Paasche, or Fisher chain-linking methods.

**Empirical analysis**

Table 2 presents the results of two time-series regressions covering all quarters starting from 2017 Q4 and 2019 Q1, respectively. The difference between the two regressions lies mainly in the introduction of observable housing characteristics that started to be collected from 2019 Q1. The dependent variable is the logarithm of advertised rents. Almost all the coefficients have the expected sign and are statistically significant. Relative to apartments, penthouses generally attract a premium of between 23% and 27%. The rental price difference between apartments and maisonettes is much less pronounced and not statistically significant since 2019. Rents in clusters A and C, together with the high-end cluster J, are more expensive than the benchmark cluster B. In contrast, rents for advertised properties in all the other clusters are cheaper than those in cluster B. Rental prices increase with the number of bedrooms. For instance, two and three bedroom units stand around 35% and 65% higher compared to the benchmark case of a one-bedroom unit. Similarly, properties that enjoy views, are situated on or close to a seafront, or advertised together with a garage, garden or pool facilities also carry a significantly higher price. For example, a property in close proximity to a seafront commands a 15% premium, while the inclusion of a garage with the property raises the advertised rent by 13%.

The coefficients can be used to obtain the estimated monthly rent in euro and, hence, can be used as inputs for valuation purposes in the context of real estate appraisals. For instance, the baseline rent in Model 2 – a

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3. The accuracy of such exercise depends on the model specification considered. We use Model 2 due to its consideration of property characteristics not incorporated in Model 1. Their inclusion improves the goodness-of-fit of the model and therefore provides a more accurate estimation of the monthly rent in euro.
### Table 2
**REGRESSION ANALYSIS**

<table>
<thead>
<tr>
<th>Dependent variable – log (price)</th>
<th>2017Q4 – 2020Q2</th>
<th>2019Q1 – 2020Q2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>6.66 ***</td>
<td>6.71 ***</td>
</tr>
<tr>
<td><strong>Property Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flats (benchmark category)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maisonettes</td>
<td>-0.02 ***</td>
<td>0.01</td>
</tr>
<tr>
<td>Penthouses</td>
<td>0.24 ***</td>
<td>0.21 ***</td>
</tr>
<tr>
<td><strong>Clusters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster A</td>
<td>0.29 ***</td>
<td>0.22 ***</td>
</tr>
<tr>
<td>Cluster B (benchmark category)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster C</td>
<td>0.05 ***</td>
<td>0.06 ***</td>
</tr>
<tr>
<td>Cluster D</td>
<td>-0.20 ***</td>
<td>-0.19 ***</td>
</tr>
<tr>
<td>Cluster E</td>
<td>-0.27 ***</td>
<td>-0.33 ***</td>
</tr>
<tr>
<td>Cluster F</td>
<td>-0.19 ***</td>
<td>-0.16 ***</td>
</tr>
<tr>
<td>Cluster G</td>
<td>-0.30 ***</td>
<td>-0.33 ***</td>
</tr>
<tr>
<td>Cluster H</td>
<td>-0.34 ***</td>
<td>-0.33 ***</td>
</tr>
<tr>
<td>Cluster I</td>
<td>-0.73 ***</td>
<td>-0.76 ***</td>
</tr>
<tr>
<td>Cluster J (high-end)</td>
<td>0.89 ***</td>
<td>0.78 ***</td>
</tr>
<tr>
<td><strong>Bedrooms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-bedroom (benchmark category)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-bedroom</td>
<td>0.31 ***</td>
<td>0.30 ***</td>
</tr>
<tr>
<td>3-bedroom</td>
<td>0.52 ***</td>
<td>0.50 ***</td>
</tr>
<tr>
<td>4+ bedroom</td>
<td>0.82 ***</td>
<td>0.76 ***</td>
</tr>
<tr>
<td><strong>Property Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garage</td>
<td></td>
<td>0.12 ***</td>
</tr>
<tr>
<td>Garden</td>
<td></td>
<td>0.06 **</td>
</tr>
<tr>
<td>Pool</td>
<td></td>
<td>0.25 ***</td>
</tr>
<tr>
<td>Seafront</td>
<td></td>
<td>0.14 ***</td>
</tr>
<tr>
<td>View</td>
<td></td>
<td>0.16 ***</td>
</tr>
<tr>
<td><strong>Time Period</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017Q4</td>
<td></td>
<td>Benchmark</td>
</tr>
<tr>
<td>2018Q1</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>2018Q2</td>
<td>0.07 ***</td>
<td></td>
</tr>
<tr>
<td>2018Q3</td>
<td>0.08 ***</td>
<td></td>
</tr>
<tr>
<td>2018Q4</td>
<td>0.08 ***</td>
<td></td>
</tr>
<tr>
<td>2019Q1</td>
<td>0.08 ***</td>
<td>Benchmark</td>
</tr>
<tr>
<td>2019Q2</td>
<td>0.12 ***</td>
<td>0.04 ***</td>
</tr>
<tr>
<td>2019Q3</td>
<td>0.11 ***</td>
<td>0.02 **</td>
</tr>
<tr>
<td>2019Q4</td>
<td>0.09 ***</td>
<td>0.00</td>
</tr>
<tr>
<td>2020Q1</td>
<td>0.04 ***</td>
<td>-0.04 ***</td>
</tr>
<tr>
<td>2020Q2</td>
<td>0.00</td>
<td>-0.07 ***</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>21,883</td>
<td>13,619</td>
</tr>
<tr>
<td><strong>Adjusted R-squared</strong></td>
<td>0.56</td>
<td>0.61</td>
</tr>
</tbody>
</table>

* significant at the 10% level.
** significant at the 5% level.
*** significant at the 1% level.
one-bedroom flat in Cluster B without any observable housing attributes in 2019 Q1 – stood at €821 per month. Other combinations are also possible and the models in Table 2 can be used flexibly according to users’ needs. For instance, again taking the estimated coefficients in Model 2, the monthly rent for a two-bedroom penthouse in cluster A with a view in 2020 Q2 stood at €1,863, while that for a three-bedroom apartment in cluster E without any notable characteristics during the same quarter amounted to €907 per month.

In addition to the regression analysis presented in Table 2, quarterly and annual changes in rental prices are also calculated using the methodology applied in Ellul et al. (2019), namely the time dummy method, the rolling time dummy method and the average characteristics method. Changes in rental prices are calculated on the basis of the full hedonic rental index dating back to 2017 Q4 (Model 1) which only controls for the property type, the number of bedrooms and the location. Since no information about the property’s proximity to the seafront, property views or the availability of a garage, garden or pool facilities is available prior to 2019, these are excluded from analysis at this stage. Furthermore, due to the abnormally high asking prices for properties located in high-end areas, cluster J is also excluded from the analysis.

“Coefficients can be used to obtain the estimated monthly rent in euro and, hence, can be used as inputs for valuation purposes in the context of real estate appraisals”

Chart 4 shows the quarter-on-quarter changes in rental prices since 2018 Q1. The second quarter of 2018 was characterised by a strong rise of around 6.5% in advertised rental prices. Prices remained broadly stable during the three periods that followed, before picking up again in the second quarter of 2019. The first signs of a drop in rental prices were noted in the third quarter of 2019 before further quarter-on-quarter declines in rental prices were observed during the latter part of the year and the first half of 2020. In fact, following a drop in 2020 Q1 – with price drops ranging between 4% and 5% – a further 4% decline was observed in the second quarter of the year.

Chart 5 shows the annual growth rate in advertised rents. The year-on-year growth rates indicate that the year 2019 was characterised by a slowdown in advertised rental prices. Although prices during 2019 were still higher when compared to the corresponding quarter in 2018, the positive rate of change in asking prices declined consistently throughout the year. The annual growth rate first turned negative during the first quarter of 2020. In fact, advertised rental prices during this period were between 3% and 3.5% cheaper than the corresponding quarter a year earlier. A more pronounced drop in rental prices was observed in 2020 Q2

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4 The inclusion of penthouses, cluster H and other small localities in 2019 Q1 implies that the house characteristics in 2017 and 2018 are different to those in 2019 and onwards. Inevitably, this has some implications on the growth rates calculated by the average characteristics method, which in itself calculates the price of the ‘average’ house based on house characteristics. In particular, these improvements in data collection cause some discrepancy among the different methods when calculating (i) the quarterly change in prices between 2018 Q4 and 2019 Q1 and (ii) the yearly price changes between 2018 and 2019. The calculation of such growth rates under the Paasche methodology are slightly on the high-side because this method divides the average house characteristics of time $t+1$ estimated at time $t+1$ by the average house characteristics of time $t+1$ estimated at time $t$. It also follows that the Fisher index – being the geometric mean of the Laspeyres and Paasche indices – is also slightly on the high side when compared to the Laspeyres or the time dummy methods.
where all methodologies find a double-digit negative growth rate of -11%. This period corresponds to the impact of the COVID-19 pandemic and is driven by a combination of sluggish demand for, and an increase in the supply of, rental units on the market.

