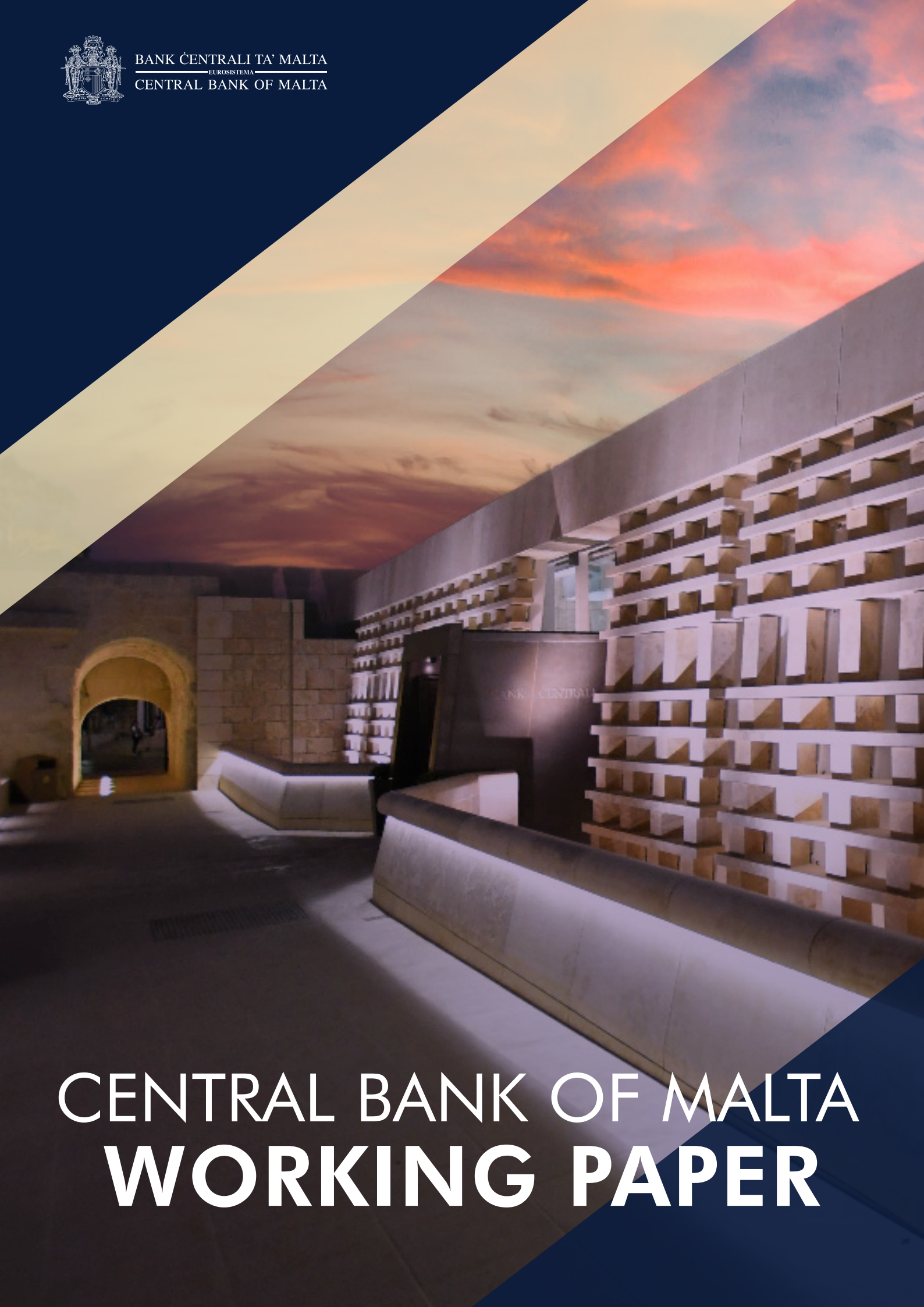


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# Financing Residential Property Purchases in Malta: The Role of Domestic Bank Credit

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**Abstract**

This paper examines how residential property purchases in Malta are financed, focusing on the role of domestic bank mortgages across locations, property types and time. Using administrative data on property deeds and new domestic bank mortgage contracts from 2020Q4 to 2025Q4, it constructs a segment-level measure of domestic bank mortgage reliance, defined as the ratio of mortgage contracts to registered property deeds within comparable district–property-type–quarter cells. Domestic bank mortgages accounted for around 64% of core housing transactions and around 47% of all registered residential property transactions. Mortgage reliance varies markedly across districts, with substantially higher model-adjusted probabilities in the Western and South Eastern districts than in Gozo and Comino or Northern Harbour. Differences across core residential property types are modest, while garages and plots of land are predominantly not financed through domestic bank mortgages. These patterns remain robust in a grouped binomial framework controlling for property type and quarter effects. A locality-level extension shows that mortgage reliance is associated with observable proxies for buyer composition, housing use and household financial capacity, including foreign participation, tenure, income and wealth. These associations are interpreted as descriptive rather than causal. The findings suggest that the domestic mortgage credit channel is uneven across Malta's housing market, with implications for monetary and macroprudential policy transmission.

**Keywords:** Housing finance; mortgage lending; residential real estate; mortgage reliance; spatial heterogeneity; monetary policy transmission; macroprudential policy.

**JEL classification:** G21, R31, G51, E52

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# 1 Introduction

The housing market plays a significant role in Malta's economy. The direct effects of construction and real estate sectors are estimated to account for around 10% of gross value added, with further indirect effects operating through output multipliers (Borg and Rapa, 2023). Beyond its direct contribution, the housing market is also an important channel through which financial conditions, including borrowing costs, credit availability and lending standards, are transmitted to the broader economy. This is particularly evident through private consumption via wealth and collateral effects, housing investment and the supply and demand for credit.

Given the importance of the mortgage credit channel, it is critical to understand how residential property purchases are financed, whether through bank mortgages or other funding sources.[2] Mortgage lending is a central channel through which financial conditions are transmitted to the housing market and the wider economy, accounting for around 55% of resident bank credit and constituting households' largest liability. Real estate also represents a very large share of households' wealth in Malta, estimated at around 82%, compared with about 65% in the euro area (Antonaroli et al., 2023).[3] This high concentration of wealth in housing amplifies macroeconomic and financial stability implications of developments in the property market.

Changes in the financing mix can alter how sensitive different parts of the housing market are to interest rates, lending conditions and borrower-based measures, with implications for the strength of monetary and macroprudential policy transmission. In Malta, however, empirical evidence on the extent to which residential property transactions are financed through the banking system remains limited, particularly across different locations, property types and over time. Earlier evidence points to a mixed financing structure, with around half of the property deeds being mortgage financed (Ellul et al., 2019). However, a more comprehensive and recent assessment of mortgage reliance across locations, property types and time remains lacking.

This paper seeks to fill this gap by combining administrative data on registered property transactions with information on new mortgage lending by domestic credit institutions. Using these sources, it constructs a segment-level measure of domestic mortgage reliance, defined as the ratio of new domestic bank mortgage contracts to registered property deeds within comparable district-property-type-quarter cells. The analysis proceeds in three steps. First, stylised facts describe the distribution of mortgage reliance across districts, property types and time during 2020Q4–2025Q4. Second, a grouped binomial logit framework assesses whether these patterns remain statistically meaningful after controlling for property-type composition and common quarter-specific effects. Third, a locality-level extension examines whether spatial variation in mortgage reliance is associated with observable proxies for buyer composition, housing use, household financial capacity and selected demographic characteristics.

The two administrative sources are aligned by district, property type and quarter, although mortgage contracts and deeds cannot be linked individually and may differ slightly in recording

[2]For the purposes of this analysis, non-mortgage or cash-financed purchases refer to transactions not financed through domestic bank mortgages. They do not necessarily imply purchases funded entirely from buyers' liquid own resources and may also include other non-bank financial arrangements, monetary donations or intra-family transfers.

[3]For Maltese households, 89.5% of total assets are real assets, of which 91.7% are real estate assets. For the euro area households, the corresponding figures are 79.9% and 81.6%, respectively.

date and coverage. Section 3 therefore describes the construction and interpretation of the measure in detail, including the possibility of timing and classification differences between the two sources. Since borrower-level characteristics are not observed, the results are interpreted as segment-level measures of mortgage reliance and as descriptive associations rather than causal estimates as set out in Section 3.6. Within these limits, the paper contributes by providing a comprehensive and recent measure of mortgage reliance across the Maltese housing market using administrative data. It also offers a structured assessment of whether spatial differences in mortgage reliance are associated with observable locality-level characteristics.

The rest of the paper is organised as follows. Section 2 reviews the existing literature on mortgage reliance. Section 3 provides an overview of the data and methodology. Section 4 presents the main stylised facts on mortgage reliance across districts, property types and over time. Section 5 assesses whether these patterns remain present after controlling for transaction composition and common quarter-specific effects, presenting the results as model-adjusted mortgage financing probabilities. Section 6 examines whether spatial variation in mortgage reliance is associated with observable locality-level proxies, while Section 7 concludes by highlighting possible policy implications.

# 2 Literature Review

This paper draws from a growing literature examining how residential property purchases are financed and the implications of mortgage reliance for housing market dynamics and policy. Rather than providing an exhaustive review, this section summarises stylised international evidence and the main factors associated with mortgage reliance that are most relevant for the Maltese context and that inform the empirical analysis conducted in this paper.

## 2.1 Mortgage versus Non-mortgage Financed Property Purchases

Cross-country evidence indicates that the share of residential property transactions financed through mortgage credit varies substantially across housing markets. This heterogeneity reflects differences in household balance sheets, mortgage-market depth, institutional frameworks, buyer composition and cultural factors. Official and institutional indicators, such as mortgage debt relative to GDP and home-ownership rates, point to sizeable differences in the role of mortgage finance across European countries (see Annex A). Such cross-country differences in mortgage reliance are also consistent with variations in the prevalence of non-mortgage property financing (Oesterreichische Nationalbank, 2025; National Bank of Romania, 2025). In broad terms, some countries exhibit high reliance on mortgage financing, while others, particularly in Southern and Eastern Europe, appear to have a larger share of transactions financed without mortgage credit. Country-specific descriptive evidence also suggests that purchases not financed through mortgage credit can account for a material share of housing-market activity, including in advanced economies such as the United States and the United Kingdom, where cash-buyer or non-mortgage purchase shares are often reported at sizeable levels (HM Land Registry, 2017; Realtor.com Research, 2025). Earlier evidence for Malta points to a mixed financing structure, with around half of property deeds being mortgage-financed (Ellul et al., 2019), reinforcing the need for a recent administrative-data-based assessment.

## 2.2 Factors Associated with Mortgage Reliance in Housing Transactions

The literature identifies a range of factors associated with whether residential property purchases are financed through mortgages or other sources. These factors are commonly grouped into three categories, namely borrower characteristics, property characteristics, and institutional or financial conditions.

Borrower characteristics play a central role. Household income, accumulated wealth, education, employment stability and life-cycle position of the borrower are clearly associated with both access to mortgage credit and mortgage use (European Central Bank, 2009; André, 2010; Cheshire and Sheppard, 1998; Camelo Rincón et al., 2018; Cousin et al., 2025). Empirical studies typically find younger households tend to rely more heavily on mortgages, while wealthier, older, or repeat buyers, are more likely to draw on savings, housing equity or inheritances. Access to family support can further reduce the dependence on bank financing. Recent evidence for Malta highlights the role of wealth transfers in facilitating access to home ownership and higher-value housing, underscoring the importance of accumulated wealth in shaping housing outcomes (Antonaroli et al., 2025). Investor activity is similarly relevant, as investment purchases are more frequently financed without bank credit in some settings (European Central Bank, 2009; André, 2010; Realtor.com Research, 2025). More broadly, observed mortgage reliance reflects both financing conditions and the composition of buyers active in the market, rather than being determined solely by macroeconomic factors.

Property characteristics also matter, mainly because they proxy transaction purpose and buyer composition. Mortgage financing tends to be more prevalent for standard residential units typically purchased for owner-occupation, where transactions are often structured around long-term housing consumption. By contrast, investment, development, second-home and some higher-value transactions may be more likely to involve own funds, housing equity or non-bank financing, although such purchases may also be leveraged depending on buyer characteristics and market conditions (Alter and Dernaoui, 2020; Realtor.com Research, 2025). Some evidence also points to non-linear price effects, with mortgage reliance potentially lower at both ends of the price distribution (Realtor.com Research, 2025). Location may interact with these effects, as some areas attract a greater concentration of investor, rental-oriented or non-primary-residence demand. Overall, these patterns reinforce the importance of transaction purpose and buyer composition for observed mortgage reliance.

Institutional and financial conditions represent further important factors associated with mortgage reliance. Countries with deeper mortgage markets, broader access to finance, and more developed financial systems generally exhibit greater use of mortgage lending and larger mortgage sectors relative to the size of their economies (André, 2010; Badev et al., 2014; International Monetary Fund, 2011; Calza et al., 2013). Conversely, higher interest rates, tighter lending standards, or stricter borrower-based macroprudential measures are typically associated with lower mortgage use, thereby increasing the relative importance of non-mortgage financed transactions (van Hoenselaar et al., 2021; Vella and Panfilo, 2025; Peydró et al., 2025; Drechsler et al., 2024; Dieckelmann et al., 2025).[4] Changes in financial conditions can therefore influence not only the volume of housing transactions, but also their financing structure.

[4] A decline in mortgage reliance may also reflect borrowers using smaller mortgages while financing a larger share from their own resources. Since the analysis captures the incidence of mortgage financing rather than loan-to-value ratios, such adjustments cannot be observed directly.

While the above factors are well documented in the international literature, their relative importance may differ in the Maltese context due to specific structural features of the domestic housing market. Malta's aggregate homeownership rate masks substantial differences across nationalities. NSO data for 2025 indicate that 84.6% of Maltese households are homeowners, compared with 36.2% of foreign households, resulting in an overall homeownership rate of 65.9%.[5] The prevalence of an outstanding mortgage among all households is also lower among foreign households, at 14.7%, compared with 21.2% among Maltese households. However, this difference largely reflects the substantially lower homeownership rate among foreign households. When the comparison is restricted to homeowners, the picture is reversed, with approximately 40.7% of foreign households having an outstanding mortgage, compared with around 25.0% of Maltese households. These stock-based figures should not be interpreted as mortgage-financing rates for recent property purchases, since they are also influenced by household age, the timing of home acquisition and whether earlier mortgages have already been repaid.

Housing demand in Malta is also influenced by strong inflows of foreign labour, which have been shown to exert significant effects on housing demand and prices (Gatt and Ruisi, 2020). Taken together, these features highlight the importance of considering foreign participation and tenure jointly when examining spatial differences in mortgage reliance. They also suggest that such differences may reflect broader variation in housing use, buyer composition and household financial capacity. In the absence of borrower-level data, the empirical analysis therefore relies on locality-level proxies for these dimensions, including foreign participation, tenure, income and wealth.

## 2.3 Why Mortgage Reliance Matters for Policy

The extent to which housing transactions rely on mortgage financing has important implications for the transmission of monetary and macroprudential policy. Mortgage lending represents a key channel through which financial conditions affect both households and the banking system.

In markets where housing transactions are predominantly mortgage-financed, changes in interest rates and lending standards tend to exert a stronger influence on housing demand, transaction volumes and prices (International Monetary Fund, 2011; Drechsler et al., 2024). This reflects the central role of mortgage credit in transmitting monetary policy through borrowing costs and credit availability (European Central Bank, 2025; Andaloussi et al., 2024). Recent evidence also shows that borrower-based macroprudential measures can affect housing credit growth by directly constraining borrowing capacity (European Central Bank, 2026). This reinforces the role of mortgage financing as a key conduit through which financial conditions and policy measures shape housing-market dynamics.

