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The impact of government spending on Ireland's housing and residential market – Targeted vs economy-wide stimulus

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Abstract

The Irish residential property market is currently characterized by a considerable structural deficiency in housing supply compared to the underlying level of demand. The lack of housing has led to several economic and social problems in Ireland. The imbalance between supply and demand has led to both house prices and rents increasing faster than household incomes. Recent policy initiatives by the Irish Government have outlined plans for significant spending aimed at increasing the numbers of housing completions to tackle these issues. This paper examines the impact of government spending on housing supply using a structural econometric model of the Irish economy with a specific construction block. Within our econometric analysis, we compare the results of an economy wide versus a sector specific government stimulus on the property market. Our simulations suggest that, in order to achieve social and economic goals like increasing the number of dwellings and making housing more affordable by containing house price inflation, a targeted policy such as that described in the Irish Government's *Housing for All* plan may be preferable to an economy-wide stimulus.

JEL classifications: R31; E62; R21; E17

Keywords: Housing Supply; Housing Policy; Government Spending; Construction Sector; Irish Economy

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1. Introduction

Since the Great Financial Crisis, Ireland has faced a substantial shortage in housing supply compared to the underlying level of demand. The reasons for the imbalance include a significant increase in demand for housing due to population growth including net immigration, and a severe decline in construction output in the wake of the financial crisis with activity slow to increase in the last decade. Estimates from both the Central Bank of Ireland (Conefrey & Staunton, 2019) and the Economic and Social Research Institute (Bergin & Garcia-Rodriguez, 2020) suggest that Ireland requires in the region of 28,000–35,000 new dwellings each year for the next ten years to keep pace with projected population growth. However, the number of new housing units has been substantially below this level over the last decade (see Fig 1). More recently, the COVID-19 pandemic has served to exacerbate Ireland's housing supply problem. As the construction industry was shut down for several months during various lockdown periods in 2020 and 2021, the pace of building new homes slowed considerably. Because of this, the short-term supply and demand mismatch has widened. The lack of housing has led to numerous economic and social challenges in Ireland including increased levels of homelessness, high rents and house prices and difficulties for many people in purchasing affordable homes. With regard to the latter, as housing supply has not kept up with housing demand in recent years, the imbalance between the two has led to both house prices and rents increasing faster than household incomes.[1]

Given this widely acknowledged imbalance in the Irish residential market, policy measures are particularly focussed on significantly increasing the supply of housing over the medium-term (Egan, Kenny, & McQuinn, 2022). In September 2021, The Irish Government released a new housing plan, "*Housing for All – A New Housing Plan for Ireland*" (Department of Housing, Local Government and Heritage, 2021). This initiative has the largest ever housing budget in Irish history and aims to transform Ireland's housing system, with funding being provided from various sources including the Exchequer, the Land Development Agency (LDA) and the Housing Finance Agency. The plan states supporting homeownership and increasing affordability as one of its overarching objectives. The plan targets annual new dwelling completions of 33,000 units up to 2030; an ambitious target given completions averaged in the region of 14,000 per year over the previous decade.

A key consideration for the Irish Government will involve striking a balance to ensure increased government spending aimed at increasing housing supply is not off-set by rising construction costs, house price inflation or other possible negative impacts to the wider economy. In light of this policy consideration, this paper examines the impact of government spending on the Irish construction sector and housing market using a structural econometric model of the Irish economy with a specific construction block. The inclusion of a specific construction sector in model of the Irish economy is motivated by the importance of the sector historically. Employment in the construction sector (NACE sectors F and L) represented 6.7 % (around 168,000 people) of total employment in 2021Q4 having peaked at 13 % (around 282,000) in 2006Q4. Crucially within our econometric analysis, we compare the results of an

[1] Remarks by Deputy Governor of the Central Bank of Ireland Vasileios at Society of Chartered Surveyors Ireland, December 2022. Accessed at https://www.centralbank.ie/news/article/remarks-deputy-governor-vasileios-madouros-at-scsi-7-december-2022.

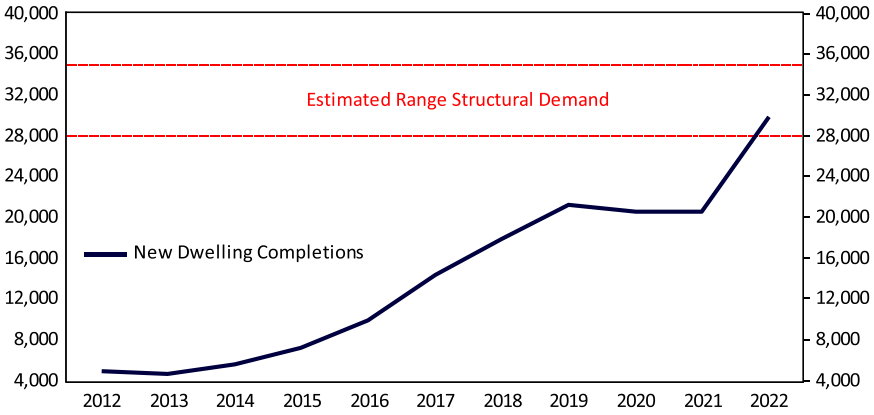

Fig 1. Annual New Dwelling Completions and Estimates of Structural Demand.
Source: CSO, Bergin & Garcia-Rodriguez (2020) and Conefrey & Staunton (2019).

economy wide versus a sector specific government stimulus on the construction sector, property market and wider economy.