“A more pronounced drop in rental prices was observed in 2020 Q2 where all methodologies find a double-digit negative growth rate”

**Conclusion**

This article introduced a novel dataset that has been constructed since 2017 using big data methods to get a better understanding on the evolution of private sector rents in Malta. The approach used is based on standard hedonic methods that include advertised rents and a set of observable characteristics. The latter include property type, its size, location and a number of attributes such as the availability of a garage, garden, pool facility, closeness to the seafront or views. As expected, all of these factors are found to have a statistically significant effect on the advertised rent. The resulting models can be used both for valuation purposes and to construct quality-adjusted rental price indices. Concerning the latter, the results clearly indicate a sharp contraction in advertised rents in 2020, amplified by the effects of COVID-19, although growth in rents had already started slowing down throughout 2019, albeit still at a relatively high rate.

Going forward, it would be interesting to compare the findings from these models, based on advertised rents, with the actual rental contracts, when the latter become available. This would allow a better understanding of the relationship between the two, the advertising margin and whether this margin fluctuates during the course of the business cycle. In this regard, information from the rental contracts registered with the Housing Authority would be useful to shed more light on these research questions.

**References**


A SECTORAL MODEL EXTENSION TO STREAM

Noel Rapa

This article describes a new integrated model that serves as a sectoral extension to STREAM, the Bank’s main macroeconomic model, by using information from input-output (IO) tables. The approach utilised differs in two main ways when compared to existing integrated models commonly found in the literature. First, the model described in this article uses three modules and two different integration strategies, making it extremely flexible and able to address a range of policy-oriented questions. Second, this model utilises a fully-fledged macroeconometric model in its error-correction (EC) module, allowing for more realistic dynamics when compared to the single equation EC models used in the literature.

Introduction and motivation

Traditionally, central banks have been responsible for maintaining price stability and, in the process, stabilising output fluctuations along the business cycle. Understandably, modelling activities within central banks have been heavily influenced by this mandate. Most models developed and utilised within central banks fall under two main categories: those with strong theoretical foundations; and models with a strong emphasis on data matching. Despite diverging significantly in their approach, both types of models focus on explaining fluctuations in aggregate demand and price levels at a business cycle frequency, with very little regard to sectoral developments.

Guided by the general practice in other central banks, the models developed at the Central Bank of Malta are largely designed to analyse developments in aggregate output and price levels, while offering little or no information about sectoral developments within the economy.¹ This has two important implications. First, these models are unable to provide information on sectoral developments following aggregate shocks. Second, they are not well suited to understand the implications that sector-specific shocks might have on other sectors as well as on aggregate economic activity. Such information is especially useful for analysts and forecasters who wish to internalise the effects of sector-specific developments on the aggregate economy.

"An integrated model therefore seeks to combine the dynamic information of an EC model with the sectoral disaggregation provided by an IO model"

Integrated models seek to exploit the complementarity between sectoral IO type models and dynamic aggregate models, which are often of an EC type. The motivations behind model integration stem from the characteristics of the separate models. An EC model depicts the economy within a partial equilibrium setup, with a focus on the dynamic adjustment of aggregate output and prices. On the other hand, IO models are static general equilibrium models, where sectoral and aggregate demand must equal supply of primary and intermediate inputs. An integrated model therefore seeks to combine the dynamic information of an EC model with the sectoral disaggregation provided by an IO model. As argued by Rey (1999), integrated models can be especially useful in improving forecasting performance when compared to stand-alone models. This is especially the case when information contained within IO models is used to set prior restrictions on VAR models estimated with a Bayesian approach. Integrated models also offer a more comprehensive model evaluation over their stand-alone counterparts, as they typically allow the researcher to assess both the implications that aggregate results from the EC module might have on the sectoral responses, as well as the plausibility of IO-derived multipliers. Finally, the main motivation behind integrating IO and EC models is the ability to enhance the scenario analysis capabilities over what is usually achievable with either IO or EC stand-alone models separately.

¹ See Borg et al. (2019), Micallef and Debono (2020), Rapa (2016, 2017) and Gatt et al. (2020).
Against this backdrop, this paper proposes a sectoral extension to STREAM, the Bank’s main macroeconometric model (Grech and Rapa, 2016). The model presented here borrows heavily from integration methods utilised primarily in regional economics literature (see Rey, 1997; Fritz et al., 2003). This study contributes to the sectoral modelling literature in three main ways. First, unlike other integrated models found in the literature, the approach discussed here utilises three different integration modules, allowing for different integration links, depending on the research question at hand. Second, unlike other integrated models that utilise single EC equations, we propose an EC module that utilises a fully-fledged macroeconometric model. The latter is considerably richer in terms of channels, thus allowing for more realistic macroeconomic dynamics. Finally, this study seeks to contribute to input-output based modelling of the Maltese economy by proposing a different integration approach than that utilised in STEMM (Economic Policy Division, 2019).

The model

Literature

Rey (1997) identifies three types of integration strategies that can be pursued: embedding, linking and coupling. Integrated models based on an embedding strategy use information contained in IO tables to provide prior information (within a Bayesian setup) or outright coefficient restrictions (within a frequentist approach) for the estimation of the EC module. As argued by Rey (1998), misspecification of the restrictions in these types of models is quite common, resulting in a considerable loss in forecast and simulation performance. Moreover, this type of strategy is usually regarded as being a less comprehensive method of integration when compared to linking and coupling strategies (Rey, 1999; Fritz et al., 2003). A linking strategy makes more extensive use of the information contained in each module. Basically, it uses the output of one module as an exogenous input to the second module in a recursive structure. Linking strategies can be accomplished in two different ways. In an IO → EC integrated model, the analyst exogenously sets sector-specific shocks within an IO module, with the output then used as exogenous shocks within sectoral EC modules. In an EC → IO integrated model, the analyst endogenously produces a set of final demand responses via the EC module, which are then used as exogenous shocks to the IO module. A coupling strategy is similar in spirit to the linking strategy but is regarded as significantly more ambitious. In a coupling strategy, the EC and IO modules are not linked in a recursive regime, but are instead allowed to interact simultaneously, allowing for richer and more internally consistent results.

Integration strategy

The selection of the integration strategy for our model was based on two principles. First, the integrated model is required to provide a detailed breakdown of results in order to enhance the simulation and forecasting capabilities of the existent suite of models available at the Bank. Second, from a practical perspective, the integration needs to be feasible especially in the light of a lack of reliable time series data for sectoral variables in real terms.

With regards to the integration strategy, an embedding strategy is quite a loose type of integration, and does not succeed in augmenting the simulation capabilities of the Bank’s existing models. On the other side of the spectrum, a coupling strategy entails substantial modifications to the Bank’s suite of models and requires time series data for real gross value added (GVA) by sector, data which is unfortunately not available for the Maltese economy. In this light, a linking strategy is believed to provide the correct balance between the extent of the integration and its feasibility.

Disaggregating aggregate final demand shocks: EC → IO link

We therefore choose to integrate an Input-Output module to STREAM, the Bank’s macroeconometric model, via a linking strategy. The choice of extending STREAM is based on its remarkable flexibility, which allows it to be useful for a large spectrum of applications. Moreover, STREAM is nowadays an integral part of the Bank’s macroeconometric forecasts, implying that this extension can also be useful from a forecasting perspective, whenever the forecaster wishes to internalise sector-specific information in a more complete and transparent way. The two models are integrated in an EC → IO fashion. STREAM is used to endogenously provide final demand responses following aggregate shocks, which are then fed to the IO module, which decomposes them into sectoral GVA, employment and household income. This is done by first taking the percentage point deviations for each final
demand component – private and government consumption, gross fixed capital formation and exports – and at each point in time, as produced by a standard simulation of STREAM, and decomposing them into a set of sector-specific demand shocks. This is done through a weighting matrix which in turn captures the proportion of each final demand component that is absorbed by each industry.

“This in turn provides us with sector-specific results that do not only capture the direct effects of the shocks, but also the indirect effects that arise from the production required to satisfy intermediate demand that arises in other sectors”

The end result of this decomposition is a set of time-varying and sector-specific demand shocks which can then be inputted in a Leontief demand-driven model in order to capture the direct and indirect effects (and if need be, also induced effects) of sector-specific shocks. This in turn provides us with sector-specific results that do not only capture the direct effects of the shocks, but also the indirect effects that arise from the production required to satisfy intermediate demand that arises in other sectors.