Mortgage reliance also affects household and bank balance sheets. Greater use of mortgage financing increases household indebtedness and leverage, heightening exposure to interest-rate and income-related shocks, particularly in environments characterised by variable-rate lending, elevated loan-to-value ratios, or limited refinancing capacity (Dynan, 2012; Ryan et al., 2023). From the perspective of the banking system, residential mortgages typically constitute a large share of banks' assets and therefore represent an important source of

[5]Source: NSO, News Release NR 086/2026. The 2025 figures provide a nationality breakdown of household tenure and outstanding mortgage status, but are not directly comparable with the 2021 Census district-level owner-occupation rates or the Eurostat homeownership rate because of differences in coverage, reference period and classification.

both income and risk. Adverse developments in the housing market may translate relatively quickly into higher credit risk and balance sheet pressures for banks (Committee on the Global Financial System, 2023).

By contrast, in market segments where housing purchases rely less heavily on mortgage borrowing, housing-market activity may be less sensitive to short-term credit conditions and relatively more influenced by non-credit determinants such as household wealth, demographic trends and investor behaviour (Calza et al., 2013; Cousin et al., 2025). In such cases, the effectiveness of credit-based monetary and macroprudential transmission channels may be attenuated, as adjustment occurs less through new mortgage origination and more through non-credit channels, including rental demand and external demand. Lower mortgage reliance does not necessarily imply lower housing-market risk, but rather a different set of transmission channels.

These considerations underscore why heterogeneity in mortgage reliance across market segments matters for policy. In the housing-market context, interest-rate changes, lending standards and borrower-based macroprudential measures are likely to have a more direct effect in segments where purchases rely more heavily on domestic mortgage credit. Borrower-based measures operate by constraining borrowing capacity, and evidence suggests that such instruments tend to affect housing credit growth more consistently than broader macroprudential tools (Lang et al., 2022; European Central Bank, 2026). This is also consistent with cross-country evidence that the transmission of monetary policy shocks to residential investment and house prices is stronger where mortgage markets are more developed and flexible (Calza et al., 2013; Drechsler et al., 2024). The converse holds in segments financed without domestic bank mortgages, as discussed above.

# 3 Data and Methodology

## 3.1 Data Sources and Coverage

This paper combines two administrative data sources to measure mortgage reliance in residential property transactions. The first source consists of registered residential property transactions obtained from the National Statistics Office (NSO), based on deeds registered with the Tax Authority. These data provide information on the number and value of residential transactions by district, property type and quarter.[6,7] The second source consists of information collected by the Central Bank of Malta on new residential mortgage loans granted by domestic credit institutions.[8] The mortgage data are compiled at the contract level and are subsequently aggregated for the purpose of this analysis.

The two data sources capture related but distinct administrative events. Mortgage contracts are recorded using the loan contract date, while property transactions are dated using the final deed. The two sources are aligned by district, property type and quarter, but the underlying observations cannot be matched at the individual transaction level. Differences may

[6]National Statistics Office, Property Transfers statistics, available at: https://nso.gov.mt/property/

[7]Given the grouped count structure of the data, the econometric analysis is based on transaction volumes. Value-based measures are reported in Annex C for completeness and yield broadly consistent descriptive patterns.

[8]Central Bank of Malta, Real Estate Data Template, available at: https://www.centralbankmalta.org/site/excel/statistics/Real_Estate_Data_Template.xlsb

therefore arise from timing, classification and coverage across the two administrative systems.[9] The analysis is conducted at the level of district–property-type–quarter segments, comparing the number of mortgage contracts with counts of registered deeds within each segment. The resulting measure is therefore interpreted as a segment-level mortgage-contract-to-deed ratio rather than an observed transaction-level financing classification of how individual purchases were financed.

Owing to data availability, the sample covers the period 2020Q4 to 2025Q4, allowing a recent assessment while preserving a relatively high level of cross-sectional detail across districts and property types.

## 3.2 Data Cleaning and Harmonisation

Several cleaning and harmonisation steps were required because the two datasets are collected for different administrative purposes and not directly linked at the transaction level. The mortgage dataset was cleaned and harmonised to ensure conceptual consistency with residential property purchases recorded in the deeds data. In addition to excluding non-residential and commercial real estate lending, the mortgage dataset was further filtered to remove renegotiated loans, loans relating to foreign property purchases, loans granted for other purposes than the acquisition of real estate, and any instances of double reporting. Transactions classified as "other" were excluded in both datasets so that the analysis focuses exclusively on clearly defined residential property types.

To enhance comparability across sources, the property-type classification was consolidated into four categories used throughout the paper. "Apartments" include apartments, maisonettes and penthouses; "houses" comprise other residential properties, including townhouses, terraced houses, villas and bungalows. Garages that do not form part of a residential unit are classified separately, as are plots of land, reflecting their distinct prices, transaction characteristics and financing patterns.

The geographical dimension of the analysis covers six districts, namely the Northern Harbour, Southern Harbour, South Eastern, Western, Northern, and Gozo and Comino regions, based on the NSO's regional classification.[10] This ensures consistency across data sources and comparability with other housing market statistics. Within Section 6, a more granular locality-level breakdown is used.

## 3.3 Measuring Mortgage Reliance

Given the structure of the data, the empirical analysis is conducted at an aggregate level. Mortgage reliance is measured as the ratio of new domestic bank mortgage contracts to registered residential property deeds within each district, property type and quarter cell. This mortgage-contract-to-deed ratio is used as a segment-level indicator of the incidence of domestic bank mortgage financing rather than the intensity of leverage per transaction. For expositional convenience, the paper also refers to this measure as the share of mortgage-financed transactions. Because individual contracts cannot be matched one-to-one with

[9] These dates are expected to be closely aligned, although in some cases the mortgage contract may precede the final deed. Any mismatch is likely to be concentrated within adjacent quarters and is not expected to materially affect the aggregated estimates of mortgage reliance.

[10] National Statistics Office, District Classification, available at: https://nso.gov.mt/district-classification/

individual deeds, the measures should be interpreted as segment-level measures of mortgage reliance rather than an observed transaction-level classification of each purchase.

Formally, for each district $d$, property type $p$, and quarter $t$, mortgage reliance is defined as:

$$MR_{d,p,t} = \frac{M_{d,p,t}}{D_{d,p,t}} \tag{1}$$

where:

- $M_{d,p,t}$ denotes the number of new residential mortgage contracts recorded in district $d$, property type $p$, and quarter $t$; and
- $D_{d,p,t}$ denotes the number of registered residential property transactions, or deeds, in the corresponding district–property-type–quarter cell.

The residual between registered deeds and mortgage contracts is used as an aggregate proxy for transactions not associated with a domestic bank mortgage in the data:

$$R_{d,p,t} = D_{d,p,t} - M_{d,p,t} \tag{2}$$

This residual may reflect purchases funded through own resources, monetary donations or other non-bank financing arrangements, together with any remaining timing, classification or coverage differences between the two administrative sources. It should therefore not be interpreted as a directly-observed count of cash-financed or otherwise non-mortgage financed purchases.

Because garages and plots of land exhibit materially different financing patterns, the analysis distinguishes between all property types and core housing transactions, defined as apartments and houses. Unless otherwise stated, the interpretation of mortgage reliance focuses on core housing, while all property results are used to illustrate composition effects. This distinction is particularly important for garages, as those purchased jointly with dwellings may be financed under mortgage contracts classified against the principal residential unit. For this reason, garages are excluded from the core housing measure and are not used to draw conclusions about the main residential mortgage credit channel.

## 3.4 Baseline Econometric Framework (District–Property Type–Quarter)

In addition to the descriptive analysis, the paper employs an econometric framework to assess whether differences in mortgage reliance across market segments remain statistically significant after controlling for property-type composition and common quarter-specific effects.[11] The baseline model is estimated at the district–property-type–quarter level, using 504 cells constructed from six districts, four property types and 21 quarters.[12]

For each district, property-type and quarter cell, the outcome is measured as a grouped proportion: new domestic bank mortgage contracts relative to registered property deeds.

[11] Quarter fixed effects are quarter dummies rather than a time trend. They are included to absorb common period-specific influences affecting all districts and property types, such as financing conditions, macroeconomic developments, policy measures or other nationwide shocks, and are not interpreted individually.

[12] Each observation corresponds to a district–property-type–quarter cell, containing aggregate counts of new domestic bank mortgage contracts and registered property deeds for a specific district, property type and quarter, for example apartments in the Northern Harbour district in 2022Q1.

Since this proportion is bounded between zero and one and is derived from grouped transaction counts, a grouped binomial logit specification provides a natural baseline framework. This model estimates segment-level mortgage-financing incidence while taking account of differences in transaction volumes across cells. Because the model is estimated using grouped counts, cells with larger transaction volumes contribute proportionately more information to estimation than smaller cells. This avoids treating small and large district–property-type–quarter cells as equally informative. This approach is consistent with the broader fractional-response literature, which favours logit-type specifications for bounded proportions (Papke and Wooldridge, 1996), with weighted least squares specifications reported as robustness checks.

Given evidence of extra-binomial variation, statistical inference is adjusted using a quasi-likelihood approach following Wedderburn (1974). This adjustment leaves the estimated conditional mean, coefficients and fitted probabilities unchanged, but produces more conservative standard errors and confidence intervals than those implied by the conventional binomial variance assumption.

The specification includes district, property-type and quarter fixed effects. District effects capture persistent spatial differences in mortgage reliance, property-type effects control for differences in transaction composition, and quarter fixed effects absorb common quarter-specific influences affecting all market segments. Since the sample begins in 2020Q4, these quarter fixed-effects also absorb common pandemic-related disruptions affecting all districts and property types in a given quarter, although segment-specific pandemic effects cannot be ruled out entirely. The objective is not to estimate structural behavioural parameters of mortgage demand, but to assess whether the heterogeneity documented in the stylised facts remains statistically meaningful after controlling for composition and common time variation.

In Section 5, the fitted model is presented mainly through model-adjusted predicted probabilities rather than odds ratios. These probabilities summarise model-adjusted mortgage-financing incidence within district or property-type segments after controlling for the other variables in the model. Because the data are aggregated at district–property-type–quarter level and mortgage contracts cannot be matched to individual deeds, these probabilities should be interpreted as segment-level indicators rather than as individual-buyer probabilities.

## 3.5 Extension: Locality-Level Association Analysis

While the baseline framework assesses whether mortgage reliance differs across districts and property types after controlling for common quarter-specific effects, it does not identify the borrower or transaction characteristics underlying this heterogeneity. The deeds data do not include borrower-level characteristics, such as first-time buyer status, intended use, age, creditworthiness, financing constraints or transaction-level income and wealth. This limits the extent to which observed differences can be attributed to household or transaction motives.

The locality-level analysis therefore examines whether spatial variation in mortgage reliance is associated with observable area-level proxies for buyer composition, housing use, household financial capacity and demographic structure. Because these indicators vary across only six districts, district-level relationships would be based on very limited cross-sectional variation and may be sensitive to individual districts. The analysis therefore moves to a

finer locality-level breakdown, increasing the number of cross-sectional units from six to 68 localities.[13]

The explanatory variables describe the resident population and housing stock of each locality and may not necessarily reflect the characteristics of the buyers purchasing property there. This distinction is particularly relevant where transactions involve non-residents, investors or buyers residing in other localities. The variables should therefore be interpreted as contextual area-level proxies rather than direct measures of buyer characteristics.

The interpretation of this reduced-form extension follows the framework set out in Section 3.6. The results are intended to provide descriptive evidence on observable correlates of spatial variation in mortgage reliance, rather than causal estimates of household financing behaviour.

### 3.6 Interpretation Framework and Robustness

The interpretation of all empirical results in this paper is governed by the aggregate structure of the data and by the fact that mortgage contracts cannot be linked to individual property deeds. The econometric frameworks serve two related purposes. First, the baseline district–property-type–quarter model assesses whether the patterns documented in the stylised facts remain statistically meaningful after controlling for transaction composition and common quarter-specific effects. Second, the locality-level models provide a reduced-form assessment of whether differences in mortgage reliance across locations are associated with observable locality characteristics.

Estimated mortgage-financed shares, mortgage-contract-to-deed ratios and model-adjusted probabilities should therefore be interpreted as segment-level measures of mortgage reliance. They summarise the incidence of domestic bank mortgage financing within district–property-type–quarter cells or locality-level segments, based on aggregate counts of mortgage contracts and property deeds. They should not be interpreted as observed transaction-level classifications of individual purchases.

The analysis does not observe individual buyer characteristics, buyer status, intended property use, creditworthiness, financing constraints, or transaction-level income and wealth. Accordingly, district, property-type and locality-level coefficients are interpreted as reduced-form descriptive associations between mortgage reliance and observable segment- or locality-level proxies. They should not be interpreted as causal effects nor as structural parameters of household mortgage demand. Robustness and diagnostic checks are used to assess whether the main qualitative patterns remain stable across alternative specifications, samples and functional forms.

## 4 Stylised Facts

This section presents descriptive evidence on mortgage reliance across property-market segments. The objective is to document the main patterns in the data before assessing their statistical robustness in Section 5 and their observable locality-level correlates in Section 6.

[13]District-level analysis is based on Malta's six districts identified by the NSO, whereas the locality-level analysis uses individual towns and villages nested within these districts. Moving from districts to localities increases the number of cross-sectional units from six to 68, providing greater variation in the explanatory indicators and a richer basis for assessing spatial differences in mortgage reliance.

## 4.1 Mortgage Financing is Widespread but Not Universal

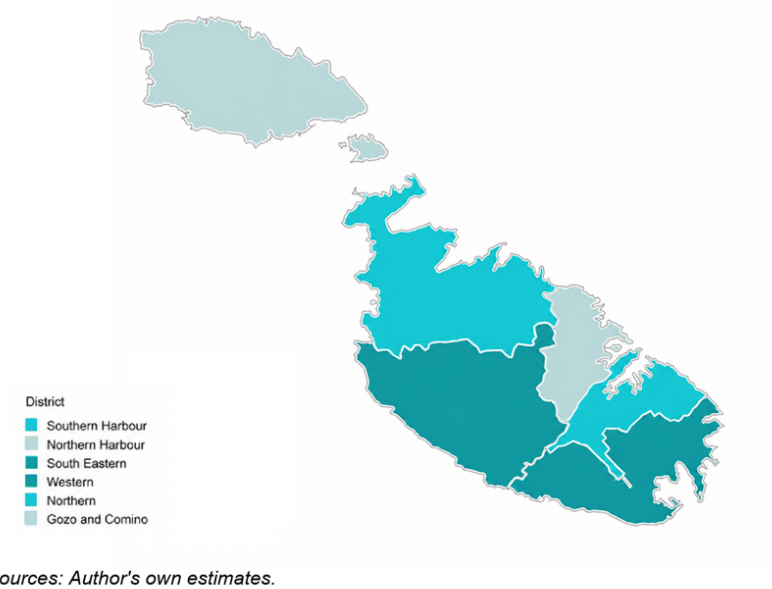
Over the period 2020Q4–2025Q4, around 47% of all registered residential property transactions in Malta were financed through bank mortgages.[14] This aggregate figure is influenced by the very low incidence of mortgage financing for garages and plots of land, which together account for almost one-third of total transactions in volume terms and have very low observed domestic mortgage reliance.

Excluding these categories and focusing on core housing, the share of transactions financed through bank mortgages rises to around 64%. At the same time, the presence of a sizeable proportion of non-mortgage-financed purchases indicates that housing market activity is not exclusively dependent on domestic bank lending and is consistent with the relevance of alternative sources of financing across different segments of the market.

## 4.2 Mortgage Reliance Varies Significantly Across Districts

Mortgage reliance differs markedly across districts, highlighting substantial geographical heterogeneity in financing patterns. Focusing on core housing, districts can be grouped into lower-, higher- and around-average mortgage-reliance segments relative to the national average (see Figure 1).