Aggregating sectoral shocks

An IO → EC link is also particularly useful if the analyst or forecaster possesses sectoral shocks and wishes to understand how this might impact aggregate final demand results. Unfortunately, such a linking strategy poses significant data requirements, some of which cannot be fulfilled with official data sources. To this end we propose a novel strategy where two IO modules, a Leontief- and a Ghoshian-based module, are used to simulate sector-specific demand and supply-side shocks respectively. Moreover, by using information solely within IO tables, these two modules are able to produce aggregate results for final demand components, thus mimicking the results of a more standard IO → EC integration strategy. This is done through a three-step procedure. First, a Leontief or a Ghoshian model is shocked with a series of sectoral final demand or primary input shocks, producing deviations for sectoral GVA. Second, in order to understand how these sectoral changes can affect the aggregate final demand components, we use a weighting structure that drives sectoral final demand components in line with changes in sector-specific GVA. This weighting scheme implicitly assumes that for each industry, the share of final demand components in the total final demand of the sector remains constant after the shock. Finally, we estimate the changes in imports for any given changes in each final demand component using the methodology described in Bussiere et al. (2013). This procedure is especially useful for forecasters who wish to internalise sector-specific information within macroeconomic forecasts in a more complete and transparent way. This is especially important when considering that the forecasting methods available at the Bank are mainly of a macro nature and fail to completely capture supply-side effects.

“This procedure is especially useful for forecasters who wish to internalise sector-specific information within macroeconomic forecasts in a more complete and transparent way”

Simulation properties of the model

This section documents the properties of the integrated model by showing two types of shocks: aggregate shocks which utilise the EC → IO link to provide us with disaggregated results; and disaggregated shocks that use information contained in the Leontief and Ghoshian models to provide us with both disaggregated effects on value added as well as with a view on aggregate final demand developments. The former simulation is very useful when the researcher has information on shocks that occur at a relatively aggregate level, such as final demand shocks or interest rate shocks. The latter modules are useful if the researcher has information on shocks that will only hit particular sectors and wishes to estimate the effects these will have on other sectors through indirect or induced effects, while assessing aggregate developments in final demand components and ultimately in GDP.

2 This method provides deviations in final demand components and imports at basic prices. In order to come to a figure for GDP, we need to convert these figures in terms of purchaser prices. This is done by simply assuming that the proportion of taxes and subsidies for each final demand component is constant across time.
Aggregate shocks: Foreign demand shock

Table 1 shows the macroeconomic results for an aggregate demand shock using STREAM. The shock is defined as a permanent 1% increase in foreign demand for Maltese goods and services. A foreign demand shock has a positive impact on exports, which in turn increases GDP. The increase in aggregate demand boosts demand for both factors of production, raising investment and employment demand. The latter causes a rise in average salaries, which in turn boosts household disposable income and eventually private consumption. This increase in domestic economic activity is especially relevant in the second and third year of the simulation, a period also characterised by a slowdown in exports due to a loss in Malta’s international competitiveness brought about by rising price pressures following the increase in aggregate demand.

Turning to the sectoral decomposition of the aggregate results, it is important to note that results derived from a Leontief demand model do not merely reflect the exposure of sectors to a particular final demand component (direct effects), but also the degree of interconnectedness of each sector. Thus, the sensitivity of sectoral GVA results to any given shock depends on three factors: the magnitude of the response of a particular final demand component; the weight that particular sector plays in the composition of final demand; and finally, the sector’s interconnectedness with the rest of the economy measured in terms of backward linkages.3

As expected, in the first year of the simulation horizon, the sectors which are mostly affected by the foreign demand shock are mainly export-oriented (see Table 2). These include the Arts, entertainment and recreation sector (which includes the gaming and betting industry), Financial and insurance activities sector, and the manufacturing sector, all of which are expected to experience a rise in their GVA of around 1% by the first year of the simulation. In view of their low degree of backward linkages with the rest of the economy, the strength of the results pertaining to the former two sectors is solely driven by a relatively strong contribution in Maltese exports.4

The drivers behind the strong results pertaining to the manufacturing sector are quite heterogeneous and depend on sub-sector-specific drivers. Some sub-sectors, such as the manufacture of computer and electronic products, are considerably affected due to their significant direct exposure to the export market. On the other hand, results of other more domestically oriented sub-sectors – such as the manufacture of basic metals – are mainly driven by their significant inter-industry ties. Moving to results for the second and third year of the simulation horizon, one can see significant gains in the GVA of domestically-oriented sectors, such as the Wholesale and retail trade. This coincides with an expansion of domestic economic activity, mainly driven by increases in private consumption.

### Table 1

<table>
<thead>
<tr>
<th>THE MACROECONOMIC IMPACT OF A 1% INCREASE IN FOREIGN DEMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage change from baseline levels unless otherwise specified</td>
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<tr>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>Real GDP</td>
</tr>
<tr>
<td>Private consumption</td>
</tr>
<tr>
<td>Government consumption</td>
</tr>
<tr>
<td>Gross fixed capital formation</td>
</tr>
<tr>
<td>Exports (goods and services)</td>
</tr>
<tr>
<td>Imports (goods and services)</td>
</tr>
</tbody>
</table>

Source: Author's calculations.

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3 Backward linkages capture the links any given sector has with upstream sectors. In other words, total backward linkages of sector  depend on the amount by which sector  production depends (either directly or indirectly) on interindustry inputs (Miller and Blair, 2009).

4 The results for the Financial and insurance sector are especially driven by the inclusion of Special Purpose Entities (SPEs) within ESA 2010 data. Since SPEs are mainly export-oriented, the sectoral decomposition of export final demand is significantly affected by their inclusion. On the other hand, since SPEs contain very high import content, their inclusion reduces the relative magnitude of the local intermediate input requirements for this sector, implicitly weakening the strength of this sector’s interconnectedness (Cassar and Rapa, 2019).
Sectoral shocks: Primary imports shock

Table 3 provides sectoral GVA results following a 10% drop in one of the primary inputs of the manufacturing sector. This shock is performed within the Ghoshian module of this integrated model. Results therefore do not merely capture the direct effects of a drop in primary inputs of the manufacturing sector, but also the indirect effects, which in this module are measured in terms of forward linkages. In this particular case, the shock is calibrated as a 10% drop in the direct imports of the sub-sectors making up the manufacturing sector, simulating sudden constraints to the imports used as part of the production process.\(^5\)\(^6\)\(^7\)

As expected, the sector that is projected to be hit the hardest by this supply-side shock is the manufacturing sector itself, whose GVA is expected to fall by almost 5%. The rest of the sectoral effects are limited to the indirect effects caused by a reduction in manufacturing output. Some of the manufacturing output forms part of the intermediate inputs used by other sectors in their production process. Therefore, a shock which restricts manufacturing output will also indirectly affect, in a negative way, the production process – and consequently the GVA – of the other sectors which use this output as an intermediate input.

The sectors that are mostly affected by indirect effects are: (i) agriculture, forestry and fishing; (ii) mining, quarrying and construction; and (iii) accommodation and food services activities. These capture the interlinkages between the various sectors. For instance, the sub-sectors covering manufacturing of food products, and repair and installation of machinery and equipment are very important suppliers of intermediate production to the agriculture sector. Similarly, the mining, quarrying and construction sector absorbs a considerable proportion of the output produced in

\(^5\) Forward linkages capture the links any given sector has with downstream sectors. A change in the primary inputs of sector \(j\) implies a change in the amount of product \(j\) that is available to be used as intermediate inputs by all other sectors. Thus in a Ghoshian model, total forward linkages of sector \(j\) are measured as the change in the output of all other sectors that occurs due to a change in the inputs used by sector \(j\) (Miller and Blair, 2009).

\(^6\) The Ghoshian model produces the same results for shocks to different primary inputs (imports, labour income and operating surplus) of the same absolute magnitude. This means that the results of a relative shock (calibrated as a share rather than in millions) to, say, imports will only differ from a similarly calibrated shock to labour income, by the extent of the difference in the contribution these two primary inputs have in total primary inputs of each sector.

\(^7\) The model cannot perform shocks to the total imports used in each sector, but is limited to capture shocks to imports that are used in the intermediate production process. This therefore excludes sectoral imports that are directly associated with final demand.
the manufacture of other non-metallic mineral products and the manufacture of fabricated metal products sectors. Finally, results for the accommodation and food services sector are driven by the fact that this sector, through direct and indirect production rounds, absorbs almost a quarter of all the output of the manufacturing of food, products, beverages and tobacco. Still, when considering the magnitude of the shock, one can conclude that the responses of the sectors not directly hit by import restrictions are relatively small. This is mainly due to the fact that the sectors being subject to the initial shock are mainly export-oriented, with a limited contribution to the intermediate production process of the rest of the economy.