**Figure 1**
**ADMINISTRATIVE DISTRICTS OF MALTA AND GOZO**




*Sources: Author's own estimates.*
*Note: Districts are grouped into those with below-average, around-average, and above-average.*

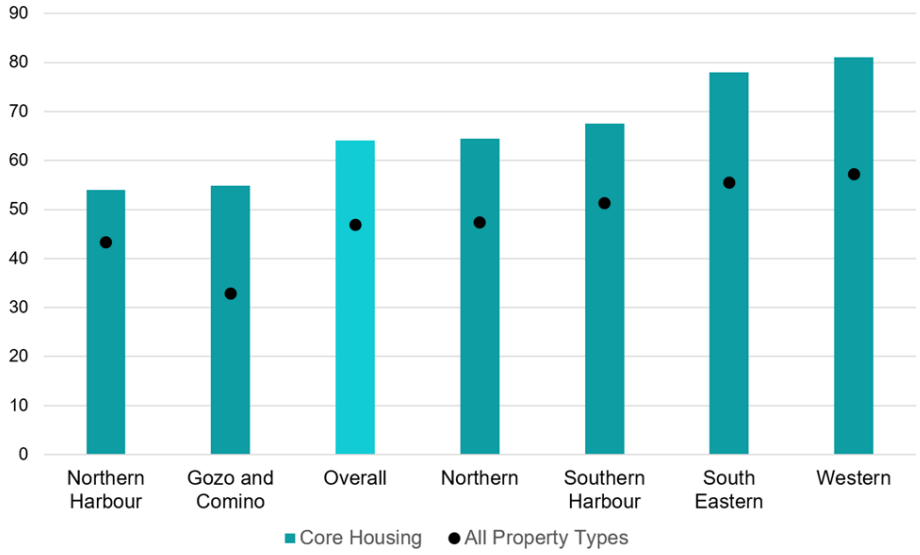
The Northern Harbour and Gozo and Comino districts exhibit the lowest mortgage reliance, with around 54–55% of core residential property transactions associated with domestic bank mortgage contracts, compared with 33–43% when all property types are included (see Chart 1). These patterns are consistent with differences in district-level buyer composition and housing use.

In the Northern Harbour district, lower mortgage reliance coincides with a comparatively high share of foreign residents, and indeed as at end-2024 the Northern Harbour district had

[14] Transactions classified as "other" are excluded.

the highest share of foreign residents, standing at 42.3% compared with 29.4% nationally.[15] As discussed in Section 2.2, foreign households have a substantially lower homeownership rate than Maltese households. Northern Harbour's high foreign-resident share is therefore consistent with a different tenure and housing-use structure, including a greater prevalence of rented accommodation. The household mortgage figures are stock-based and do not directly identify how recent property purchases by Maltese or foreign buyers were financed. Apartments account for around 62% of property deeds in the district, compared with 54% across Malta and Gozo as a whole, while Census 2021 data indicate that only about two-thirds of households in the district are owner-occupied, compared with a national average of around 75%. Together, these characteristics are consistent with a greater role for rental, investment and non-primary-residence activity.

**Chart 1**
**SHARE OF DEEDS MORTGAGE-FINANCED BY DISTRICT**
*(per cent)*




*Sources: Central Bank of Malta, NSO, Author's estimates.*

In Gozo and Comino, lower mortgage reliance is consistent with patterns commonly associated with wealth-based and lifestyle-driven demand, including second-home and retirement-related purchases. Household survey evidence suggests comparatively higher household wealth in Gozo (Antonaroli and Castaldo, 2026), while relatively lower property prices compared with mainland Malta may also be consistent with a greater role for equity-financed purchases, including by Maltese residents. Moreover, Census 2021 data indicate that only 55% of properties in Gozo are used as a main residence, compared with 72.5% nationally, which is consistent with a higher incidence of non-primary residence purchases and lower reliance on mortgage financing.

At the other end of the spectrum, the Western and South Eastern districts display substantially higher mortgage reliance, at around 81% and 78%, respectively for core housing, compared with 57% and 55% when all property types are included. These districts have a lower concentration of foreign residents, accounting for 13.5% and 19.3% of the population, respectively, compared with 29.4% nationally.[16] Census 2021 data indicate high levels of

[15]Source: NSO News Release NR 122/2025. The nationality-based homeownership and mortgage statistics discussed in Section 2.2 are drawn from NSO News Release NR 086/2026. The two sources provide complementary information but differ in reference period, coverage and geographical detail.

[16]Source: NSO News Release NR 122/2025.

ownership in these districts, standing at 88.7% and 83.0% respectively, compared with a national average of around 75%. The Northern and Southern Harbour districts lie broadly in line with the national average, with mortgage-financed transactions accounting for around 64–68% of core housing purchases and around 47–51% for all properties.

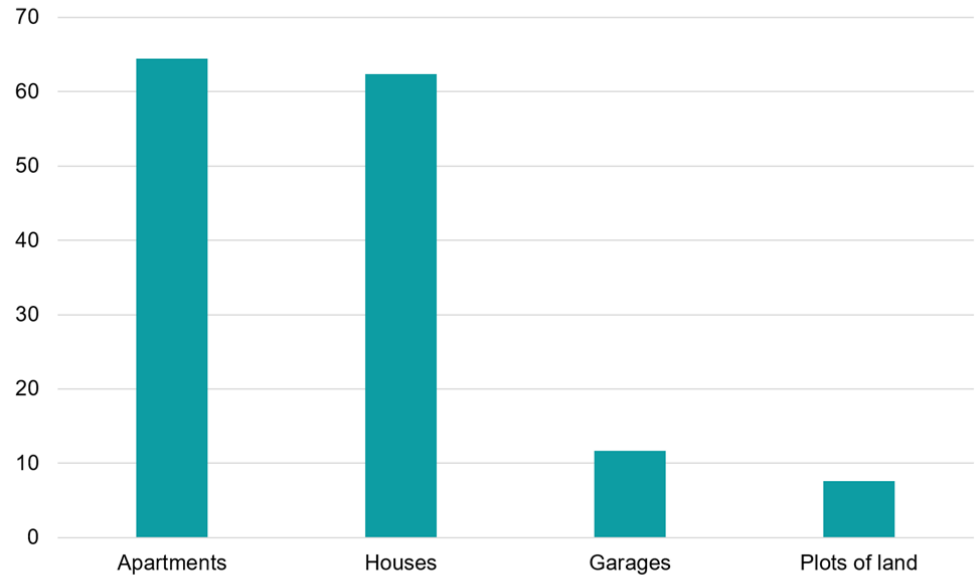
Wilson confidence intervals provide a descriptive benchmark for the uncertainty around observed district-level mortgage-contract-to-deed shares for core housing, indicating that low- and high-reliance districts remain clearly separated (see Annex C). Overall, these stylised facts highlight significant cross-district heterogeneity in mortgage reliance. The discussion above provides descriptive context using external indicators but does not identify the underlying borrower-level drivers of these differences. The extent to which spatial differences are associated with observable locality-level proxies is examined more formally in Section 6.

## 4.3 Mortgage Reliance Differs Modestly Across Core Property Types

Differences in mortgage reliance across core housing exist but appear relatively contained. Over the sample period, around 64% of transactions involving apartments, maisonettes and penthouses were financed through bank mortgages, compared with approximately 62% for houses (see Chart 2). The slightly higher mortgage reliance for apartments is most evident in the Southern Harbour, Western and Gozo and Comino districts, although the pattern is not uniform across all districts and appears considerably weaker elsewhere (see Chart 3). Overall, within core housing, broad property-type differences appear limited relative to the spatial variation in mortgage reliance across districts.

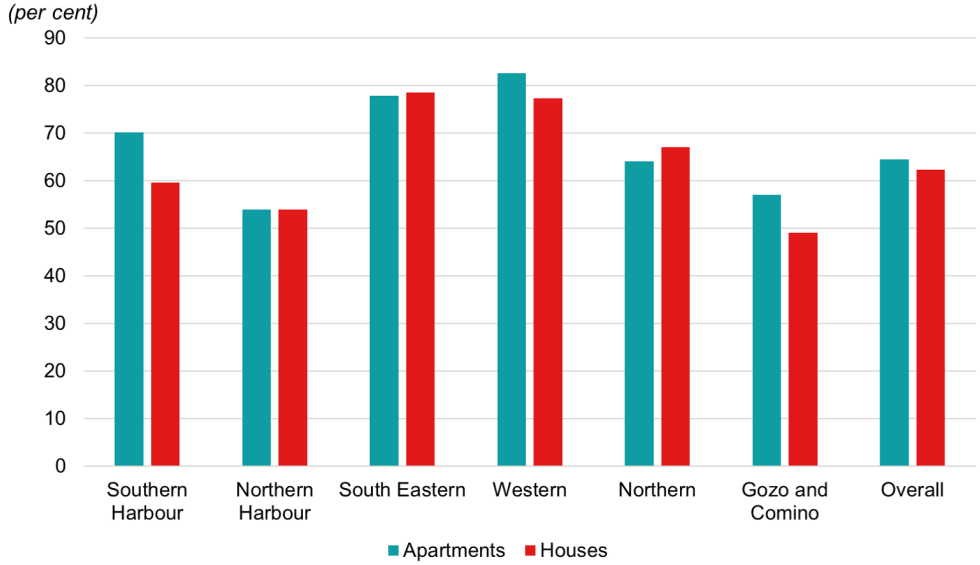
By contrast, garages and plots of land show markedly lower mortgage reliance, at around 12% and 8%, respectively. These segments are generally characterised by lower transaction values and, in some cases, an investment- or development-oriented transaction profile, distinguishing them clearly from the core residential market and reinforcing the rationale for focusing on core housing when interpreting the mortgage credit channel.

**Chart 2**
**SHARE OF DEEDS MORTGAGE-FINANCED BY PROPERTY TYPE**
*(per cent)*




*Sources: Central Bank of Malta, NSO, Author's estimates.*

**Chart 3**
**SHARE OF DEEDS MORTGAGE-FINANCED BY DISTRICT AND PROPERTY TYPE**
*(per cent)*




*Sources: Central Bank of Malta, NSO, Author's own estimates.*
*Note: Apartments also include maisonettes and penthouses*

### 4.4 Mortgage Reliance Exhibits No Trend Amid Short-Term Fluctuations

Mortgage reliance in core housing typically fluctuated within a 60–70% range over the sample period, with no clear upward or downward trend. Short-term fluctuations are evident, but they do not point to a persistent structural shift in financing behaviour (see Annex B).

## 5 Baseline Econometric Evidence on Mortgage Reliance

To complement the descriptive analysis, this section estimates a grouped binomial logit model to assess whether the differences in mortgage reliance documented in the stylised facts remain statistically meaningful after controlling for district, property type and quarter fixed effects. The baseline specification is estimated on all property types, while a separate core housing specification focuses on the main residential market.

Formally, segment-level mortgage-financing incidence is modelled using a grouped binomial logit specification as:

$$y_i \sim \text{Binomial}(n_i, p_i) \tag{3}$$

$$\log\left(\frac{p_i}{1-p_i}\right) = \alpha + D_i\beta + P_i\gamma + T_i\delta \tag{4}$$

where $y_i$ denotes the number of new domestic bank mortgage contracts in cell $i$, $n_i$ is the number of registered property deeds in that cell, and $p_i$ denotes the segment-level mortgage financing incidence. The index $i$ refers to an aggregated district–property-type–quarter cell

rather than to an individual transaction. The terms $D_i$, $P_i$, and $T_i$ denote sets of dummy variables capturing district, property type, and quarter fixed effects, respectively.

The residual between total registered deeds and new domestic bank mortgage contracts is interpreted as a segment-level proxy for transactions not associated with a domestic bank mortgage in the data. This framework allows the joint assessment of spatial, compositional and quarter-specific differences in mortgage reliance within a single specification. Apartments, maisonettes and penthouses, Gozo and Comino, and 2020Q4 serve as the reference categories in the coefficient-based specification. Since the main results are presented as model-adjusted probabilities, their interpretation does not depend on the choice of reference category. The corresponding coefficient and odds-ratio estimates are reported in Annex D.

Consistent with the interpretation framework in Section 3.6, the resulting predicted probabilities are interpreted as segment-level indicators of mortgage reliance rather than individual-buyer probabilities.

The specification is intentionally highly parameterised, reflecting the objective of controlling for cross-sectional composition across district–property-type–quarter cells rather than estimating a structural model of mortgage demand. The results should be interpreted as a reduced-form decomposition of segment-level heterogeneity in mortgage reliance.

Model diagnostics indicate a substantial improvement over an intercept-only specification, with district, property-type and quarter effects capturing meaningful variation in segment-level mortgage reliance. These fit measures should be interpreted cautiously, since high pseudo-$R^2$ values partly reflect the grouped structure of the data and the large differences between core housing and non-core categories. Moreover, the overdispersion discussed in Section 5.3 and Annex E means that model fit should not be interpreted as transaction-level predictive accuracy.

## 5.1 Model-Adjusted Mortgage-Financing Probabilities by District

Expressed in probability terms, the model-adjusted results closely mirror the stylised facts, although the confidence intervals are wider once overdispersion is taken into account (see Table 1). The district probabilities are computed as transaction-weighted average marginal predictions, standardised over the common observed property-type and quarter distribution in the estimation sample. They therefore measure expected mortgage-financing incidence within each district segment under a common transaction composition, rather than individual-level probabilities attached to a specific buyer or property purchase. For core housing, the estimated probability is around 55% in Gozo and Comino and 54% in Northern Harbour, compared with 78% in the South Eastern district and 81% in the Western district. Relative to Gozo and Comino, the estimated incidence is around 23 percentage points higher in the South Eastern district and 26 percentage points higher in the Western district. The wider confidence intervals do not alter the main ranking: the Western and South Eastern districts remain clearly higher-mortgage-reliance segments, while Northern Harbour remains statistically close to Gozo and Comino.

These probability gaps indicate that spatial heterogeneity in mortgage reliance remains economically meaningful after controlling for property type composition and quarter fixed effects. Consistent with Section 3.6, these differences are interpreted as segment-level associations rather than causal effects of geography.

Table 1: Model-adjusted mortgage-financing probabilities by district

| District | All property types | Core housing | Difference vs Gozo and Comino (Core housing) | Share of core transactions |
|---|---|---|---|---|
| Gozo and Comino | 39.0 [37.0, 40.9] | 55.1 [51.9, 58.2] | 0.0 | 11.8% |
| Northern Harbour | 39.8 [38.5, 41.1] | 53.8 [51.8, 55.8] | -1.3 [-5.1, 2.4] | 30.3% |
| Northern | 46.8 [45.2, 48.3] | 64.3 [61.9, 66.5] | +9.2 [5.4, 13.2] | 19.8% |
| Southern Harbour | 50.3 [48.6, 52.0] | 67.7 [65.0, 70.1] | +12.6 [8.5, 16.6] | 15.0% |
| South Eastern | 56.8 [55.0, 58.4] | 78.0 [75.4, 80.2] | +22.9 [18.9, 26.8] | 13.9% |
| Western | 58.7 [56.6, 60.7] | 81.1 [78.0, 83.8] | +26.0 [21.5, 30.2] | 9.3% |

*Notes:* Model-adjusted probabilities summarise segment-level mortgage financing incidence derived from the grouped logit mean specification. District probabilities are computed as transaction-weighted average marginal predictions, with property type and quarter averaged over their common observed transaction-weighted distribution in the estimation sample. Values are expressed as percentages, with 95% confidence intervals in brackets. Confidence intervals are computed using overdispersion-adjusted standard errors, based on the quasi-binomial variance adjustment discussed in Section 5.3 and Annex E. Differences relative to Gozo and Comino are expressed in percentage points. The final column reports each district's share of all core-housing transactions in the estimation sample. Interpretation follows Sections 3.4 and 3.6. The corresponding odds-ratio estimates are reported in Annex D.

## 5.2 Model-Adjusted Mortgage-Financing Probabilities by Property Type

Clear differences are also observed across property types, although the main distinction is between core housing and non-core categories. The model-adjusted probability is estimated at around 65% for apartments, maisonettes and penthouses, compared with around 62% for houses, a difference of around 3 percentage points (see Table 2). While statistically significant, this difference within core housing is modest relative to the district-level variation documented above. This pattern is consistent with the view that location captures broader differences in buyer composition, housing use and transaction motives, whereas broad property type alone provides a more limited signal of mortgage-financing behaviour.