This point is reflected in the aggregate final demand results shown in Table 4. Indeed, excluding inventories – which as expected fall considerably as producers of manufactured goods run down their existing stocks in the light of import restrictions – the largest declines in aggregate final demand components are seen in total exports. The latter are expected to fall by more than 1%, with the main driver being the manufacture of computer, electronic and

<table>
<thead>
<tr>
<th>Table 3</th>
<th>SECTORAL GVA RESULTS FOR A 10% DROP IN PRIMARY IMPORTS OF THE MANUFACTURING SECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>NACE code</td>
<td>Sector name</td>
</tr>
<tr>
<td>01-03</td>
<td>Agriculture, forestry and fishing</td>
</tr>
<tr>
<td>B05-09</td>
<td>Mining, quarrying and construction</td>
</tr>
<tr>
<td>C10-33</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>D35E36-39</td>
<td>Electricity, gas, steam ...</td>
</tr>
<tr>
<td>G45-47</td>
<td>Wholesale and retail trade...</td>
</tr>
<tr>
<td>H49-53</td>
<td>Transportation and storage</td>
</tr>
<tr>
<td>I55-56</td>
<td>Accommodation, food services activities...</td>
</tr>
<tr>
<td>J58-63</td>
<td>Information and communication</td>
</tr>
<tr>
<td>K64-66</td>
<td>Financial and insurance activities</td>
</tr>
<tr>
<td>L68</td>
<td>Real estate activities</td>
</tr>
<tr>
<td>M69-75</td>
<td>Professional, scientific and technical...</td>
</tr>
<tr>
<td>N77-82</td>
<td>Administrative and support services</td>
</tr>
<tr>
<td>O84</td>
<td>Public administration and defence</td>
</tr>
<tr>
<td>P85</td>
<td>Education</td>
</tr>
<tr>
<td>Q86-88</td>
<td>Human health and social work activities</td>
</tr>
<tr>
<td>R90-93</td>
<td>Arts, entertainment and recreation</td>
</tr>
<tr>
<td>S94-96</td>
<td>Other service activities</td>
</tr>
<tr>
<td>T97-98U99</td>
<td>Households as employers...</td>
</tr>
<tr>
<td>Source: Author's calculations.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4</th>
<th>THE MACROECONOMIC IMPACT OF A 10% DROP IN THE PRIMARY IMPORTS OF THE MANUFACTURING SECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td></td>
</tr>
<tr>
<td>Real GDP</td>
<td>-0.79</td>
</tr>
<tr>
<td>Private consumption</td>
<td>-0.52</td>
</tr>
<tr>
<td>Government consumption</td>
<td>-0.16</td>
</tr>
<tr>
<td>Gross fixed capital formation</td>
<td>-0.73</td>
</tr>
<tr>
<td>Inventories</td>
<td>-2.26</td>
</tr>
<tr>
<td>Exports (goods and services)</td>
<td>-1.06</td>
</tr>
<tr>
<td>Imports (goods and services)</td>
<td>-0.86</td>
</tr>
<tr>
<td>Source: Author's calculations.</td>
<td></td>
</tr>
</tbody>
</table>
optical products. Gross fixed capital formation is expected to fall by more than 0.7%, mainly on the back of a reduction in the output of the Mining, quarrying and construction sector. Since a considerable proportion of the output of the manufacturing of food products and the accommodation and food services sectors are directly consumed by households, falls in the production capabilities of these two sectors brings about a fall in aggregate household consumption of around 0.5%.

This result points to an important limitation of this model. Indeed, the Ghoshian model assumes that sectors, or final users of these sectors, are unable to substitute any inputs (be it primary or intermediate inputs, or indeed final production) with supplies that are either produced by other sectors or imported from abroad. Thus, in this case, when faced by a fall in the supply of manufactured food products and of accommodation and food services, households or intermediate sectors, are assumed not to be able to substitute this shortfall in supply with imported alternatives.

**Conclusion**

This article provides an outline of a sectoral extension to the Bank’s macroeconometric model, which utilises information derived from IO tables to provide a sectoral disaggregation of aggregate simulation results, and to produce aggregate results following sectoral shocks. The integration strategy utilised in this model is of a linking type, implying that there is a clear order of recursion between the different modules that make up this integrated model. Unlike other integrated models found in literature, the model proposed here utilises three different modules using different integration regimes and which allow for greater flexibility in the ways the model can be used. Two simulations are presented to illustrate the main properties of the new model.

“Results derived from this integrated model need to be interpreted with caution as they are deeply sensitive to the assumptions underlying the linking strategy employed”

Results derived from this integrated model need to be interpreted with caution as they are deeply sensitive to the assumptions underlying the linking strategy employed. Moreover, results are very much reliant on the data within the IO table. As is customary in IO literature, this data is updated with a significant time lag. This is an especially important limitation for economies – such as Malta’s – which undergo deep structural transformations in relatively short periods of time. Moreover, the sectoral modules are unable to capture effects of shocks to different final demand or primary input components. Finally, since input-output modules are completely static, they are unable to capture how the propagation of shocks occurs across the time dimension. Despite these limitations, this extension is an important addition to the Bank’s modelling toolkit and served as a valuable input in forecasts and simulations during the COVID-19 period.

**References**


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Rey, S. J. (1999), Integrated regional econometric and input-output modelling, Department of Geography, San Diego State University.
This article compares the main findings from the third wave of the HFCS for Malta with those for the other participating countries. Results show that in 2016 the median Maltese household held more real and financial assets, and more total liabilities, than households in most other countries, although the number of indebted households was far less than most European countries. Nevertheless, the debt-to-asset ratio indicates that Maltese households have a significantly higher amount of assets to back their debt. Largely reflecting the higher prevalence of homeownership and to a lesser extent, investment in other property, the median net wealth in Malta was estimated to be significantly higher than most other European countries, while inequality in households’ net wealth was notably lower. At the same time, gross income of Maltese households stood lower when compared to a number of other nations, though the share of Maltese households stating that their regular expenses were lower than their income was comparable to that in countries like Germany and France.

Introduction

In 2017, the Central Bank of Malta carried out the third wave of the HFCS. The two previous waves were carried out in 2010 and in 2014.2 This survey is part of a co-ordinated research project led by the European Central Bank (ECB) and involving national central banks of all euro area countries and selected non-euro area EU member states.3 The reference year for Malta was 2016, while for most other countries it was 2017. The survey provides detailed information on households’ real and financial assets, their liabilities, net wealth, income and consumption.

This article compares the main findings of the HFCS for Malta with those of the other participating countries.4 The total sample across the participating countries consisted of over 91,000 households, varying from 1,004 households in Malta to 13,685 in France. The sampling of the HFCS includes only private households, as persons living in institutions were not included in the sampling frame.5 Following the methodological guidelines of the Household Finance and Consumption Network (HFCN) in all three waves, surveys have a probabilistic sample design and are thus representative of the populations surveyed. The sampling designs, however, vary across countries, with stratification of the population prior to sample selection being the most commonly-used practice. Malta and The Netherlands were the only two countries where a systematic sample selection was implemented.

In the 2017 wave, 12 countries including Malta had a panel component, that is, households that also participated in the second wave. In Malta, the panel component consisted of 539 households. The overall response rate in

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1 The authors would like to acknowledge the assistance provided by various officials at the National Statistics Office who were responsible for carrying out this survey and who assisted in the compilation of the data.

2 More information on the main findings of the first three waves of the HFCS conducted in Malta, including previous research, are available on the Bank’s website, here.

3 The participating countries include: Belgium (BE), Germany (DE), Estonia (EE), Ireland (IE), Greece (GR), Spain (ES), France (FR), Croatia (HR), Italy (IT), Cyprus (CY), Latvia (LV), Lithuania (LT), Luxembourg (LU), Hungary (HU), Malta (MT), The Netherlands (NL), Austria (AT), Poland (PL), Portugal (PT), Slovenia (SI), Slovakia (SK) and Finland (FI).

4 More detailed information on the HFCS can be retrieved from the ECB’s website, here.

5 Population in institutions include persons living in homes for elderly people, military compounds, prisons and boarding schools, amongst others.
Malta was of 64.8%, whereas response rates across countries varied from as low as 31.5% in Germany up to 77.4% in Finland.

The remainder of this article presents a comparison of Malta’s results with all other participating countries and focuses on households’ demographic characteristics, assets, liabilities, net wealth and income. It also reports on households’ consumption patterns and their ability to save. The concluding section summarises the key results of this study and delineates a number of limitations of the Survey.

Household characteristics

In the euro area as a whole, around 66% of households are composed of one or two members. In Malta, this share stands at 54%. The distribution of household size is quite consistent across the participating countries, with only Poland and Slovakia shown to have slightly higher percentages of households having three or more members (see Table 1).