By contrast, garages and plots of land have much lower adjusted probabilities, at around 11% and 8%, respectively. These results confirm that non-core categories are clearly distinct from apartments and houses and support the focus on core housing when interpreting the residential mortgage credit channel, as set out in Section 3.3.

## 5.3 Robustness of Results

As a robustness exercise, the baseline specification was re-estimated under alternative treatments of common time variation, variance assumptions and functional forms. Given the evidence of extra-binomial variation, statistical inference is based on a quasi-binomial variance adjustment following the quasi-likelihood framework developed by Wedderburn

Table 2: Model-adjusted mortgage-financing probabilities by property type

| Property type | Model-adjusted probability | Difference vs apartments | Share of transactions |
|---|---|---|---|
| Apartments / maisonettes / penthouses | 64.7 [63.7, 65.7] | 0.0 | 54.2% |
| Houses | 61.6 [59.4, 63.7] | -3.1 [-5.6, -0.8] | 13.6% |
| Garages | 11.2 [10.3, 12.3] | -53.5 [-54.8, -52.0] | 24.5% |
| Plots of land | 8.2 [6.7, 10.0] | -56.5 [-58.3, -54.5] | 7.7% |

*Notes:* Model-adjusted probabilities summarise segment-level mortgage-financing incidence from the grouped logit mean specification. Property-type probabilities are computed as transaction-weighted average marginal predictions: for each property type, the property-type indicator is set to the relevant category, while district and quarter are averaged over their common observed transaction-weighted distribution in the estimation sample. Values are expressed as percentages, with 95% confidence intervals in brackets. Confidence intervals are computed using overdispersion-adjusted standard errors, based on the quasi-binomial variance adjustment discussed in Section 5.3 and Annex E. Differences relative to apartments, maisonettes and penthouses are expressed in percentage points. The share of transactions refers to each property type's proportion of total observations in the estimation sample. Interpretation follows Sections 3.4 and 3.6. The corresponding odds-ratio estimates are reported in Annex D.

(1974). This adjustment produces more conservative standard errors and confidence intervals while leaving the estimated coefficients and fitted probabilities unchanged. The main district and property-type rankings are robust to replacing quarter fixed effects with macro-financial controls, re-estimating using a probit link, and estimating transaction-weighted least squares models. When quarter fixed effects are replaced by the mortgage lending rate and real GDP growth, the mortgage-rate coefficient is negative, consistent with standard credit-demand and affordability channels. This result is interpreted descriptively in line with Section 3.6. Full results are reported in Annex E.

## 5.4 Summary of Baseline Econometric Evidence

Overall, the baseline econometric evidence confirms the main stylised facts. Mortgage reliance differs substantially across districts after controlling for property type and quarter fixed effects, while differences between apartments and houses are comparatively modest. The results therefore point to spatial heterogeneity as the more prominent dimension of variation within core housing. Consistent with Section 3.6, these estimates are interpreted as segment-level associations rather than causal effects.

# 6 Locality-Level Extension: Observable Correlates of Spatial Variation

## 6.1 Motivation

Section 5 showed that mortgage reliance differs substantially across districts even after controlling for property-type composition and quarter fixed effects. While district fixed effects summarise this heterogeneity, they do not identify the factors associated with it because they capture a bundle of underlying differences across areas, including variation in buyer composition, transaction purpose, housing use and demographic structure. This section therefore examines whether observable locality-level characteristics related to buyer composition, housing use and household financial capacity are associated with the observed spatial variation in mortgage reliance. Demographic and property-price indicators are considered separately as supplementary checks.

Two considerations motivate the locality-level approach rather than relying solely on district-level data. First, with only six districts, relationships between mortgage reliance and district characteristics can be sensitive to individual observations and correlations among explanatory proxies. Second, a finer geographic breakdown provides substantially more cross-sectional variation, allowing a more robust assessment of whether the relationships observed at the district level persist once the unit of analysis is expanded to localities. Consistent with Section 3.6, the locality-level variables are interpreted as area-level proxies rather than borrower-level controls.

## 6.2 Locality-Level Empirical Strategy and Data

The locality-level analysis uses the same administrative data sources as the baseline district-level analysis, but aggregates mortgage contracts and registered deeds at locality level over the full sample period. The preferred 'Core' dataset covers apartments and houses, while the 'All' dataset additionally includes garages and plots of land and is used as a robustness check. This distinction mirrors the earlier focus on core housing as the more relevant segment for assessing the domestic residential mortgage credit channel.

The dependent variable is the number of new domestic bank mortgage contracts in each locality, modelled relative to the total number of registered deeds using a grouped logit specification. Unlike the district-level baseline model, which is estimated on district–property-type–quarter cells, the locality-level model aggregates mortgage contracts and deeds over the full sample period and is estimated as a cross-section of 68 localities. Each locality therefore enters the preferred specification once, meaning that the model does not contain repeated quarterly observations within localities and does not give rise to within-locality serial correlation across quarters. Locality-level mortgage reliance is therefore interpreted as estimated segment-level mortgage-financing incidence, rather than as an observed classification of individual transactions. As in the baseline framework, the model uses transaction counts directly, so that localities with larger transaction volumes contribute proportionately more information to the estimation.

The locality-level explanatory variables in the preferred specification are intended to proxy observable dimensions of buyer composition, housing use and household financial capacity. Foreign participation is proxied by the share of the locality population that is

foreign.[17] Housing use is proxied primarily by tenure, which captures the degree of owner-occupation in the locality. A higher tenure value indicates a stronger owner-occupied housing structure, while lower tenure values are consistent with a greater prevalence of rented or non-owner-occupied housing. The share of dwellings used as a main residence is considered separately as an alternative housing-use proxy in robustness checks. An interaction between foreign participation and tenure allows the association between mortgage reliance and foreign participation to vary with local housing-use structure, rather than imposing purely additive relationships.

The preferred specification also includes HFCS-based proxies for household financial capacity, measured by locality-level median household gross income and median household net wealth. These variables are area-level proxies and do not measure the income or wealth of the buyers observed in the transaction data. Because HFCS locality-level estimates are survey-based and some cells contain relatively few observations, locality medians are shrunk towards the corresponding district medians before inclusion in the model. This reduces the influence of small-sample locality estimates while preserving locality-specific information where sample sizes are larger. This approach follows the general logic of small-area estimation, whereby less precise local estimates are partially pooled towards more reliable higher-level estimates (Fay and Herriot, 1979). Wealth is log-transformed after adjustment to account for skewness. Annex H provides the full construction details. The Gozo and Comino dummy is included to capture a structural level shift in mortgage reliance for Gozo localities relative to localities on Malta's main island, reflecting the distinct housing-market characteristics documented earlier in the paper.

All continuous explanatory variables are standardised using the mean and standard deviation across localities in the estimation sample. Accordingly, coefficients are interpreted as the change in log-odds of mortgage financing associated with a one-standard-deviation increase in the relevant locality characteristic, conditional on the other covariates. This standardisation facilitates comparison across variables measured in different units, such as foreign population shares, tenure rates, income and wealth.

A more parsimonious specification excluding income and wealth is also reported as a benchmark, given the survey-based nature of the HFCS income and wealth proxies. This allows the analysis to assess whether the core foreign participation–tenure relationship remains stable once the HFCS-based financial-capacity proxies are included.

Locality-level property prices are not included in the preferred specification because a consistent transaction-level price measure is unavailable across all property types and localities. The available official indicator is an apartment-specific relative price index with more limited geographic coverage. Property prices and demographic indicators are therefore examined separately as supplementary checks in Section 6.7, rather than incorporated in the preferred specification.

[17] As discussed in Section 2.2, foreign households have substantially lower homeownership than Maltese households. Among current homeowners, the prevalence of an outstanding mortgage is higher among foreign households, although this stock-based comparison is influenced by the timing of home acquisition and mortgage repayment and does not measure the financing of recent property purchases. The foreign-participation variable may therefore capture differences in tenure composition, rental market intensity and housing use, as well as broader differences between the resident population and the buyers active in each locality.

## 6.3 Preferred Locality-Level Specification

Following the motivation set out above, the locality-level analysis is based on a preferred specification that combines observable proxies for buyer composition, housing use and household financial capacity. The specification includes foreign participation, tenure, their interaction, a Gozo and Comino dummy, and HFCS-based proxies for household income and wealth. It is intended to assess whether these observable locality-level indicators are jointly associated with cross-locality variation in mortgage reliance.

Formally, for locality $l$, the preferred grouped binomial logit specification is given by:

$$y_l \sim \text{Binomial}(n_l, p_l) \tag{5}$$

$$\begin{aligned} \log\left(\frac{p_l}{1-p_l}\right) =& \alpha + \beta_1 Foreign_l + \beta_2 Tenure_l \\ &+ \beta_3(Foreign_l \times Tenure_l) + \beta_4 Income_l \\ &+ \beta_5 Wealth_l + \beta_6 Gozo_l \end{aligned} \tag{6}$$

where $y_l$ denotes the number of new domestic bank mortgage contracts in locality $l$, $n_l$ denotes the number of registered property deeds, and $p_l$ denotes the locality-level mortgage financing incidence. $Foreign_l$, $Tenure_l$, $Income_l$ and $Wealth_l$ are standardised locality-level proxies, as described in Section 6.2, while $Gozo_l$ is a dummy variable taking the value 1 for localities in Gozo and Comino and 0 otherwise. The interaction term allows the association between foreign participation and mortgage reliance to vary with the tenure structure of the locality. Interpretation follows the framework set out in Section 3.6.

The specification is first estimated using the 2023 HFCS income and wealth proxies. As a robustness check, the same specification is re-estimated using the corresponding 2020 HFCS proxies. The parsimonious benchmark described in Section 6.2 is also reported alongside the preferred specifications.

## 6.4 Main Results

Across the three specifications, foreign participation is negatively associated with mortgage reliance, while tenure is positively associated with mortgage reliance (see Table 3). A descriptive visualisation of the underlying locality-level variation in mortgage reliance, foreign participation and owner-occupation is provided in Figure 3. Localities with a higher foreign-resident share tend to exhibit lower aggregate domestic mortgage financing, while areas with stronger owner-occupation tend to exhibit higher mortgage reliance.

The negative association with foreign participation should not be interpreted as evidence that foreign purchasers generally make less use of mortgage finance. As discussed in Section 2.2, the available household statistics describe current tenure and outstanding mortgage status rather than the financing of recent property purchases. The locality-level association is therefore more appropriately interpreted in the context of broader differences in tenure composition, rental market intensity, housing use, residency or buyer composition. These potential channels cannot be separated directly using the available data.

The interaction term between foreign participation and tenure is negative and highly statistically significant in all specifications, indicating that the association between mortgage reliance and these two locality characteristics is not purely additive. In practical terms, the positive association between tenure and mortgage reliance weakens as foreign presence rises,

while the negative association between foreign participation and mortgage reliance becomes more pronounced in localities with higher tenure.

In both full specifications, income enters positively, consistent with higher-income localities exhibiting greater mortgage reliance, possibly reflecting greater borrowing capacity at area level. Wealth enters negatively, possibly reflecting a greater ability to finance property purchases through own funds, accumulated savings or housing equity, although the 2020 coefficient is not statistically significant once overdispersion-adjusted standard errors are used. Given their survey-based and area-level nature, the income and wealth coefficients should be interpreted more cautiously than the directly observed locality composition variables, although robustness checks using alternative HFCS asset measures yield similar qualitative results.

Table 3: Locality-level models of mortgage reliance – preferred and parsimonious specifications

| Variable | Full model: 2023 | Full model: 2020 | Parsimonious |
|---|---|---|---|
| Foreign share (z-score) | -0.311 (0.085) | -0.390 (0.094) | -0.419 (0.086) |
| Tenure (z-score) | +0.635 (0.084) | +0.448 (0.095) | +0.475 (0.077) |
| Foreign × Tenure | -0.191 (0.046) | -0.235 (0.047) | -0.219 (0.048) |
| Income (z-score) | +0.146 (0.057) | +0.210 (0.070) | – |
| Wealth (z-score) | -0.218 (0.059) | -0.107 (0.075) | – |
| Gozo dummy | -0.741 (0.141) | -0.683 (0.141) | -0.696 (0.148) |
| Pseudo $R^2$ | 0.821 | 0.809 | 0.781 |
| AIC | 1578.4 | 1652.0 | 1828.6 |
| Residual deviance | 1146.0 | 1219.6 | 1400.2 |

*Notes:* Grouped logit estimates using locality-level counts of mortgage contracts and registered deeds in the Core dataset. Coefficients are reported as log-odds, with overdispersion-adjusted standard errors in parentheses based on the quasi-binomial variance adjustment. All continuous explanatory variables are standardised. Income and wealth proxies are derived from HFCS locality-level medians, shrunk toward district medians using sample-size-based weights. Wealth is log-transformed after shrinkage. The 2023 and 2020 full models use the corresponding HFCS wave-specific income and wealth proxies. The parsimonious model excludes income and wealth and is reported as a benchmark. Fit statistics are reported for the grouped logit mean specification and are shown for model comparison; quasi-binomial likelihood-based information criteria are not formally defined.

In the main tenure-based specifications, the Gozo dummy is negative across all specifications, indicating that Gozo and Comino exhibit a lower level of mortgage reliance than localities on Malta's main island, even after controlling for foreign participation, tenure, income and wealth. This suggests that additional unobserved locality-specific characteristics, such as the prevalence of second homes, lifestyle-related purchases or other transaction motives, may continue to differentiate Gozo from the mainland.

Including the HFCS-based income and wealth proxies improves model fit relative to the parsimonious foreign–tenure interaction model, while the signs and interpretation of the foreign participation, tenure and interaction terms remain stable across specifications. This suggests that income and wealth add information on locality-level mortgage reliance, but do not explain away the core foreign–tenure relationship. The 2023 full model is therefore retained as the preferred specification, while the parsimonious model remains a useful benchmark for showing that the central locality-level pattern is not driven by the survey-based income and wealth proxies.

## 6.5 Predicted Probabilities

To facilitate interpretation of the preferred locality-level logit model, the estimated coefficients are translated into predicted probabilities. This is particularly useful because the preferred specification includes standardised continuous variables and an interaction between foreign participation and tenure. The probability estimates therefore provide a more intuitive summary of how mortgage reliance varies across representative locality characteristics.

The analysis considers three sets of scenarios. First, foreign participation and tenure are varied jointly to illustrate the interaction effect. Second, income and wealth are varied to show the implied probability effects of the HFCS-based financial-capacity proxies. Third, the Gozo and Comino dummy is used to compare an average mainland locality with an otherwise similar Gozo locality. Throughout this section, "low" and "high" values refer to one standard deviation below and above the sample mean, respectively, while "average" refers to the sample mean.[18] These scenarios are illustrative segment-level predictions and should be interpreted in line with Section 3.6.

### Foreign participation and tenure

Table 4 reports the predicted probability of mortgage financing for mainland localities under combinations of low, average and high foreign participation and tenure. Income and wealth are held at their sample averages, and the Gozo dummy is set equal to zero, so that the scenarios refer to mainland localities.

The probability estimates show a clear interaction pattern. Mortgage reliance is highest in localities combining low foreign participation and high tenure, where the predicted probability of mortgage financing is estimated at around 87.5%. By contrast, in localities with high foreign participation and low tenure, the predicted probability is around 51.4%. Higher tenure is associated with higher mortgage reliance at all levels of foreign participation.

The interaction pattern also shows that the probability increase associated with moving from low to high tenure is larger when foreign participation is low than when it is high. For example, moving from low to high tenure raises the predicted probability from 57.3% to 87.5% when foreign participation is low, compared with an increase from 51.4% to 72.0% when foreign participation is high. This is consistent with the negative interaction coefficient reported in Table 3. Predicted probabilities for Gozo and Comino are reported in Annex F.

### Income and wealth

Table 5 reports predicted mortgage-financing probabilities for combinations of low, average and high income and wealth. In these scenarios, foreign participation and tenure are held at their sample averages and the Gozo dummy is set equal to zero. Income and wealth are HFCS-based locality-level proxies and should not be interpreted as the income or wealth of the actual buyers in the transaction data.

The predicted probabilities help interpret the income and wealth coefficients for mainland localities. Holding wealth at its average, moving from a low-income to a high-income locality

[18] In the probability scenarios, "low" and "high" values correspond to one standard deviation below and above the locality sample mean, respectively. In actual terms, this corresponds to foreign participation of around 5.7%, 19.3% and 32.8%, and tenure rates of around 63.7%, 77.5% and 91.4%. For the HFCS-based financial variables, the corresponding values are approximately EUR 31,300, EUR 40,700 and EUR 50,100 for shrunk median income, and EUR 254,100, EUR 371,600 and EUR 543,600 for shrunk median net wealth. Wealth values are shown in levels for interpretability, although the model uses log-transformed wealth after shrinkage.

Table 4: Predicted probability of mortgage-financed transactions by foreign participation and tenure

| Tenure / Foreign participation | Low foreign (-1 SD) | Average foreign | High foreign (+1 SD) |
|---|---|---|---|
| Low tenure (-1 SD) | 57.3 [50.2, 64.1] | 54.3 [49.7, 58.9] | 51.4 [48.1, 54.6] |
| Average tenure | 75.4 [71.9, 78.6] | 69.2 [66.7, 71.6] | 62.2 [56.9, 67.3] |
| High tenure (+1 SD) | 87.5 [84.9, 89.7] | 80.9 [77.4, 84.0] | 72.0 [63.3, 79.3] |

*Notes:* Predicted probabilities are derived from the preferred 2023 grouped logit mean specification reported in Table 3. Foreign participation and tenure are varied as described above, while income and wealth are held at their sample averages and the Gozo dummy is set equal to zero. Values are reported in percent, with 95% confidence intervals in brackets. Confidence intervals are computed using overdispersion-adjusted standard errors, based on the quasi-binomial variance adjustment. Interpretation follows the reduced-form framework set out in Section 3.6.

raises the predicted probability of mortgage financing from 66.0% to 72.2%. Holding income at its average, moving from a low-wealth to a high-wealth locality lowers the predicted probability from 73.6% to 64.4%. This is consistent with income proxying borrowing capacity and wealth proxying the ability to finance purchases from own funds or housing equity. These HFCS-based financial-capacity proxies should be interpreted cautiously because they are locality-level measures rather than buyer-level characteristics. Predicted probabilities for Gozo and Comino are reported in Annex F.

Table 5: Predicted probability of mortgage financing by income and wealth scenarios

| Income / Wealth | Low wealth (-1 SD) | Average wealth | High wealth (+1 SD) |
|---|---|---|---|
| Low income (-1 SD) | 70.7 [67.3, 73.9] | 66.0 [62.7, 69.2] | 61.0 [55.9, 65.8] |
| Average income | 73.6 [70.1, 76.8] | 69.2 [66.7, 71.6] | 64.4 [60.8, 67.8] |
| High income (+1 SD) | 76.4 [71.6, 80.5] | 72.2 [68.5, 75.6] | 67.6 [63.8, 71.2] |

*Notes:* Predicted probabilities are derived from the preferred 2023 grouped logit mean specification. Income and wealth are varied as described above, while foreign participation and tenure are held at their sample averages and the Gozo and Comino dummy is set equal to zero. Income and wealth are HFCS-based locality medians shrunk toward district medians using sample-size-based weights; wealth is log-transformed after shrinkage in the model. Values are expressed in percent, with 95% confidence intervals in brackets. Confidence intervals are computed using overdispersion-adjusted standard errors. Interpretation follows the reduced-form framework set out in Section 3.6.

### Gozo and Comino

The Gozo dummy translates into a sizeable probability difference. At average values of foreign participation, tenure, income and wealth, the predicted probability of mortgage financing is around 69.2% for a mainland locality, compared with around 51.7% for a Gozo locality with the same modelled characteristics. This reinforces the interpretation that Gozo and Comino exhibit a distinct level shift in mortgage reliance that is not fully captured by the included locality characteristics.

## 6.6 Robustness Tests

Several robustness tests were conducted to assess whether the locality-level results are sensitive to sample definition, proxy choice, influential observations or functional form. Full results are reported in Annex G. Overall, the core associations remain stable, although the magnitude and statistical significance of some coefficients vary across specifications.

First, the results are robust to alternative transaction samples and housing-use proxies. Re-estimating the preferred specification on the All-property dataset, which includes garages and plots of land, preserves the main sign pattern, although coefficient magnitudes are attenuated relative to the Core specification. Replacing tenure with the share of dwellings used as a main residence also preserves the negative association with foreign participation and the negative interaction term, although the main-residence specification provides a weaker fit and the separate Gozo dummy loses statistical significance. Given Gozo's comparatively low share of properties used as main residences, this suggests that the main-residence measure captures an important part of the Gozo-specific difference in mortgage reliance documented in Section 4.2. The result therefore helps interpret Gozo's distinctiveness, although the tenure-based specification provides stronger overall fit and more stable associations across localities.

Second, the core results are not driven by the specific construction of the HFCS-based financial-capacity proxies. The foreign participation, tenure, interaction and Gozo coefficients remain qualitatively stable when income and wealth are entered separately, when alternative asset measures are used, and when the analysis is restricted to localities with higher HFCS sample sizes or to common high-reliability samples across HFCS waves.

Third, diagnostic checks do not indicate that the results are driven by multicollinearity or by a small number of influential localities. Variance inflation factors remain below conventional thresholds, the orthogonalised-tenure specification yields similar qualitative results, and excluding the most influential localities does not alter the main conclusions.

Fourth, the results are robust to alternative functional forms. Grouped probit, quasi-binomial logit and transaction-weighted least squares specifications yield the same broad sign pattern as the preferred grouped logit model. Taken together, these checks suggest that the locality-level associations documented in Section 6 are not artefacts of a particular sample, proxy definition, influential observation or estimation approach.

## 6.7 Supplementary Demographic and Property-price Checks

While the preferred specification focuses on buyer composition, housing-use structure and household financial-capacity proxies, additional exploratory analysis was conducted using demographic and property-market indicators. These exercises are intended to provide supplementary descriptive context rather than to extend the preferred specification.

Locality-level demographic indicators obtained from NSO sources suggest that older population structures are associated with lower mortgage reliance. Both average age and the old-age dependency ratio enter negatively when added individually to the preferred specification, while the main coefficients on foreign participation, tenure, their interaction, wealth and the Gozo and Comino dummy remain qualitatively unchanged (Annex Table 31). These results suggest that demographic structure contains additional information regarding mortgage reliance, but they should not be interpreted as identifying the age profile or financing behaviour of actual buyers.

An additional exploratory exercise incorporates locality-level apartment price indicators based on the official Statistical Insights apartment relative price index. The index is added to the preferred locality-level specification using both the average index for 2023–2025 and the 2025 index separately. In both specifications, the apartment price index is negatively and statistically significantly associated with mortgage reliance, conditional on foreign participation, tenure, income, wealth and the Gozo dummy (Annex Table 32). A separate tercile analysis suggests that the relationship may not be strictly linear, with mortgage reliance highest among middle-price localities and lower among both lower- and higher-price localities (Annex Table 33).

Taken together, these results suggest that locality-level apartment prices contain additional information about mortgage reliance. However, the indicator is apartment-specific, covers a reduced sample of localities and is expressed as a relative index rather than a transaction-level price. The price results are therefore retained as supplementary evidence and are not incorporated into the preferred specification.

### 6.8 Summary of Locality-Level Associations

The locality-level extension shows that spatial variation in mortgage reliance is associated with observable area-level proxies for buyer composition, housing use and household financial capacity. Higher foreign participation is associated with lower mortgage reliance, while higher tenure is associated with greater mortgage reliance. Income enters positively and wealth negatively, although these HFCS-based financial-capacity proxies should be interpreted cautiously because they are locality-level measures rather than buyer-level characteristics.

The preferred specification also identifies a negative interaction between foreign participation and tenure, indicating that the positive association between owner-occupation and mortgage reliance weakens as foreign participation rises. Gozo and Comino exhibit a negative level shift relative to localities on Malta's main island, although alternative housing-use specifications suggest that part of this difference reflects Gozo's distinctive housing-use structure. In line with Section 3.6, these findings are interpreted as descriptive locality-level associations.

Overall, the foreign participation, tenure, interaction and Gozo relationships remain stable across alternative samples, proxy choices, influence checks and functional forms. The supplementary demographic and apartment-price results provide additional descriptive context but are not part of the preferred specification. At the same time, substantial locality-level heterogeneity in mortgage reliance remains even after controlling for the observable locality characteristics included in the model, suggesting that additional unobserved factors continue to influence the financing structure of property purchases.

## 7 Conclusion and Policy Implications

This paper provides a structured assessment of how residential property purchases in Malta are financed, combining administrative data on registered property transactions with information on new mortgage lending by domestic credit institutions. Its main contribution is to quantify mortgage reliance across locations, property types and time, using a segment-level measure based on mortgage contracts and property deeds. The paper also assesses whether spatial

variation in mortgage reliance is associated with observable locality-level proxies for buyer composition, housing use and household financial capacity.

The analysis documents a central but uneven role for domestic bank mortgage financing. Domestic bank mortgages account for around 47% of all registered residential property transactions when all property types are included, but around 64% of core housing transactions. This highlights the importance of distinguishing dwelling purchases from non-core categories such as garages and plots of land when assessing the residential mortgage credit channel.

The stylised facts and econometric evidence jointly indicate that spatial variation is the most prominent dimension of heterogeneity in mortgage reliance. Model-adjusted probabilities confirm substantially higher mortgage reliance in the Western and South Eastern districts than in Gozo and Comino or Northern Harbour, even after controlling for property type and quarter fixed effects. Differences across core residential property types are comparatively modest, while garages and plots of land remain predominantly outside the domestic mortgage-financed core housing channel.

The locality-level analysis provides complementary evidence on observable correlates of spatial heterogeneity in mortgage reliance. Localities with higher foreign participation tend to exhibit lower mortgage reliance, while localities with higher tenure tend to exhibit greater mortgage reliance. The foreign-participation result should be interpreted jointly with tenure and housing-use composition, rather than as direct evidence about the mortgage-financing choices of foreign purchasers. The negative interaction between foreign participation and tenure indicates that these relationships are not purely additive. HFCS-based income and wealth proxies add further information, and Gozo and Comino continue to exhibit a lower level of mortgage reliance in the main tenure-based specifications. These results are interpreted as descriptive locality-level associations based on area-level proxies, rather than causal explanations of household mortgage-financing behaviour.

These findings have important implications for the transmission of financial conditions to the housing market. Districts and localities where property purchases are predominantly mortgage-financed are likely to be more directly exposed to changes in interest rates, credit conditions and borrower-based macroprudential measures through the domestic purchase-mortgage origination channel. This does not imply that overall policy transmission or policy effectiveness can be inferred directly from mortgage reliance alone. The measure captures exposure to domestic purchase-mortgage origination, but does not capture outstanding mortgage exposure, leverage, interest-rate reset sensitivity, transactions deterred by policy, or adjustment through prices and non-credit channels.

In lower-mortgage-reliance locations, housing-market adjustment may occur less through new domestic mortgage origination and more through rental, external-demand, demographic or investment-return channels. Segmentation in financing behaviour does not eliminate risk, but changes the channels through which housing-market conditions may adjust.

Overall, the results indicate that Malta's housing market should not be treated as a single homogeneous credit-sensitive market. Domestic mortgage credit remains central, particularly for core housing and in higher-reliance districts, but its role varies materially across locations and market segments. Interest-rate changes, lending standards and borrower-based macroprudential measures are therefore likely to operate unevenly across the property market. Recognising this heterogeneity is important for interpreting housing-market developments and for assessing the reach and effectiveness of monetary and macroprudential policy.

# References


A. Alter and M. Dernaoui. Non-Primary Home Buyers, Shadow Banking, and the US Housing Market. IMF Working Paper WP/20/174, International Monetary Fund, 2020.

M. B. Andaloussi, N. Biljanovska, and A. De Stefani. Housing Markets and Monetary Policy, 2024. Finance & Development, International Monetary Fund, December.

C. André. A Bird's Eye View of OECD Housing Markets. OECD Economics Department Working Paper 746, OECD Publishing, 2010.

A. Antonaroli and A. Castaldo. MTHFCS 2023 Report. Working Paper 02/26, Central Bank of Malta, 2026.

A. Antonaroli, A. Castaldo, et al. Household Wealth Composition in Malta: Main Results from the Fourth Wave. Working Paper 01/2023, Central Bank of Malta, 2023.

A. Antonaroli, W. Deguara, and A. Castaldo. Wealth Transfers and Homeownership in Malta. Working Paper 02/2025, Central Bank of Malta, 2025.

A. Badev, T. Beck, L. Vado, and S. Walley. Housing Finance Across Countries: New Data and Analysis. Policy Research Working Paper 6756, World Bank, 2014.

I. Borg and N. Rapa. Box 1: The Contribution of the Construction and Real Estate Sector in Malta, 2023. Quarterly Review 2023:1, pp. 33–38.

A. Calza, T. Monacelli, and L. Stracca. Housing Finance and Monetary Policy. *Journal of the European Economic Association*, 11(1):101–122, 2013.

M. S. Camelo Rincón, J. S. Amaya Cárdenas, and J. F. Parra Guzmán. Determinants of the Use of Mortgage Credit by Households in Bogota. *Ecos de Economía: A Latin American Journal of Applied Economics*, 22(47):38–57, 2018.

P. Cheshire and S. Sheppard. Estimating the Demand for Housing, Land, and Neighbourhood Characteristics. *Oxford Bulletin of Economics and Statistics*, 60(3):357–382, 1998.

Committee on the Global Financial System. Macroprudential Policies to Mitigate Housing Market Risks. CGFS Papers 69, Bank for International Settlements, 2023.

G. Cousin, C. Frayne, V. D. Martins, and B. Vašíček. Housing in the European Union: Market Developments, Underlying Drivers, and Policies. European Economy Discussion Paper 228, European Commission, 2025.

D. Dieckelmann, H. S. Hempell, B. Jarmulska, J. H. Lang, and M. Rusnák. House Prices and Ultra-Low Interest Rates: Exploring the Nonlinear Nexus, March 2025. Published version of ECB Working Paper No. 2789, originally issued in 2023.

I. Drechsler, A. Savov, P. Schnabl, and D. Supera. Monetary Policy and the Mortgage Market. Working paper, Federal Reserve Bank of Kansas City / NBER, 2024.

K. Dynan. Is a Household Debt Overhang Holding Back Consumption? *Brookings Papers on Economic Activity*, pages 299–344, 2012. Spring.

R. Ellul, J. Darmanin, and I. Borg. Hedonic House Price Indices for Malta: A Mortgage-Based Approach. Working Paper 02/2019, Central Bank of Malta, 2019.

European Central Bank. Housing finance in the euro area. ECB occasional paper series, European Central Bank, Frankfurt am Main, 2009.

European Central Bank. Monetary Policy Transmission: From Mortgage Rates to Consumption, 2025. ECB Blog, 28 May.

European Central Bank. Financial Stability Review, Special Feature C: House Price Booms and Policy Choices, 2026. May.

Robert E. Fay and Roger A. Herriot. Estimates of income for small places: An application of James–Stein procedures to census data. *Journal of the American Statistical Association*, 74(366a):269–277, 1979.

W. Gatt and G. Ruisi. Housing Demand Shocks, Foreign Labour Inflows and Consumption. Working Paper 07/2020, Central Bank of Malta, 2020.

HM Land Registry. UK House Price Index: New Data Reveals Number of Cash Buyers, 2017. GOV.UK.