“Approximately one fifth of Maltese reference persons hold a tertiary level of education”

On average, 58.7% of the reference persons in the euro area declared to be in employment, with cross-country figures oscillating between 48.7% in Croatia and 67.2% in Slovakia. In line with the observed rates, in Malta we find that 63.5% of respondents were in employment in 2016. With regards to educational attainment, survey results show that persons with a tertiary level of education are much less than the number of reference persons with no or basic education; this is true for all participating countries. The share of

Table 1

| Household Structure                           | EA | BE | DE | EE | IE | GR | ES | FR | IT | CY | LV | LT | HU | NL | AT | PL | PT | SI | SK | FI |
|-----------------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Household size                                |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 1 and 2 persons                               | 66 | 66 | 75 | 66 | 57 | 55 | 55 | 56 | 68 | 52 | 60 | 62 | 52 | 65 | 71 | 61 | 62 | 54 | 71 | 72 | 50 |
| 3 and more persons                            | 34 | 34 | 25 | 34 | 43 | 45 | 44 | 32 | 48 | 40 | 48 | 39 | 39 | 46 | 29 | 39 | 46 | 29 | 28 | 50 | 45 |
| Work status of reference person(1)            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| In employment                                 | 59 | 56 | 66 | 65 | 64 | 51 | 55 | 53 | 49 | 57 | 65 | 64 | 59 | 66 | 63 | 64 | 58 | 64 | 59 | 56 | 67 |
| Other                                         | 41 | 44 | 34 | 35 | 36 | 49 | 46 | 47 | 51 | 43 | 35 | 36 | 41 | 34 | 37 | 37 | 42 | 36 | 41 | 44 | 33 |
| Education level of reference person(2)        |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Non-tertiary                                  | 71 | 54 | 67 | 62 | 59 | 76 | 67 | 70 | 84 | 87 | 72 | 66 | 58 | 64 | 75 | 79 | 62 | 76 | 74 | 81 | 74 |
| Tertiary                                     | 29 | 46 | 33 | 38 | 41 | 24 | 33 | 30 | 16 | 13 | 28 | 34 | 42 | 36 | 25 | 21 | 38 | 24 | 26 | 20 | 26 |

Source: ECB-HFCS Statistical Tables (wave 3) and authors’ calculations.

The table shows weighted household structure of the HFCS samples.

(1) The ‘In employment’ category comprises of reference persons who are either employed or self-employed. The ‘Other’ category includes reference persons who are: unemployed, retired, students, permanently disabled, doing compulsory military service, fulfilling domestic tasks, or not working for pay in other ways.

(2) Educational attainment is measured on the basis of the ISCED-2011 scale, ranging from 0 to 8. The ‘Non-tertiary’ category is composed of reference persons with ISCED scale 0 to ISCED scale 4, while the ‘Tertiary’ category refers to ISCED scale 5 to ISCED scale 8.
population with a tertiary level of education ranges from 13.3% of Italian respondents to 46.3% in Belgium. Domestically, approximately one fifth of Maltese reference persons hold a tertiary level of education, which is one of the lowest rates observed among EU countries.

**Household assets**

One of the main contributions of the HFCS is the collection of information on households’ assets, precisely on the characterisation of real and financial assets. In the euro area, the median value of households’ total assets was estimated to stand at €131,300. This figure was almost half the self-declared value for Maltese households, which stood at €252,800 (see Chart 1). Heterogeneity amongst participating countries is notable, with the median asset value ranging from €23,600 in Latvia to €634,000 in Luxembourg.

Overall, the composition of assets for the observed countries is consistently and heavily based on real assets. In fact, survey results showed that 80.9% of households’ assets consisted of real assets in the euro area, with the lowest of these shares found in The Netherlands (68.5%) and the highest in Croatia (96.5%). Figures for Malta are well in line with other countries, where the share of real assets on total assets stood at 86.4%.

**Real assets**

According to results from the third wave of the HFCS, the percentage of households stating to have held some type of real asset stood at 91.2% in the euro area (see Chart 2). This ranged from 82.7% in Germany to 100% in France, implying that all French citizens interviewed stated that they held some type of real asset. In Malta, 95.4% of responding households reported to have some form of real assets. The median value of real assets in the euro area was estimated at €131,000, much less than the €225,800 reported in Malta. Malta’s median value compares closely to Ireland’s €233,900 and the €232,700 reported by Cypriot households. However, cross-country heterogeneity prevails. The lowest figures were observed in Latvia (€29,900).  

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6 Real assets comprise of the household’s main residence, other real estate properties, vehicles, valuables and self-employment business.
and Hungary (€39,400). Luxembourg definitely stands out, recording a median value of real assets of over €600,000. Survey results indicate that for the majority of participating countries, the households’ main residence constitutes the most valuable real asset in households’ asset portfolio. More than 60% of households’ total real assets were taken up by their main residential property in the euro area. This percentage was highest in The Netherlands at 82.2% and lowest in Cyprus at 35.8%. In Malta, households’ main residence accounted for 54.8% of total real assets.

“The median value of real assets in the euro area was estimated at €131,000, much less than the €225,800 reported in Malta”

Financial assets

The share of interviewed households holding some type of financial asset, predominantly bank deposits, is very high throughout the observed countries, exceeding 90% in most cases (see Chart 3). In Malta, this figure stood at 97.2%. The median value of total financial assets held by euro area households was estimated to be €10,300. Once again, this amount varied significantly across all participating countries. Median financial assets varied from as low as €500 or less in Latvia and Croatia, to over €30,000 in Luxembourg. In Malta, the median value of financial assets was the third highest in the euro area at €25,000.

Bank deposits constituted 43.7% of the total financial assets of euro area households, varying from 31.3% in Ireland to 90.3% in Greece. In Malta’s case, bank deposits made up 51.8% of households’ financial assets by the end of 2016. In line with our previous findings, the median value of deposits was found to be the lowest in Latvia and Croatia with €200 and €300 respectively, and the highest in Luxembourg with €20,100. At €12,600, the median value of deposit holdings in Malta was more than double that of the euro area, which stood at €6,100, and compared closely to The Netherlands’ €13,700 and Austria’s €12,800.

“In Malta’s case, bank deposits made up 51.8% of households’ financial assets by the end of 2016”

Household liabilities

The percentage of indebted households in the euro area stood at around 42%, ranging from roughly 20% in Italy and Greece, to around 58% in The Netherlands and Finland (see Chart 4). In Malta, the percentage of indebted households stood at 34.3%, having a median debt level of €40,000. This was higher than the €29,500 median reported in the euro area. Across countries, the median level of indebtedness varied significantly, with the lowest of just above €2,000 in Croatia and Poland, and the highest in The Netherlands, with €133,700.

7 Financial assets refer to bank deposits, mutual funds, bonds, shares, money owed to the household, voluntary pension/whole life insurance and any other types of financial assets.

8 Total liabilities include mortgages collateralised on household’s main residence, mortgages collateralised on other real estate property owned by the household, non-mortgage loans, credit lines/bank overdrafts debt and credit card debt.
The percentage of households having mortgage debt, which was the main type of liability held by respondents, stood at 23.5% in the euro area and 20.9% in Malta. This type of debt was mostly driven by household main residence mortgage debt. The median outstanding balance on household main residence mortgages in Malta amounted to €80,000, similar to the average for the euro area. As for the rest of the countries, household main residence mortgage debt medians spanned from €11,300 in Hungary to over €200,000 in Luxembourg. Although the median level of outstanding balance on household main residence mortgages in Malta was broadly in line with the euro area average, the median level of debt on other properties in Malta, at €100,000, exceeded the reported euro area average of €69,800. Malta’s figure was the fourth highest reported in all participating countries.

“The percentage of households having mortgage debt, which was the main type of liability held by respondents, stood at 23.5% in the euro area and 20.9% in Malta”

Financial burden indicators

When assessing the debt burden, the debt-to-asset ratio\(^9\) was 25.5% in the euro area (see Chart 5). The ratio for The Netherlands was the highest at 52.1% and that for Croatia was the lowest at 4.8%. The ratio for Malta was found to be 13.5%, which is one of the lowest among the participating countries. Meanwhile, the debt-to-income ratio\(^10\) in the euro area stood at 70.3%. This ratio exceeded 100% in Malta, Spain, Cyprus, Portugal, and The Netherlands. On the other hand, this ratio was below 30% in Estonia, Croatia, Latvia, Poland and Slovenia. Furthermore, the debt service-to-income ratio\(^11\) ranged from 19.5% in Cyprus to 2.8% in Lithuania, with Croatia reporting a zero ratio. In Malta, this ratio was estimated to be 11.0%, equalling the euro area average.

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9 This is the ratio of total liabilities to total gross assets, and is defined for indebted households.

10 This is the ratio of total liabilities to total gross household income, and is defined for indebted households.

11 This is the ratio of total monthly debt payments to household gross monthly income, and is defined for indebted households.
BOX 1: HOUSEHOLD NET WEALTH, HOME OWNERSHIP AND INEQUALITY

The estimated household median net wealth in Malta, which is defined as households’ total assets net of liabilities, stood at €236,100 as at end 2016. This is more than double the euro area median value of €99,400 and second highest in Europe following Luxembourg’s €498,500 (see Chart 6). Nonetheless, there exists substantial heterogeneity across Europe, with the lowest value being €20,500 in Latvia.