International Monetary Fund. Housing Finance and Financial Stability: Back to Basics. In *Global Financial Stability Report*, chapter 3. Washington, DC, 2011.

J. H. Lang, M. Behn, B. Jarmulska, and M. Lo Duca. Real Estate Markets, Financial Stability and Macroprudential Policy. ECB Macroprudential Bulletin 19, European Central Bank, October 2022.

National Bank of Romania. Financial Stability Report, 2025. June.

Oesterreichische Nationalbank. CESEE Property Market Review, 2025. Issue No. 14/2025.

L. E. Papke and J. M. Wooldridge. Econometric Methods for Fractional Response Variables with an Application to 401(k) Plan Participation Rates. *Journal of Applied Econometrics*, 11(6):619–632, 1996.

J. L. Peydró, F. Rodriguez-Tous, J. Tripathy, and A. Uluc. The Distributional Consequences of Borrower-Based Macroprudential Tools. Working paper, Bank of England, 2025.

Realtor.com Research. Cash Is King: Trends in All-Cash Home Sales, 2025. Realtor.com.

E. Ryan, B. Jarmulska, G. De Nora, A. Fontana, A. Horan, J. H. Lang, M. Lo Duca, C. Moldovan, and M. Rusnák. Real Estate Markets in an Environment of High Financing Costs. *Financial Stability Review*, November 2023. Special Feature B.

F. van Hoenselaar, B. Cournède, F. De Pace, and V. Ziemann. Mortgage Finance Across OECD Countries. Technical report, OECD Publishing, Paris, 2021.

S. Vella and M. Panfilo. Financial Stability Report 2024, Box 5: Borrower-Based Measures and the Housing Market, 2025. Central Bank of Malta.

R. W. M. Wedderburn. Quasi-likelihood functions, generalized linear models, and the gauss–newton method. *Biometrika*, 61(3):439–447, 1974.

# Annex A: Descriptive Mortgage Intensity Indicator Across European Countries

This annex presents a descriptive indicator combining residential mortgage debt and home-ownership rates across European countries. Higher values are consistent with greater use of mortgage financing among owner-occupiers, while lower values are consistent with a greater prevalence of non-mortgage financing. This indicator is illustrative and should not be interpreted as a structural measure of mortgage market development or household leverage and is not used in the empirical analysis.

Table 6: Mortgage Debt, Home Ownership and Descriptive Mortgage Intensity Indicator across European Countries (2025)

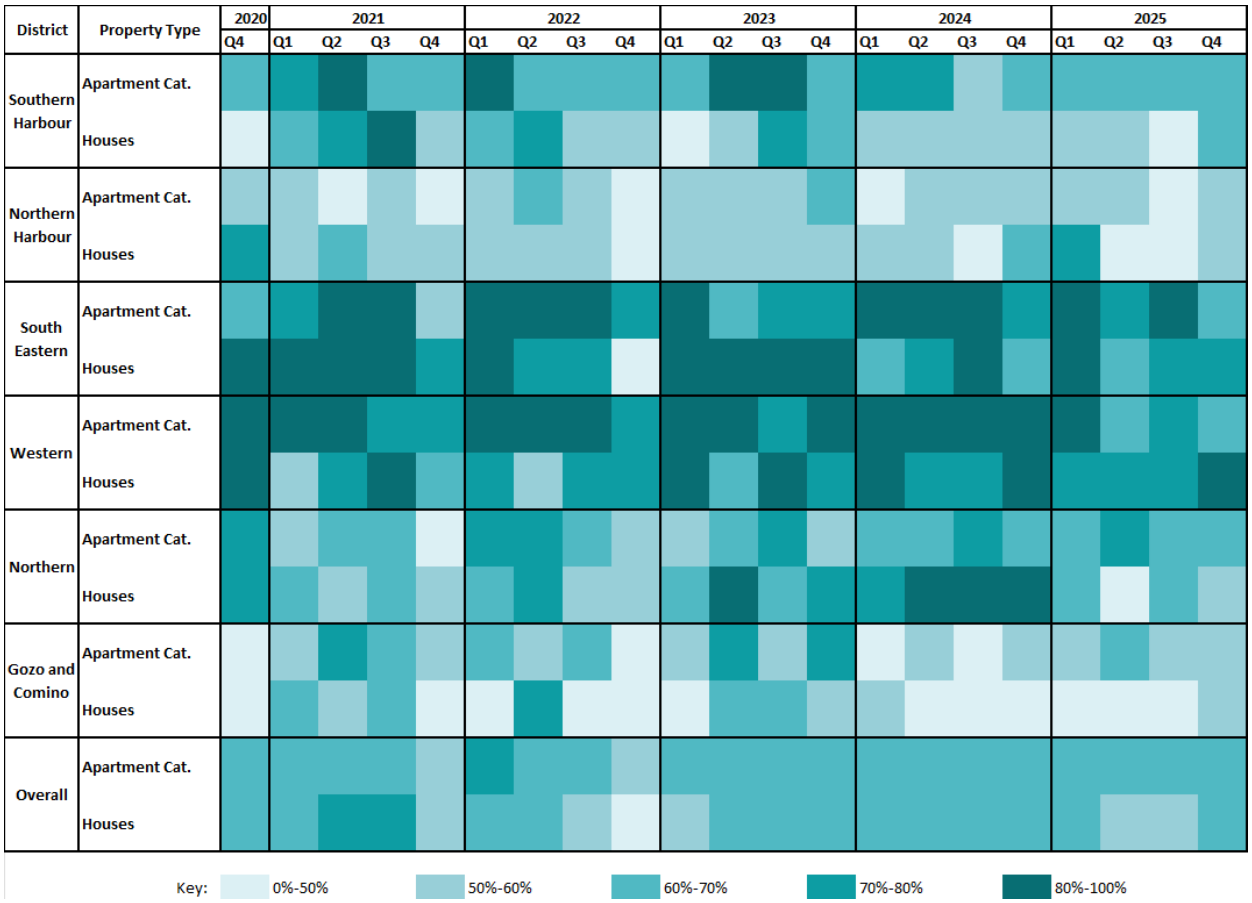
| Country | Residential mortgage debt (% of GDP) | Home ownership rate (%) | Mortgage debt relative to home ownership (%) |
|---|---|---|---|
| Netherlands | 75.5 | 68.8 | 109.7 |
| Luxembourg | 54.8 | 64.1 | 85.5 |
| Germany | 38.0 | 47.2 | 80.6 |
| France | 48.4 | 61.4 | 78.8 |
| Belgium | 51.9 | 70.9 | 73.3 |
| **Malta** | **43.6** | **70.9** | **61.5** |
| Cyprus | 42.3 | 69.2 | 61.1 |
| Portugal | 41.0 | 71.2 | 57.6 |
| Finland | 38.0 | 66.9 | 56.9 |
| Austria | 28.9 | 54.2 | 53.4 |
| Spain | 30.9 | 73.6 | 42.0 |
| Estonia | 31.9 | 79.7 | 40.0 |
| Slovakia | 32.4 | 93.8 | 34.5 |
| Greece | 21.3 | 69.4 | 30.7 |
| Italy | 22.9 | 77.1 | 29.7 |
| Ireland | 19.8 | 70.9 | 27.9 |
| Lithuania | 19.4 | 86.5 | 22.5 |
| Slovenia | 15.7 | 74.2 | 21.2 |
| Latvia | 15.8 | 82.2 | 19.2 |
| Croatia | 15.6 | 91.4 | 17.1 |
| Hungary | 10.0 | 89.8 | 11.2 |

*Source:* Eurostat, ECB Data Portal, De Nederlandsche Bank, Author's own estimates.

# Annex B: Detailed Patterns of Mortgage Reliance

This annex presents detailed quarterly patterns of mortgage reliance across districts and core property types. Garages and plots of land are excluded from this heatmap because their mortgage reliance remains below 50% in all district-quarter cells and are treated separately as non-core categories. Mortgage reliance is depicted using five discrete colour buckets.

Figure 2: Quarterly mortgage reliance by district and core property type, 2020Q4–2025Q4



# Annex C: Count- and Value-Based Mortgage Reliance

This annex reports district-level mortgage reliance using both count-based and value-based measures. Count-based shares compare the number of mortgage contracts with the number of registered deeds, while mortgage-associated property-value shares compare the aggregate reported property value associated with new mortgage contracts with the total value of registered transactions. Wilson 95% confidence intervals are reported for the count-based shares as descriptive benchmarks. The value-based columns are included to show whether the main district patterns are similar when transaction values, rather than transaction counts, are used.

Table 7: Mortgage reliance by district, core housing

| District | Count-based mortgage share (%) | 95% CI | Total transactions | Mortgage-associated property-value share (%) |
|---|---|---|---|---|
| Northern Harbour | 54.0 | [53.2, 54.8] | 14,581 | 46.7 |
| Gozo and Comino | 54.8 | [53.5, 56.1] | 5,679 | 49.9 |
| Northern | 64.5 | [63.5, 65.4] | 9,547 | 62.7 |
| Southern Harbour | 67.5 | [66.4, 68.6] | 7,199 | 53.8 |
| South Eastern | 77.9 | [76.9, 78.9] | 6,676 | 75.9 |
| Western | 81.0 | [79.8, 82.1] | 4,489 | 76.4 |

*Notes:* Count-based mortgage reliance is calculated as the number of new domestic bank mortgage contracts relative to the number of registered deeds for core housing. Wilson 95% confidence intervals are reported for the count-based shares. The mortgage-associated property-value share compares the aggregate reported property value associated with new mortgage contracts with the aggregate value of registered core-housing transactions. The property-value-based measure is reported as a descriptive counterpart and is not used in the grouped logit estimation.

Table 8: Mortgage reliance by district, all property types

| District | Count-based mortgage share (%) | 95% CI | Total transactions | Mortgage-associated property-value share (%) |
|---|---|---|---|---|
| Gozo and Comino | 32.8 | [31.9, 33.8] | 10,156 | 43.0 |
| Northern Harbour | 43.2 | [42.6, 43.9] | 19,556 | 42.9 |
| Northern | 47.4 | [46.6, 48.2] | 13,886 | 56.4 |
| Southern Harbour | 51.3 | [50.3, 52.2] | 10,364 | 56.2 |
| South Eastern | 55.4 | [54.4, 56.4] | 10,206 | 63.1 |
| Western | 57.2 | [56.0, 58.3] | 6,880 | 67.4 |

*Notes:* Count-based mortgage reliance is calculated as the number of new domestic bank mortgage contracts relative to the number of registered deeds for all property types. Wilson 95% confidence intervals are reported for the count-based shares. The mortgage-associated property-value share compares the aggregate reported property value associated with new mortgage contracts with the aggregate value of all registered property transactions. The property-value-based measure is reported as a descriptive counterpart and is not used in the grouped logit estimation.

Table 9: Mortgage reliance by property type, count- and value-based measures

| Property type | Count-based mortgage share (%) | Mortgage-associated property-value share (%) |
|---|---|---|
| Apartments / maisonettes / penthouses | 64.4 | 59.9 |
| Houses | 62.4 | 58.4 |
| Garages | 11.6 | 13.9 |
| Plots of land | 7.6 | 20.3 |

*Notes:* Count-based mortgage reliance is calculated as the number of new domestic bank mortgage contracts relative to registered property deeds. The mortgage-associated property-value share measures the proportion of total transacted property value represented by properties associated with mortgage financing. The higher value-based share for plots of land reflects a limited number of high-value land purchases, also involving legal entities for development purposes, which are more frequently financed through bank borrowing. Value-based shares are descriptive and are not used in the grouped logit estimation.

# Annex D: Odds-Ratio Estimates Underlying the Baseline Grouped Binomial Logit Models

This annex reports the odds-ratio estimates from the grouped binomial logit models underlying the model-adjusted probabilities presented in Section 5. These results are provided for technical completeness, while the main text focuses on predicted probabilities because they offer a more direct interpretation of mortgage reliance across districts and property types.

Table 10: District effects, odds ratios

| District | All property types | Sig. | Core housing | Sig. |
|---|---|---|---|---|
| Gozo and Comino | 1.00 [Ref.] | Ref. | 1.00 [Ref.] | Ref. |
| Northern Harbour | 1.04 [0.92, 1.19] | n.s. | 0.95 [0.81, 1.11] | n.s. |
| Northern | 1.52 [1.33, 1.74] | *** | 1.48 [1.25, 1.74] | *** |
| Southern Harbour | 1.85 [1.60, 2.15] | *** | 1.72 [1.44, 2.05] | *** |
| South Eastern | 2.69 [2.32, 3.13] | *** | 2.91 [2.40, 3.53] | *** |
| Western | 3.04 [2.57, 3.60] | *** | 3.54 [2.83, 4.43] | *** |

*Notes:* Odds ratios are derived from grouped logit models. Confidence intervals and significance levels are based on quasi-binomial standard errors, allowing for extra-binomial variation. "All property types" includes apartments, houses, garages and plots of land; "Core housing" includes apartments and houses only. Values above one indicate higher odds of mortgage financing relative to the reference category; values below one indicate lower odds. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$; n.s. = not significant.

Table 11: Property-type effects, odds ratios

| Property type | Odds ratio [95% CI] | Sig. |
|---|---|---|
| Apartments / Maisonettes / Penthouses | 1.00 [Ref.] | Ref. |
| Houses | 0.87 [0.78, 0.96] | *** |
| Garages | 0.06 [0.06, 0.07] | *** |
| Plots of land | 0.04 [0.03, 0.05] | *** |

*Notes:* Odds ratios are derived from grouped logit models estimated on all property types. Confidence intervals and significance levels are based on quasi-binomial standard errors, allowing for extra-binomial variation. Values below one indicate lower odds of mortgage financing relative to the reference category of apartments, maisonettes and penthouses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

# Annex E: Robustness to Alternative Specifications and Functional Forms

This annex reports robustness checks for the baseline grouped binomial logit model presented in Section 5. The checks assess whether the main district and property-type patterns remain stable when quarter fixed effects are replaced by macro-financial controls, when the binomial variance assumption is relaxed, and when alternative functional forms are used.

## Panel A: Macro-Financial Controls

This panel reports robustness checks in which quarter fixed effects are replaced by observable macro-financial variables. Two alternatives are considered: (i) the ECB main refinancing operations (MRO) rate and real GDP growth; and (ii) the mortgage lending rate and real GDP growth. The purpose is to assess whether the estimated district and property-type differences remain stable when common time variation is captured through observable macro-financial indicators rather than quarter fixed effects. The substantive district and property-type effects are unchanged across the macro-financial specifications, with Northern Harbour remaining statistically indistinguishable from Gozo and Comino.

Table 12: District effects on the likelihood of mortgage-financed transactions: odds ratios, all-property sample

| District | Baseline model | ECB MRO + GDP | Mortgage rate + GDP |
|---|---|---|---|
| Gozo and Comino | 1.00 | 1.00 | 1.00 |
| Northern Harbour | 1.04 | 1.04 | 1.04 |
| Northern | 1.52 | 1.51 | 1.51 |
| Southern Harbour | 1.85 | 1.85 | 1.84 |
| South Eastern | 2.69 | 2.67 | 2.68 |
| Western | 3.04 | 3.05 | 3.04 |

*Notes:* Reference category: Gozo and Comino.

Table 13: Property-type effects on the likelihood of mortgage-financed transactions: odds ratios, all-property sample

| Property type | Baseline model | ECB MRO + GDP | Mortgage rate + GDP |
|---|---|---|---|
| Apartments / Maisonettes / Penthouses | 1.00 | 1.00 | 1.00 |
| Houses | 0.87 | 0.87 | 0.87 |
| Garages | 0.06 | 0.06 | 0.06 |
| Plots of land | 0.04 | 0.04 | 0.04 |

*Notes:* Values are exponentiated logit coefficients. Values above one indicate higher odds of mortgage financing relative to the reference category; values below one indicate lower odds.

The inclusion of macro-financial controls does not materially alter the estimated district or property-type effects in terms of sign, magnitude or ranking. Consistent with expectations,

higher mortgage lending rates are associated with a lower likelihood that transactions are mortgage-financed.