“Net wealth is significantly linked to homeownership, as households who were owners of their main residence had a much higher level of net wealth”

Survey results clearly indicate that net wealth is significantly linked to homeownership, as households who were owners of their main residence had a much higher level of net wealth. In the euro area, the homeownership rate was estimated to be around 60% and the median net wealth of homeowners stood at €203,000, as opposed to just €9,000 for non-owners (see Chart 7). Such divergence is observed in all countries. The homeownership rate in Malta was estimated at 81.3% and the median net wealth of Maltese households who own their main residence stood at €290,100, as opposed to €10,000 for other households. The higher value of net wealth in Malta can also be partly explained by the composition of the typical Maltese household, which tends to be composed of a larger number of adults. One reason for this is that the Maltese take longer to move out of their parents’ homes when compared to their European counterparts.

The net wealth inequality varies notably across countries. The HFCS-based Gini coefficient – a measure of statistical dispersion for inequality - suggests that inequality in the euro area stood at 0.695, ranging from 0.54 in Slovakia to 0.78 in The Netherlands (see Chart 6).

In Malta, inequality in households’ net wealth stood at 0.602 in 2016, notably lower than the euro area average (see Chart 6). This is

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Sources: ECB-HFCS Statistical Tables (wave 3) and authors’ calculations.

1 The Gini coefficient corresponds to the normalised area between the Lorenz curve of the distribution and the 45 degrees line. This coefficient is bound between 0 and 1, where the higher the value, the more unequal a society is.
consistent with findings from other surveys, such as the Survey on Income and Living Conditions (Darmanin, 2018). Furthermore, inequality across European countries is evident when comparing net wealth of the bottom 10% of households to the top 10%. The former households have a net wealth of less than €3,000 in all countries, apart from those in Malta (€11,000), Lithuania (€10,900), Slovakia (€7,700) and Luxembourg (€7,100). Conversely, the top 10% of households in Europe have a net wealth of at least €150,000. Luxembourg is a clear outlier, whereby the top 10% of households have a net wealth of over €1.8 million. For more information on inequality in Malta see Georgakopoulos (2019).

Household income, consumption and ability to save

The annual household gross median income\(^{12}\) for the euro area was estimated at €31,000, although such figures must be interpreted with caution since cross-country comparisons reveal pronounced differences. Namely, the analysis shows that median income ranged from values as high as €71,100 in Luxembourg to below €9,000 in Lithuania and Croatia. In Malta, the median gross income for Maltese households was estimated at €25,400, below the euro area value but in line with the median income in other Mediterranean countries (see Chart 8).\(^{13}\) Furthermore, when analysing income in net terms, the gap between Malta and the euro area narrows as Malta’s implicit tax rate on labour was amongst the lowest in Europe in the period under review.\(^{14}\)

According to the Survey, the overall annual median household spending in the euro area on food consumption stood at €5,200 and expenditure on utilities stood at €2,500. Malta’s expenditure on food is higher at €6,800 whereas expenditure on utilities is lower at €1,500. These results are broadly consistent with the findings in the 2015 Household Budgetary Survey (HBS).\(^ {15}\) Malta’s food consumption expenditure was the third highest following Luxembourg and Ireland. Conversely, Malta’s expenditure on utilities was the third lowest following Latvia and Lithuania, partly on account of relatively cheaper tariffs and possible lower energy consumption due to milder winters.

With regards to savings, the share of Maltese households stating that their regular expenses were lower than their income was 45.6%. Notable heterogeneity across Europe can be noted; only 15.5% of all Greek households reported that their income is higher than their expenses as opposed to a high of 65.2% in Luxembourg. Malta’s figure compares closely to Germany’s 49.3% and France’s 43.3%.

\(^{12}\) The survey defines gross household income as the sum of all pre-tax income and social contributions, including labour/pension income, rents from real estate assets, return from financial assets, regular social/private transfers, and any income from other sources of all members within the household.

\(^{13}\) More information on studies focusing on income developments in Malta using administrative or survey data is available in Knoppe (2018) and Darmanin, Georgakopoulos, & Knoppe (2018).

\(^{14}\) In 2017, Malta’s implicit tax rate on labour stood at 23.5%, compared to 38.5% and 36.2% in the euro area and European Union, respectively. This result is driven by relatively low social security contributions, especially from employers. Further details are available here.

\(^{15}\) For more information, please click here.
Conclusion

The HFCS provides valuable information on households’ consumption and finances, including information on their assets and liabilities. Consequently, it enables a deeper understanding of individual behaviour and provides insight into the transmission mechanism of monetary policy, as well as issues related to financial stability in the euro area. Against different macroeconomic and socio-demographic backgrounds, the survey results highlight heterogeneous developments between Malta and other countries. Moreover, differences between countries in statistics of interest must be assessed against relevant institutional differences and cultural preferences.

Results from surveys need to be interpreted with caution due to a number of caveats. The main limitation of the HFCS relies on the subjective self-assessed valuation of assets. Whilst perceptions and preferences are crucial for understanding individual economic behaviour, such self-assessments are normally imprecise. Furthermore, wealth differences across countries may have also arisen from the size and composition of households participating in the survey. The use of households instead of per capita basis as a unit of measurement of wealth may explain why Maltese households scored highly in terms of wealth, which is predominantly in the form of real estate assets and not in income. Due to a relatively small sample size in Malta, another limitation of the Survey relates to a possible lack of representation of particular population sub-groups. The latter is a concern, particularly when capturing households of foreign nationals living in Malta and other sub-categories that make it difficult to extract meaningful results from a small number of observations.

Currently, the Central Bank of Malta is making the necessary preparations for the collection of data for the fourth wave of the HFCS, which is expected to have 2020 as the reference year. The process will commence in November 2020.

References


Housing Demand Shocks, Foreign Labour Infows and Consumption

William Gatt Fenech and Germano Ruisi

In this paper we propose a Structural Vector Autoregression (SVAR) identification strategy to disentangle two housing demand shocks and their ensuing effect on consumption. This builds on the literature studying the role of the collateral and housing wealth effects on household behaviour. A mix of zero and sign restrictions allows us to disentangle domestic and foreign housing demand shocks, which capture different motivations for owning or using real estate by residents and foreign workers. Using Maltese data over the period 2000 Q1-2019 Q4, we find that both housing demand shocks generate an increase in consumption, in line with the theoretical predictions from micro-founded models with financial frictions. While a domestic housing demand shock drives consumption via both the collateral and housing wealth channels, a foreign housing demand shock operates mainly via the latter. Moreover, these shocks account for about 40% of the fluctuations in house prices and consumption in the long run. From a historical perspective, these shocks exhibit a good match with the dynamics of foreign worker growth and a number of events that are associated with activity in the housing market.

Introduction

A majority of households in Malta are owners of their dwelling, and a subset of these own at least another property. According to the EU-SILC database, homeownership in Malta averaged 80.3% over the period 2005-2019. Besides providing a service, real estate serves an important role as collateral for loans (Spiteri, 2019). In this article, we look at the implications of movements in house prices on household consumption. The literature identifies two main theoretical channels through which house prices affect consumption: the collateral channel and the housing wealth channel (Campbell and Cocco, 2007). The collateral channel arises from borrowing limits that are conditional on the value of housing. An increase in house prices raises the borrowing limit – absent any other changes – which allows households to use the additional resources to smooth consumption. The wealth channel hinges on the ability of households to realise the capital gain by selling part of their holdings of housing, which frees resources that can be used, inter alia, for consumption.

Our contribution is to study the role of housing demand shocks in driving consumption from a macroeconomic perspective. As part of our contribution, we identify two distinct sources of housing market disturbances, which we label domestic and foreign housing demand shocks, respectively. The former captures preference shifters in the demand for housing by permanent residents for long-term use, such as the desire for higher average homeownership, government housing market initiatives, and socio-economic changes such as separations and divorces. This shock is routinely identified in theoretical and empirical studies of the housing market. On the other hand, a foreign housing demand shock is our novel contribution and captures a rise in demand for accommodation by migrant workers.

We consider this to be an important shock to identify as migration flows were positive since Malta’s accession to the European Union (EU), and accelerated substantially since 2012. Besides contributing significantly to economic activity (Furlanetto and Robstad, 2019), and in the case of Malta to its economic boom over the past years (Grech, 2015; Grech and Borg, 2018), migration inflows are likely associated with increases in aggregate house prices

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1 We would like to thank Mr Alexander Demarco, Dr Aaron George Grech, Dr Brian Micallef and participants in an internal seminar at the Central Bank of Malta for helpful comments and suggestions, and Dr Valentina Antonaroli and Ms Abigail Marie Rapa for assistance with Household Finance and Consumption Survey and population data respectively. Any remaining errors are our own. The views expressed in this paper are the authors’ own and do not necessarily reflect the views of the Central Bank of Malta.
(Saiz, 2007; McDonald, 2013). For this reason, we investigate whether the demand for accommodation exerted by immigrants can also affect consumption through the channels discussed above.

“We investigate whether the demand for accommodation exerted by immigrants can also affect consumption through the channels discussed above”

Using a Bayesian VAR identified through a mix of zero and sign restrictions, we find a positive consumption response to a domestic housing demand shock that raises house prices and credit, in support of the collateral and housing wealth channels. The reaction of consumption is in line with theoretical predictions from MEDSEA-FIN, a dynamic stochastic general equilibrium (DSGE) model with housing and financial frictions calibrated to the Maltese economy (Gatt et al., 2020). Thus, our work also serves as a cross-check on the restrictions imposed in a microfounded model. Additionally, we decompose the rise in consumption into the collateral and housing wealth channels and find they are both equally important in driving the consumption response. A foreign housing demand shock generates a weaker consumption response, and seems to operate mainly through the housing wealth channel. The two shocks combined account for about 40% of the fluctuations of house prices and consumption in the long run, similar to results for Ireland and Spain (Nocera and Roma, 2017). Consequently, we show that both housing demand shocks were important in explaining movements in house prices, credit and consumption over the past two decades and, in addition, align well with a set of relevant historical events, such as the EU referendum/accession and stamp duty reductions.

“We show that both housing demand shocks were important in explaining movements in house prices, credit and consumption over the past two decades”

Methodology

The model we estimate includes both endogenous and exogenous variables and has the following VAR representation:

\[
y_t = A + B t + \sum_{l=1}^{L} C_l y_{t-l} + \sum_{l=1}^{L} D_l z_{t-l} + u_t
\]

for \( t = 1, \ldots, T \), where \( y_t \) is an \( N \times 1 \) vector of endogenous variables and \( y_{t-l} \) a number of lagged values of the latter with \( l = 1, \ldots, L \). Similarly, \( z_{t-l} \) represents \( M \times 1 \) vectors containing lagged values of exogenous variables. \( A \) is an \( N \times 1 \) vector of intercepts, \( B \) an \( N \times 1 \) vector of coefficients that loads on a linear time trend \( t \) while \( C_l \) and \( D_l \) respectively represent \( N \times N \) and \( N \times M \) matrices containing the slopes relative to the lagged values of the endogenous and the exogenous variables. Finally, \( u_t \) is an \( N \times 1 \) vector of reduced form residuals with \( u_t \sim N(0, \Sigma) \) where \( \Sigma \) is the \( N \times N \) variance-covariance matrix.

We estimate a five-variable Bayesian VAR featuring real GDP per capita, the retail price index (RPI), real house prices, real household credit per capita and real consumption per capita. Our measure of house prices is based on advertised prices as compiled by the Central Bank of Malta and we choose this index as it is the longest available time series for house prices in Malta. Finally, the model includes the real lending rate as an exogenous variable. All the variables are expressed in logarithms with the exception of the lending rate, which is expressed in levels. We use quarterly data with the sample running from 2000 Q1 to 2019 Q4, and we implement zero and sign restrictions using the procedure developed in Arias et al. (2018).

\footnote{We remove the housing rent component from the RPI to make sure that the latter reflects only the price level of all goods except housing. By doing so, the RPI index and the real house prices series used in this model are completely distinct from one another. See Gatt and Ruisi (2020), Appendix A for a full description of the data used.}

\footnote{We do not endogenise the lending rate because it is likely driven by conventional and unconventional monetary policy measures, which are not the focus of this paper.}
We fully identify the system with five shocks: the two housing demand shocks, a loan supply shock, and aggregate demand and supply shocks. The two housing demand shocks are the focus of this article as they help us detect the presence of the wealth and collateral channels that run from house prices to consumption through different transmission mechanisms, and allow us to recover counterfactual paths for the observables. The other three shocks are meant to capture the remaining dynamics in the system. We only impose impact restrictions and allow the responses at higher horizons to be driven by the data. The joint use of zero and sign restrictions allows us to distinguish a housing demand shock from an aggregate demand shock. Table 1 summarises the identification of these shocks.

We identify the first housing demand shock – a domestic housing demand shock – as the classic impulse to preferences as specified in DSGE models with housing or land (Iacoviello and Neri, 2010; Liu et al., 2013). This shock represents taste shifters, such as a desire for homeownership or a desire to upsize or downsize a house that one lives in. We label this ‘domestic’ since we have in mind transactions conducted by residents in Malta who are able to purchase a house through a bank loan. We therefore identify a positive domestic housing demand shock as one that raises house prices and credit and has no contemporaneous effect on all other prices. We leave the response of consumption and GDP unrestricted and therefore data-driven. Our prior expectation is that consumption rises in response to this shock, as discussed in the introduction and in line with theoretical predictions from DSGE models (Iacoviello, 2005; Iacoviello and Neri, 2010).

The second is a foreign housing demand shock. This shock captures shifts in the desire for accommodation by non-Maltese residents, namely migrant workers. Although it raises house prices, it has an immediate negative effect on credit per capita, and we justify the latter identifying restriction as follows. A net rise in inward migration raises housing demand and the population size, but since these workers likely do not intend to buy property, at least immediately, then credit for mortgages is unaffected on impact. This assumption is especially valid since the length of stay of foreign workers in Malta is typically short (Borg, 2019) and therefore unlikely to feature the purchase of real estate through bank financing. As a result, we should observe a fall in credit per capita following a foreign housing demand shock on impact, all else being equal, since the stock of credit is unchanged but the population rises.

**Results**

We present the main results through impulse response functions (IRFs), scaled at a 1% impact rise in house prices, and forecast error variance decompositions (FEVD) over a 40-quarter horizon. Furthermore, we show some counterfactual exercises that highlight the link between house prices and consumption.

A domestic housing demand shock, shown in Figure 1, produces a persistent rise in house prices that spans four years. It also produces a humped-shaped response of household credit, which persists throughout a ten-year horizon, even though house prices experience a correction after about four years. We find a positive median response of consumption to the domestic housing demand shock, in line with the collateral and wealth effect channels discussed.

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**Table 1**

<table>
<thead>
<tr>
<th></th>
<th>Domestic housing demand</th>
<th>Foreign housing demand</th>
<th>Loan supply</th>
<th>Aggregate demand</th>
<th>Aggregate supply</th>
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<tbody>
<tr>
<td>Real GDP per capita</td>
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<td>+</td>
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<td>?</td>
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<tr>
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<td>-</td>
<td>+</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Real consumption per capita</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

*Source: Authors’ contribution.*

*Note: The entries refer to the impact response of a variable to a structural shock; + indicates a positive response, - indicates a negative response, while ? indicates that no restriction is imposed on that variable.*

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For a full discussion of the identifying restrictions as well as the full set of results please refer to Gatt and Ruisi (2020).
above. The response is low on impact but peaks at just under 0.2% in the period after the shock. The consumption response is very similar to the results in the literature, and the response at four quarters is 0.07%, in the ballpark of the estimates in Jarocinski and Smets (2008) and Iacoviello and Neri (2010) for the United States. The ten-year cumulated responses of house prices, credit and consumption to this shock are 3.3%, 11.1% and 0.9% respectively.

“We find a positive median response of consumption to the domestic housing demand shock, in line with the collateral and wealth effect channels discussed above”

The foreign housing demand shock leads to a very persistent rise in house prices based on the median response, and remains positive for up to ten years (see Figure 2). The consumption response is initially negative but surrounded by a high degree of uncertainty, peaking at 0.05% by the second quarter and staying elevated above zero throughout the response horizon. However, the peak median consumption response is lower than in the case of a domestic housing demand shock and the 68% credible bands are wider and cross zero throughout most of the horizon.
response horizon. This highlights the uncertainty around the effects of this shock on macroeconomic outcomes among the set of identified models. This uncertainty could be due to the fact that although inward labour migration has been positive since the early 2000s, most macroeconomic effects became strong enough in the data only following the recent surge in the inflow of foreign workers starting in 2012. Furthermore, a foreign housing demand shock changes the composition of the population, increasing the share of residents who are not able to borrow against collateral. This therefore dampens the potential rise in credit following a rise in house prices and therefore also lowers the aggregate consumption response. This makes it hard to identify with precision the effect in our model. Therefore, we cautiously interpret the consumption response as suggestive evidence for wealth effects from house price changes arising from foreign demand shocks. The response of household credit per capita is negative for the first three years, in line with the nature of the shock which increases the population but does not change the total stock of household credit.

Which shocks are important in explaining the fluctuations in the unexpected component of house prices, credit and consumption? Figure 3 shows the forecast error variance decomposition for the five structural shocks which we identify, based on the median draw. The domestic housing demand shock plays an important role in explaining the dynamics of all three variables, both in the short and long run, which we limit to a ten-year horizon. It explains a substantial share, around 50% and 25% of the variation in house prices and household credit respectively, in the first few periods following the shock, and about a third of the variation in consumption by the first year. This highlights a potentially strong role for the collateral channel in Malta. The contribution of this shock to house price variation falls to about 30% in the medium to long term, but rises to about 50% for household credit. The foreign housing demand shock plays a smaller yet significant role in house price movements across all horizons; about 33% on impact and slightly lower in the medium to long term. However, it explains a very small share of the unexplained component of consumption.