Table 14: Macro-financial coefficients across model specifications, all-property sample

| Macroeconomic variable | ECB MRO + GDP model | Mortgage rate + GDP model |
|---|---|---|
| ECB MRO | 0.001 (n.s.) | – |
| Mortgage lending rate (new business) | – | -0.320** |
| Real GDP growth (YoY) | 0.000 (n.s.) | -0.001 (n.s.) |

*Notes:* Coefficients are from grouped logit models in which quarter fixed effects are replaced by macro-financial controls. Significance levels are based on quasi-binomial standard errors, allowing for extra-binomial variation. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$; n.s. = not significant.

Model fit is strongest in the baseline specification with quarter fixed effects, as shown by the lower AIC and BIC in both the all-property and Core housing samples. The macro-financial specifications nevertheless provide a useful robustness check, showing that the main district and property-type rankings are not driven by the specific treatment of common time variation.

Table 15: Model fit comparison: all property types

| Model specification | McFadden $R^2$ | AIC | BIC |
|---|---|---|---|
| Baseline: District + Property type + Quarter fixed effects | 0.905 | 4536.5 | 4658.9 |
| ECB MRO + GDP | 0.889 | 4890.0 | 4936.5 |
| Mortgage rate + GDP | 0.890 | 4867.9 | 4914.3 |

Table 16: Model fit comparison: Core housing sample

| Model specification | McFadden $R^2$ | AIC | BIC |
|---|---|---|---|
| Baseline: District + Property type + Quarter fixed effects | 0.632 | 2802.2 | 2897.5 |
| ECB MRO + GDP | 0.533 | 3164.7 | 3196.4 |
| Mortgage rate + GDP | 0.537 | 3146.3 | 3178.0 |

The McFadden pseudo-$R^2$ is higher in the all-property specification than in the Core housing specification. This is expected, since the all-property model captures the large difference in mortgage reliance between core housing transactions and non-core categories such as garages and plots of land. Once the sample is restricted to apartments and houses, the pseudo-$R^2$ remains high but is materially lower, indicating that the very high value in the all-property baseline partly reflects strong compositional differences across property types rather than transaction-level predictive accuracy.

## Panel B: Quasi-binomial variance assumption

The quasi-binomial specification relaxes the binomial variance restriction to allow for within-cell heterogeneity, or extra-binomial variation following the quasi-likelihood framework of

Wedderburn (1974). Coefficient estimates are unchanged relative to the baseline grouped binomial logit model, while standard errors become more conservative through the estimation of an overdispersion parameter. The estimated dispersion parameter is approximately 4.8 in the all-property specification and 5.9 in the core-housing specification. Despite this adjustment, all statistically significant district and property-type effects in the baseline model remain statistically significant and retain their original signs. The district ranking, property-type ranking and substantive conclusions are therefore unchanged, indicating that the results are robust to within-cell heterogeneity and overdispersion-adjusted inference.

Table 17: Baseline vs quasi-binomial variance robustness, Section 5 model

| Specification | Dispersion ($\phi$) | Notes |
|---|---|---|
| Binomial, baseline | 1.0 | Assumes binomial variance |
| Quasi-binomial, all property types | 4.8 | Same coefficients; SEs scaled by $\sqrt{\phi}$ |
| Quasi-binomial, core housing | 5.9 | Same coefficients; SEs scaled by $\sqrt{\phi}$ |

## Panel C: Alternative Functional Forms

To assess whether results depend on the choice of the logit link, the baseline grouped binomial model is re-estimated using a probit specification. In addition, a weighted least squares model is estimated using the mortgage-financed share as the dependent variable, with weights equal to the number of transactions in each district–property-type–quarter cell and heteroskedasticity-robust standard errors. Across these alternative specifications, the sign pattern and ranking of district and property-type effects remain unchanged relative to the baseline model, confirming that the main findings are not driven by the choice of logit functional form.

Table 18: Robustness to alternative functional forms, all-property sample

| Variable | Logit, quasi-binomial SEs | Probit | Weighted OLS on share (HC1) |
|---|---|---|---|
| District: Northern | +0.419 (0.070) *** | +0.254 (0.019) *** | +0.071 (0.012) *** |
| District: Northern Harbour | +0.042 (0.065) n.s. | +0.037 (0.018) * | -0.002 (0.012) n.s. |
| District: South Eastern | +0.991 (0.077) *** | +0.583 (0.020) *** | +0.170 (0.015) *** |
| District: Southern Harbour | +0.617 (0.074) *** | +0.374 (0.020) *** | +0.108 (0.015) *** |
| District: Western | +1.112 (0.086) *** | +0.651 (0.023) *** | +0.189 (0.015) *** |
| Property type: Houses | -0.142 (0.053) *** | -0.086 (0.015) *** | -0.030 (0.012) * |
| Property type: Garages | -2.779 (0.059) *** | -1.639 (0.014) *** | -0.538 (0.010) *** |
| Property type: Plots of land | -3.141 (0.117) *** | -1.808 (0.027) *** | -0.558 (0.011) *** |

*Notes:* District and property-type coefficients are relative to the omitted reference categories in each model. The logit column reports coefficient estimates with quasi-binomial standard errors to allow for extra-binomial variation. The probit specification is not adjusted for overdispersion. Logit and probit coefficients are on different scales; comparison should focus on sign and ranking. Weighted OLS coefficients are expressed as proportionate differences and may be multiplied by 100 to obtain approximate percentage-point differences in the mortgage share, conditional on controls. Quarter fixed effects are included in estimation but omitted from this table for brevity. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$; n.s. = not significant.

# Annex F: Predicted Mortgage-Financing Probabilities for Gozo Localities

This annex reports additional model predicted-probability scenarios for Gozo and Comino derived from the preferred 2023 locality-level grouped binomial logit model presented in Section 6. The predicted probabilities are evaluated under representative local characteristics and are illustrative model-based associations rather than causal effects. Confidence intervals are computed using the quasi-binomial variance adjustment to allow for extra-binomial variation and are therefore more conservative than standard binomial confidence intervals.

Table 19: Gozo: Foreign Participation × Tenure Scenarios

| Tenure / Foreign participation | Low foreign (-1 SD) | Average foreign | High foreign (+1 SD) |
|---|---|---|---|
| Low tenure (-1 SD) | 39.0 [29.7, 49.1] | 36.2 [29.0, 44.0] | 33.5 [27.7, 39.7] |
| Average tenure | 59.3 [51.4, 66.9] | 51.7 [45.6, 57.8] | 44.0 [37.5, 50.6] |
| High tenure (+1 SD) | 76.9 [70.8, 82.1] | 66.9 [60.9, 72.4] | 55.0 [45.5, 64.2] |

*Notes:* Predicted probabilities are derived from the preferred 2023 locality-level grouped binomial logit model. Confidence intervals are computed using the quasi-binomial variance adjustment to allow for extra-binomial variation. The Gozo dummy is set equal to one. Income and wealth are held at their sample averages. Low and high values correspond to one standard deviation below and above the sample mean, respectively. Values are expressed as percentages, with 95% confidence intervals in brackets.

Consistent with the mainland results shown in Section 6, mortgage-financing probabilities increase with tenure and decrease with foreign participation. However, predicted probabilities are uniformly lower because of the negative Gozo-specific level shift identified in the preferred specification.

Table 20: Gozo: Income × Wealth Scenarios

| Income / Wealth | Low wealth (-1 SD) | Average wealth | High wealth (+1 SD) |
|---|---|---|---|
| Low income (-1 SD) | 53.5 [46.1, 60.7] | 48.1 [40.9, 55.3] | 42.7 [34.9, 50.8] |
| Average income | 57.1 [50.3, 63.6] | 51.7 [45.6, 57.8] | 46.3 [39.7, 53.0] |
| High income (+1 SD) | 60.6 [53.3, 67.5] | 55.3 [49.1, 61.4] | 49.9 [43.8, 56.0] |

*Notes:* Predicted probabilities are derived from the preferred 2023 locality-level grouped binomial logit model. Confidence intervals are computed using the quasi-binomial variance adjustment to allow for extra-binomial variation. The Gozo dummy is set equal to one. Foreign participation and tenure are held at their sample averages. Low and high values correspond to one standard deviation below and above the sample mean, respectively. Income and wealth proxies are based on HFCS locality-level medians shrunk toward district medians using sample-size-based weights; wealth is log-transformed after shrinkage. Values are expressed as percentages, with 95% confidence intervals in brackets.

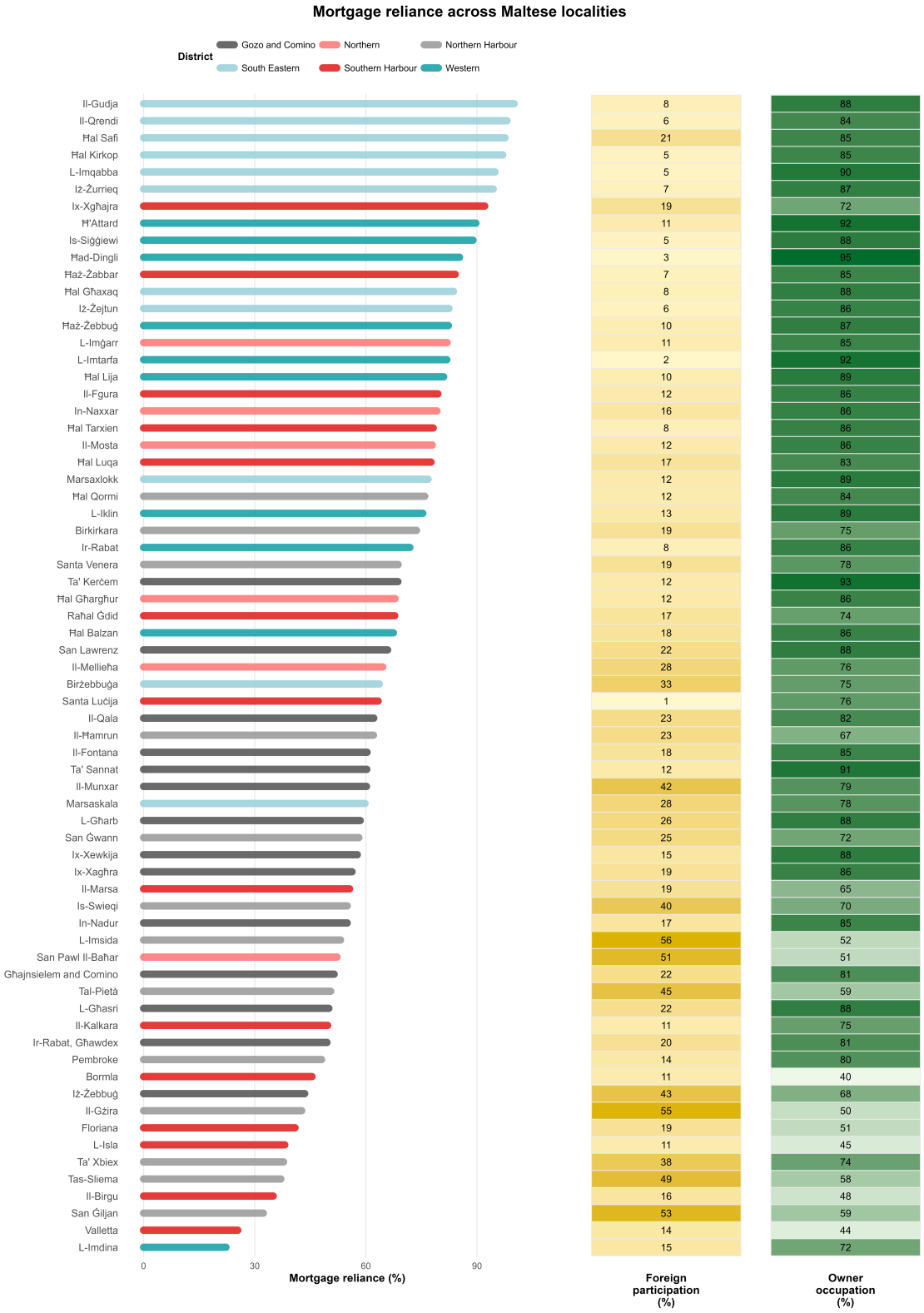
Higher income is associated with higher model-implied mortgage reliance, while higher wealth is associated with lower mortgage reliance. The overall probability levels remain below those reported for mainland localities, reflecting the estimated Gozo effect in the preferred model.

# Annex G: Locality-Level Robustness Checks and Additional Analysis

This annex reports robustness checks and supplementary locality-level analyses underlying Section 6. The robustness exercises assess the stability of the preferred specification across alternative samples, proxy definitions, estimation methods and specification choices. Where grouped-logit robustness tables report standard errors, these are based on quasi-binomial variance adjustments to allow for extra-binomial variation. Additional exploratory analysis considers demographic characteristics and locality-level property-price indicators.

The annex is organised as follows. Figure 3 provides a descriptive visualisation of the locality-level data underlying the preferred specification, showing observed mortgage reliance alongside foreign participation and owner-occupation. Tables 21 and 22 assess robustness to alternative samples and housing-use proxies. Tables 23 and 24 examine robustness to alternative financial-capacity measures, including separate income and wealth specifications and alternative asset-based proxies. Table 25 reports robustness to higher-reliability HFCS samples. Tables 26 and 27 present multicollinearity and correlation diagnostics, while Table 28 reports the orthogonalised-tenure specification. Tables 29 and 30 assess robustness to influential localities and alternative functional forms, respectively. Finally, Tables 31–33 present supplementary locality-level analysis using demographic indicators and official apartment price index measures.

Figure 3: Observed mortgage reliance, foreign participation and owner-occupation across Maltese localities




*Notes:* Localities are ranked by observed mortgage reliance. Mortgage reliance is measured as the ratio of new domestic bank mortgage contracts to registered property deeds in the Core locality dataset. Foreign participation and owner-occupation are reported as locality-level percentages. Colours denote districts. The figure is descriptive and is not based on model-adjusted predictions.

Table 21: All-property specification robustness

| Variable | Parsimonious | Full 2023 | Full 2020 |
|---|---|---|---|
| Foreign | -0.232 (0.057) | -0.165 (0.056) | -0.225 (0.063) |
| Tenure | +0.161 (0.057) | +0.274 (0.061) | +0.144 (0.069) |
| Foreign × Tenure | -0.082 (0.031) | -0.067 (0.030) | -0.087 (0.031) |
| Income | – | +0.093 (0.034) | +0.076 (0.042) |
| Wealth | – | -0.148 (0.041) | -0.038 (0.046) |
| Gozo dummy | -0.744 (0.095) | -0.761 (0.089) | -0.733 (0.095) |

*Note:* Grouped logit estimates using locality-level counts from the All-property dataset. Coefficients are reported as log-odds with quasi-binomial standard errors in parentheses, allowing for extra-binomial variation. All continuous explanatory variables are standardised. Income and wealth are HFCS-based shrunk locality proxies, wealth is log-transformed after shrinkage. The All dataset includes garages and plots of land, while the Core dataset focuses on apartments and houses. The table is intended to assess whether the main signs and magnitudes are robust to the inclusion of non-core property categories.

Table 22: Main Residence robustness

| Variable | Parsimonious: Foreign × Main residence + Gozo | Full 2023 | Full 2020 |
|---|---|---|---|
| Foreign share (z-score) | -0.429 (0.065) | -0.432 (0.067) | -0.377 (0.070) |
| Main residence (z-score) | +0.205 (0.159) | +0.218 (0.163) | +0.222 (0.147) |
| Foreign × Main residence | -0.175 (0.075) | -0.183 (0.078) | -0.141 (0.069) |
| Income (z-score) | – | -0.035 (0.084) | +0.228 (0.089) |
| Wealth (z-score) | – | -0.003 (0.075) | +0.084 (0.082) |
| Gozo dummy | -0.287 (0.330) | -0.233 (0.351) | -0.334 (0.308) |

*Notes:* Grouped logit estimates using locality-level counts of mortgage-financed and non-mortgage-financed transactions in the Core dataset. Coefficients are reported as log-odds with quasi-binomial standard errors in parentheses. All continuous explanatory variables are standardised. The main-residence proxy replaces tenure as the housing-use variable. Income and wealth proxies are derived from HFCS locality-level medians, shrunk toward district medians using sample-size-based weights; wealth is log-transformed after shrinkage. The table is intended to assess whether the main results are robust to using an alternative housing-use proxy.