Our findings are close to those discussed in Nocera and Roma (2017), in particular for Ireland and Spain. In both these countries, housing demand shocks explain slightly more than 40% of the movements in house prices and about 15% of movements in consumption at a 20-quarter horizon. Moreover, close to 40% of the unexplained component of credit is explained

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5 Conversely, we conjecture that a large share of homeowners in Malta do not refinance their mortgage when the value of their housing wealth rises. This could also explain the muted response of credit and therefore of consumption to this shock.
by the housing demand shock in their study, a result which is largely homogeneous across the seven euro area countries they consider.

The impulse response functions and the forecast error variance decomposition imply a significant role for domestic housing demand shocks in driving consumption. To illustrate the importance of the housing wealth and collateral channels, we build the counterfactual response of consumption to a domestic housing demand shock. In particular, we try to disentangle the two channels by first building the counterfactual consumption response in the absence of a rise in credit. Then, we build the counterfactual response in the absence of both credit and house price movements. In Figure 4, we plot these two counterfactuals, superimposed on the benchmark response, for the two housing demand shocks.

In the case of a domestic housing demand shock both the collateral and housing wealth channels are operative. In the absence of credit rising, consumption still rises but is always lower compared to the benchmark (top left). In the second scenario (bottom left), the consumption response is virtually flat. With this exercise we illustrate the importance of the two main theoretical channels we are after. To quantify the relative strengths of these two channels, we compute the effect on the long-run cumulative response of consumption in the absence of each of these channels, and report them in Table 2. The collateral and housing wealth channels each contribute about 0.4% to the cumulated response of consumption at a ten year horizon, and jointly explain about 87% of the total consumption response to the domestic housing demand shock. Therefore, not only are the two channels about equally important but they also capture the main driving forces behind the consumption response.

**Figure 4**

*IRFs TO A DOMESTIC HOUSING DEMAND SHOCK*

**DOMESTIC HOUSING DEMAND**

*(percentage deviations from baseline)*

**FOREIGN HOUSING DEMAND**

*(percentage deviations from baseline)*

Source: Authors’ calculation.

Notes: The figure shows the median responses across the identified sets and the 68% credible bands, in percentage deviation from the baseline projection. Values on the horizontal axis are quarters following the shock. We normalise the shock to produce a 1% rise in real house prices on impact in both scenarios.
On the other hand, in the case of a foreign housing demand shock the consumption response seems to be driven by the housing wealth channel, although the absence of a collateral channel could be due to the changing composition of the population and the absence of mortgage refinancing we discussed above. Indeed, the top right panel in Figure 4 shows a very similar consumption response in the absence of credit movements, but the bottom right panel shows a very muted consumption response in the absence of both credit and house prices. In Table 2, we quantify the relative sizes and find that the housing wealth channel dominates the entire response. The cumulative impact due to this channel is stronger than in the benchmark response, since consumption in the latter falls in the first few periods.

“The collateral and housing wealth channels each contribute about 0.4% to the cumulated response of consumption at a ten year horizon, and jointly explain about 87% of the total consumption response to the domestic housing demand shock”

Validating the identified shocks

In this section, we test the information content of the identified housing demand shocks by studying their historical impact on key observables. Armed with a set of specific events which likely contributed to these shocks, we observe whether the timing of these events and the contribution of the shocks overlap. We find that most events line up very well with the shocks we identify. Figure 5 shows the contribution of the two housing demand shocks to growth in house prices, household credit and consumption, where the latter two are both expressed in per capita terms. When the shaded area is below the actual data, this implies that the shock contributed positively to the variable in question, and vice versa. For example, in the beginning of 2011, house price growth would have been around 0% instead of -5% in the absence of both housing demand shocks.

The earliest event of interest in our sample is the referendum on Malta’s membership of the European Union, which was held in March 2003, labelled ‘EU ref.’. We view the outcome – which was in favour of EU membership – as contributing to optimism about the economic outlook and development which boosted asset prices, credit and consumption. In fact, the contribution of domestic housing demand shocks to house prices – and to a lesser extent consumption – turned positive in the wake of this event, and the negative contributions to credit started to subside. Malta then joined the European Union on 1 May 2004, marked ‘EU accession’ in Figure 5. The contribution of domestic housing demand shocks was the highest in this period, also explaining the rise in credit and consumption per capita. The next event related to the housing market is a measure announced in the 2008 Budget Speech, effective as from 2007 Q4, which offered an interest rate subsidy for first time buyers of up to 1% if this was greater than 3.75% for ten years, and the lower stamp duty of 3.5% on a personal residence worth up to €70,000 was extended to property valued at up to €116,498. We label this event as ‘interest subsidy’. This measure was meant to stimulate the property sector, which was experiencing a heavy correction following several years of strong growth. We find that in this period low housing demand contributed negatively to house price growth, and the measure does not seem to have had any major influence on house prices, credit and consumption.

<table>
<thead>
<tr>
<th>Table 2</th>
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<tbody>
<tr>
<td><strong>LONG RUN CUMULATIVE IMPACT ON CONSUMPTION</strong></td>
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<tr>
<td><strong>Per cent</strong></td>
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<td></td>
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<tr>
<td><strong>Domestic housing demand</strong></td>
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<tr>
<td>Total</td>
</tr>
<tr>
<td>Collateral channel</td>
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<tr>
<td>Housing wealth channel</td>
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</table>

Source: Authors’ calculation.

Note: The table shows the cumulative rise in consumption following a domestic and foreign housing demand shock respectively at a 10-year horizon.
Two other related events that we consider relevant for explaining shocks are the stamp duty reductions for first-time buyers in 2014 and for second-time buyers in 2018 (‘FTB st.duty’ and ‘STB st.duty’ respectively). These two policies reduced the amount of stamp duty that a household incurs upon buying a house, with the former in particular aimed at re-igniting the real estate market following years of subdued activity. These two events coincide with sizeable, positive
contributions of domestic housing demand shocks to house prices. The policy relating to first-time buyers was announced while domestic demand was already strong. However, since we use advertised house prices, we cannot rule out possible anticipation effects behind the rise in house prices prior to 2014. Although this policy was extended every year up to the end of our sample, we do not find strong contributions of housing demand shocks to house prices until the stamp duty refund for second-time buyers was announced. The latter coincides with a reversal from negative to positive contributions to house prices, and we attribute at least part of the rebound in advertised prices at that point in time to this policy.

Another noteworthy event in 2014 was the reduction in tax on rental income from 35% to 15%. This – over and above any other factor that increased supply – likely contributed to the housing sector by boosting the supply of rental properties by increasing the willingness of landlords to put their property on the rental market. Notwithstanding this, our decomposition attributes positive foreign housing demand shocks, which pushed up house prices in this period. As we show in Figure 6, the number of foreign workers was rising at double digit rates in this period, with demand likely outstripping supply and putting further upward pressure on house prices.

Finally, in Figure 6 we focus on the contribution of foreign housing demand shocks to house prices and consumption and plot them on top of the dynamics of foreign workers in Malta. The growth in the number of foreign workers – which evolves differently from total population growth – correlates strongly with the contribution of our identified foreign demand shocks on house prices and consumption, giving us confidence in our identification strategy. In particular, the house price contribution and foreign worker growth fit each other very well in the period 2004-2014, even though in our estimation we divide real variables by the total population – which followed largely different growth dynamics. In the bottom panel, we lag the contribution to consumption by a year since the effect of the foreign housing demand shock takes about this long to take full effect. This contribution also correlates reasonably well with the dynamics of foreign workers, albeit to a lesser extent than house prices. Our results for the contributions of foreign housing demand shocks on the variables in Figure 5 are therefore well explained by the movement in foreign workers over time.

Conclusion

In this article we look at the link between house prices and consumption, motivated by the collateral and housing wealth channels documented in the literature. We use a Bayesian VAR model estimated on Maltese data to study the responses of a set of macroeconomic variables to housing demand shocks. We propose an identification strategy that allows us to disentangle the effects of two housing demand shocks, to capture the potentially different channels through which they might propagate.

We find a positive response of consumption to a domestic housing demand shock, driven equally by both the collateral and housing wealth channels. This is in line with theoretical predictions from DSGE models and empirical evidence from VAR models estimated for other economies. Therefore, the results in this paper also serve as an
important cross-check on the same theoretical restrictions imposed in MEDSEA-FIN via the collateral constraint. Domestic housing demand shocks contributed significantly to the evolution of house prices, credit and consumption in Malta. Moreover, we also find an important role for foreign housing demand shocks, driven by strong inflows of foreign workers in the Maltese economy, on house prices and consumption.

References


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