Table 23: Financial-capacity proxy robustness: income only / wealth only

| Variable | Full 2023 | Income only | Wealth only |
|---|---|---|---|
| Foreign share (z-score) | -0.311 (0.085) | -0.423 (0.086) | -0.336 (0.087) |
| Tenure (z-score) | +0.635 (0.084) | +0.474 (0.077) | +0.585 (0.084) |
| Foreign × Tenure | -0.191 (0.046) | -0.227 (0.049) | -0.183 (0.048) |
| Income (z-score) | +0.146 (0.057) | +0.042 (0.054) | – |
| Wealth (z-score) | -0.218 (0.059) | – | -0.145 (0.053) |
| Gozo dummy | -0.741 (0.141) | -0.729 (0.154) | -0.650 (0.142) |
| Residual deviance | 1146.0 | 1387.8 | 1259.8 |

*Notes:* Grouped logit estimates using the Core dataset and quasi-binomial standard errors. The "Income only" specification excludes wealth, while the "Wealth only" specification excludes income. The purpose of this robustness check is to assess whether the main results depend on the simultaneous inclusion of both HFCS-based financial-capacity proxies.

Table 24: Alternative asset proxies

| Variable | Net wealth | Total assets | Real assets | Financial assets |
|---|---|---|---|---|
| Foreign | -0.311 | -0.289 | -0.298 | -0.412 |
| Tenure | +0.635 | +0.644 | +0.628 | +0.484 |
| Foreign × Tenure | -0.191 | -0.179 | -0.190 | -0.225 |
| Income | +0.146 | +0.142 | +0.114 | +0.075 |
| Asset proxy | -0.218 | -0.213 | -0.194 | -0.096 |
| Gozo | -0.741 | -0.793 | -0.779 | -0.664 |
| Residual deviance | 1146.0 | 1141.9 | 1195.7 | 1300.5 |

*Notes:* Grouped logit estimates using the Core dataset and quasi-binomial standard errors. The preferred specification replaces net wealth sequentially with total household assets, real assets and financial assets. Asset measures are derived from HFCS locality-level medians, shrunk toward district medians using sample-size-based weights, log-transformed after shrinkage and standardised prior to estimation and are introduced individually in place of net wealth.

Table 25: High-N and common-sample HFCS robustness checks

| Variable | 2023 $N \geq 10$ | 2020 $N \geq 10$ | 2023 common sample | 2020 common sample |
|---|---|---|---|---|
| Foreign share (z-score) | -0.416 | -0.486 | -0.395 | -0.515 |
| Tenure (z-score) | +0.565 | +0.408 | +0.579 | +0.401 |
| Foreign × Tenure | -0.219 | -0.266 | -0.211 | -0.278 |
| Income (z-score) | +0.090 | +0.189 | +0.111 | +0.204 |
| Wealth (z-score) | -0.179 | -0.086 | -0.199 | -0.106 |
| Gozo dummy | -0.973 | -0.770 | -1.003 | -0.947 |
| N localities | 35 | 39 | 32 | 32 |

*Notes:* Grouped binomial logit estimates using the Core locality dataset. High-N samples restrict the relevant HFCS wave to localities with at least ten observations. The common sample includes localities with at least ten observations in both HFCS waves. All continuous explanatory variables are standardised. Income and wealth are HFCS-based locality medians shrunk toward district medians using sample-size-based weights; wealth is log-transformed after shrinkage. The updated Core dataset uses actual locality-level mortgage and non-mortgage deed counts.

Table 26: Variance inflation factors

| Variable | Full 2023 | Full 2020 |
|---|---|---|
| Foreign share (z) | 3.13 | 3.65 |
| Tenure (z) | 2.91 | 3.57 |
| Income (z) | 1.44 | 1.62 |
| Wealth (z) | 2.42 | 2.53 |
| Gozo dummy | 1.53 | 1.45 |
| Foreign × Tenure | 2.07 | 2.09 |

*Notes:* VIFs are computed using a linear approximation to the preferred locality specifications. The 2023 and 2020 specifications use the corresponding HFCS-based income and wealth proxies. The underlying Core dataset uses actual locality-level mortgage and non-mortgage deed counts.

Table 27: Correlation matrix of locality proxies, 2023

| | Foreign | Tenure | Income 2023 | Wealth 2023 | Gozo |
|---|---|---|---|---|---|
| Foreign | 1.000 | -0.545 | -0.156 | -0.219 | 0.118 |
| Tenure | -0.545 | 1.000 | 0.239 | 0.649 | 0.261 |
| Income 2023 | -0.156 | 0.239 | 1.000 | 0.501 | 0.288 |
| Wealth 2023 | -0.219 | 0.649 | 0.501 | 1.000 | 0.384 |
| Gozo | 0.118 | 0.261 | 0.288 | 0.384 | 1.000 |

*Notes:* Pearson correlations across localities in the Core dataset. Income and wealth are HFCS-based shrunk locality proxies; wealth is log-transformed after shrinkage. The Core dataset uses actual locality-level mortgage and non-mortgage deed counts.

Table 28: Orthogonalised tenure

| Variable | Baseline 2023 | Orthogonalised tenure |
|---|---|---|
| Foreign | -0.311 | -0.513 |
| Tenure | +0.635 | +0.599 |
| Foreign × Tenure | -0.191 | -0.322 |
| Income | +0.146 | +0.137 |
| Wealth | -0.218 | -0.216 |
| Gozo | -0.741 | -0.762 |

*Notes:* The orthogonalised-tenure specification replaces the raw tenure variable with the residual from a regression of tenure on foreign participation. This exercise is intended as a robustness check to assess whether tenure contains information beyond that shared with foreign participation, rather than as a correction for multicollinearity. The interaction term is constructed using foreign participation and the orthogonalised tenure measure. Coefficients are reported as log-odds. All continuous variables are standardised. The baseline model is the preferred 2023 Core specification.

## Table 29: Influence robustness: dropping influential localities

| Variable | Baseline full 2023 | Drop top 1 Cook's D | Drop top 3 Cook's D |
|---|---|---|---|
| Foreign share (z-score) | -0.311 | -0.282 | -0.285 |
| Tenure (z-score) | +0.635 | +0.664 | +0.611 |
| Foreign × Tenure | -0.191 | -0.150 | -0.152 |
| Income 2023 (z-score) | +0.146 | +0.134 | +0.127 |
| Wealth 2023 (z-score) | -0.218 | -0.210 | -0.183 |
| Gozo dummy | -0.741 | -0.759 | -0.771 |

*Notes:* Grouped binomial logit estimates using the Core locality dataset. The baseline model is the preferred 2023 specification. "Drop top 1" excludes San Pawl Il-Bahar, while "Drop top 3" excludes San Pawl Il-Bahar, San Ġiljan and Valletta, identified using Cook's distance. Coefficients are log-odds. The Core dataset uses actual locality-level mortgage and non-mortgage deed counts.

## Table 30: Functional-form robustness

| Variable | Grouped logit | Grouped probit | Quasi-binomial logit | Weighted OLS, HC1 SE |
|---|---|---|---|---|
| Foreign share (z-score) | -0.311 (0.020) | -0.183 (0.012) | -0.311 (0.085) | -0.054 (0.019) |
| Tenure (z-score) | +0.635 (0.020) | +0.390 (0.012) | +0.635 (0.084) | +0.144 (0.017) |
| Foreign × Tenure | -0.191 (0.011) | -0.113 (0.007) | -0.191 (0.046) | -0.033 (0.010) |
| Income 2023 (z-score) | +0.146 (0.014) | +0.087 (0.008) | +0.146 (0.057) | +0.028 (0.010) |
| Wealth 2023 (z-score) | -0.218 (0.014) | -0.135 (0.009) | -0.218 (0.059) | -0.051 (0.011) |
| Gozo dummy | -0.741 (0.034) | -0.449 (0.021) | -0.741 (0.141) | -0.157 (0.024) |

*Notes:* Estimates are based on the preferred 2023 Core specification. The grouped logit, grouped probit and quasi-binomial models use locality-level mortgage and non-mortgage transaction counts. The weighted OLS model uses the mortgage share as dependent variable and transaction totals as weights, with HC1 robust standard errors. Coefficients are not directly comparable across nonlinear and linear models, but signs and statistical significance are used to assess robustness. The quasi-binomial model allows for overdispersion and therefore reports larger standard errors. All key coefficients remain statistically significant at conventional levels. The Core dataset uses actual locality-level mortgage and non-mortgage deed counts.

## Table 31: Supplementary Demographic Analysis

| Variable | Preferred | Average age | Old dependency ratio |
|---|---|---|---|
| Foreign | -0.311 | -0.414 | -0.416 |
| Tenure | +0.635 | +0.488 | +0.528 |
| Foreign × Tenure | -0.191 | -0.177 | -0.180 |
| Income | +0.146 | +0.120 | +0.129 |
| Wealth | -0.218 | -0.155 | -0.178 |
| Age | – | -0.215 | – |
| Dependency ratio | – | – | -0.180 |
| Gozo | -0.741 | -0.571 | -0.623 |
| Residual deviance | 1146.0 | 980.6 | 1026.8 |

*Notes:* Grouped logit estimates using the Core dataset and quasi-binomial standard errors. Average age and old-age dependency ratio are locality-level demographic indicators obtained from NSO sources and standardised prior to estimation. Demographic variables are added individually to the preferred 2023 specification.

## Table 32: Supplementary Apartment Price Index Analysis

| Variable | Preferred specification, common price-data sample | Average apartment index added | 2025 apartment index added |
|---|---|---|---|
| Foreign share (z-score) | -0.398 (0.127) | -0.230 (0.126) | -0.199 (0.127) |
| Tenure (z-score) | +0.401 (0.187) | +0.511 (0.172) | +0.512 (0.168) |
| Foreign × Tenure | -0.145 (0.055) | -0.167 (0.050) | -0.154 (0.049) |
| Income 2023 (z-score) | +0.129 (0.060) | +0.073 (0.057) | +0.063 (0.057) |
| Wealth 2023 (z-score) | -0.182 (0.061) | +0.010 (0.083) | +0.017 (0.080) |
| Apartment price index | – | -0.263 (0.085) | -0.278 (0.083) |
| Gozo dummy | -0.669 (0.154) | -1.195 (0.220) | -1.228 (0.216) |
| N localities | 43 | 43 | 43 |
| Residual deviance | 638.0 | 506.0 | 488.7 |
| Dispersion | 17.36 | 13.85 | 13.35 |

*Notes:* Grouped logit estimates using the Core dataset and quasi-binomial standard errors. The apartment price indicators are based on the official Statistical Insights locality-level apartment relative price index. The first price specification uses the average apartment price index for 2023–2025, while the second uses the 2025 apartment price index. Models are estimated on the common sample of 43 localities with available apartment price data. All continuous explanatory variables are standardised prior to estimation. Since the price measure is apartment-specific and expressed as a relative index rather than a transaction-level price, the results are interpreted as supplementary descriptive evidence and are not incorporated into the preferred specification.

Table 33: Mortgage reliance by official apartment price index tercile

| Apartment price tercile | Number of localities | Average apartment price index | Average mortgage share |
|---|---|---|---|
| Lower third | 15 | 75.3 | 61.5% |
| Middle third | 14 | 97.0 | 74.5% |
| Upper third | 14 | 124.0 | 60.5% |

*Notes:* Localities are grouped into terciles based on the official apartment relative price index, using the average index for 2023–2025. The table reports the unweighted average observed mortgage-financed share within each tercile. The figures are descriptive and are not derived from the preferred grouped logit specification. The pattern suggests that mortgage reliance is highest among middle-price localities and lower in both lower- and higher-price localities.

# Annex H: Construction of HFCS Locality-Level Income and Wealth Proxies

This annex documents the construction of the HFCS-based locality-level income and wealth proxies used in the locality-level analysis in Section 6. These variables are intended to capture broad differences in household financial capacity across localities. They should not be interpreted as direct borrower-level controls, since the transaction data do not identify the income or wealth of the buyers involved in each property purchase. The proxies are based on locality-level HFCS median household gross income and median household net wealth. Because some locality-level HFCS cells contain relatively few observations, raw locality medians are adjusted before inclusion in the regression model. Specifically, each locality-level median is shrunk toward the corresponding district median using a sample-size-based reliability weight. This reduces the influence of small-sample locality estimates while preserving locality-specific information where HFCS sample sizes are larger. The adjustment follows the general logic of empirical small-area estimation methods, which combine local information with more stable higher-level estimates to reduce sampling noise in areas with small samples (Fay and Herriot, 1979). For locality $l$, the shrunk proxy is defined as:

$$X_l^{shrunk} = w_l X_l^{local} + (1 - w_l) X_{d(l)}^{district} \tag{7}$$

where:

$$w_l = \frac{n_l}{n_l + k} \tag{8}$$

$X_l^{local}$ denotes the raw HFCS locality median, $X_{d(l)}^{district}$ denotes the corresponding district median, $n_l$ is the HFCS sample count in locality $l$, and $k$ is the smoothing parameter. The weight increases with the locality-level HFCS sample size, so that larger locality samples receive greater weight relative to the district median. Where the locality-level HFCS value is unavailable, the district median is used directly. Different smoothing constants are used for income and wealth. The smoothing constant is set at $k = 10$ for income and $k = 15$ for wealth, reflecting the greater skewness and volatility of wealth measures. Income is included after shrinkage and standardisation. Wealth is first shrunk in levels, then transformed using $\log(1 + \text{wealth})$, and subsequently standardised before inclusion in the regression model.

Table 34: HFCS proxy construction summary

| Item | Income proxy | Wealth proxy |
|---|---|---|
| HFCS variable | Median household gross income | Median household net wealth |
| HFCS wave used in preferred model | 2023 | 2023 |
| Alternative wave used in robustness | 2020 | 2020 |
| Shrinkage target | District median | District median |
| Smoothing parameter $k$ | 10 | 15 |
| Shrinkage weight | $w_l = n_l/(n_l + k)$ | $w_l = n_l/(n_l + k)$ |
| Missing locality value | District median fallback | District median fallback |
| Transformation after shrinkage | None | $\log(1 + \text{wealth})$ |
| Standardised before regression | Yes | Yes, after log transformation |

Table 35: HFCS locality sample coverage and shrinkage weights

| Statistic | Income 2023 | Wealth 2023 | Income 2020 | Wealth 2020 |
|---|---|---|---|---|
| Localities in Core dataset | 68 | 68 | 68 | 68 |
| Localities with raw HFCS value | 66 | 66 | 67 | 66 |
| Localities using district fallback | 2 | 2 | 1 | 2 |
| Minimum locality HFCS sample count | 1 | 1 | 2 | 2 |
| Median locality HFCS sample count | 10.5 | 10.5 | 11.0 | 11.0 |
| Maximum locality HFCS sample count | 60 | 60 | 50 | 50 |
| Minimum shrinkage weight | 0.000 | 0.000 | 0.000 | 0.000 |
| Median shrinkage weight | 0.500 | 0.400 | 0.524 | 0.423 |
| Maximum shrinkage weight | 0.857 | 0.800 | 0.833 | 0.769 |

*Notes:* The shrinkage weight is defined as $w_l = n_l/(n_l + k)$, where $n_l$ is the HFCS locality sample count and $k$ is the smoothing parameter. A weight of zero indicates that the district median is used directly, either because the locality-level HFCS value is unavailable or because the locality-specific value receives no weight. Wealth is log-transformed after shrinkage and before standardisation. Both income and wealth are standardised across localities before entering the regression models.