While the literature on quantifying the impact of expansionary fiscal policy on macroeconomic variables such as output, consumption, investment and employment is extensive (see for example Baxter and King (1993), Blanchard and Perotti, 2002, de Castro Fernández and Hernández de Cos (2008), Perotti, 2004, and Papaioannou (2019)), papers which include the reaction of the residential construction and housing market to a change in government spending are more limited. Much of the empirical links between policy and house prices has focused on monetary intervention (see for example Bauer, 2017; Hülsewig and Rottmann, 2021; Iacoviello, 2005; Iacoviello and Neri, 2010; Musso, Neri, & Stracca, 2010; Del Negro and Otrok, 2007; Wadud et al., 2012; Yang, Wang, & Campbell, 2010). From the relatively scarce work relating fiscal policy to the housing market, there is a lack of consensus in empirical literature about the effect of increasing government spending policies on residential investment and house prices. Ramey, Shapiro (1998) include the response of residential investment to an increase in government spending and find that it falls substantially and statistically significantly. Edelberg, Eichenbaum, and Fisher (1999) investigate the consequences of an exogenous increase in U.S. government purchases and find that in response to such a shock, employment, output, and non-residential investment rise, while real wages, residential investment, and consumption expenditures fall. The authors find that a positive shock to government purchases induces a broad-based expansion in non-residential investment along with a delayed fall in consumption expenditures. The latter occurs mostly via a reduction in durable consumer good expenditures, defined to include investment in housing. Wigren and Wilhelmsson (2007) examine investment in construction in Western Europe and find that public infrastructure policies have an effect on short-run economic growth but only a weak effect on the long run. Using US quarterly data, from 1955 to 2000, Mountford and Uhlig (2005) find that government spending shocks crowd out both residential and non-residential investment without causing interest rates to rise. Fatás and Mihov (2001) find that while the response of overall investment in government expenditures is ambiguous, residential investment responds positively. The authors point out that the increase is small, however. Analysing empirical evidence from the US, the UK, Germany and Italy, Afonso and Sousa (2012) provide a detailed evaluation of the macroeconomic effects

of fiscal policy and find that government spending shocks have a positive effect on house prices which persists for almost 20 quarters. In contrast, Agnello and Sousa (2013) analyse the impact of fiscal policy on asset prices using a panel vector auto-regressive (PVAR) approach and quarterly data for ten industrialized countries and find that positive fiscal shocks lead to a gradual and persistent decrease in housing prices. Finally, Andres, Bosca and Ferri (2015) show that after a positive government spending shock, house prices fall across various measures of residential property inflation. The authors find that the decrease is more intense when prices are measured by a quality constant Laspeyres index (about 3.2 % points after one year) but lasts longer when a Fisher index of house prices is used (after nine quarters the fall in housing prices is still significant).

The aim of this paper is to add to this relatively scarce body of literature by examining the role that government spending can have on the construction sector and residential property market. The Irish case provides a particularly good case study for such an analysis given the current shortage of available housing units to meet the level of demand, the overall importance of the construction sector to the Irish economy, as well as the proposed policy response of the Irish Government. The remainder of the paper is structured as follows. Section 2 describes the model used in our empirical analysis, Section 3 discusses establishing the link between government spending and housing supply in the Irish economy while Section 4 presents the empirical results of our policy simulations and discusses the findings in the context of policy lessons. Finally, Section 5 concludes.

2. The model

2.1. Core structural model of the Irish economy (COSMO)[2]

COSMO is a macro-econometric model of the Irish economy designed for both economic projections and policy analysis (for examples of its uses see Bergin, Economides, Garcia-Rodriguez, & Murphy, 2019 and Conefrey, O'Reilly, & Walsh, 2018). Similar to previous macro models for Ireland, COSMO models the behaviour of the economy in a small open economy framework.[3] COSMO embodies the neoclassical synthesis[4] combining both short-run dynamics based on empirical evidence as well as theoretically founded long-run relationships which are static optimisation conditions (Fenz and Spitzner, 2005). The long-run equilibrium is supply driven, determined by available factors of production and total factor productivity. The long-run properties of the model, as derived from optimisation, exert their influence through the error correction structure. This anchors the model and ensures that although there are short-run dynamics the variables do eventually converge to their long-run path as specified by theory.[5]

[2] This section draws on Bergin et al. (2017) which contains a full description of the mechanisms and behaviour of the model

[3] Previous structural macroeconomic models of Ireland include HERMES (Bergin, Conefrey, FitzGerald, Kearney, & Žnuderl, 2013) and HERMIN (Bradley, Whelan, & Wright, 1995; Bradley and Untiedt, 2008) while ÉIRE-Mod (Clancy and Merola, 2016) is an example of a DSGE model.

[4] The most prominent example of this type approach is the NiGEM global macro econometric model. See Mitchell, Sault, Smith, and Wallis (1998) for an overview.

[5] The short-run dynamics are not purely data driven as consistency with economic theory is given more importance. Dummy variables and fixed parameters are occasionally used but will not be discussed in detail.

COSMO initially focuses on the supply-side (output) of the economy and then examines the downstream expenditure and income consequences. It is a multisectoral model and on the production side distinguishes between the traded sector, the government sector, the domestic sector and the construction sector.[6] The disaggregation reflects the significant differences between firms/agents operating within the sectors. The traded sector, for example, has a high share of multinational firms, together with some local firms also dedicated to supplying foreign markets. There is an underlying production function for each sector that ultimately drives medium-term growth in the economy. Output in the traded sector is driven by global demand for Irish exports and cost competitiveness. The behaviour of the government sector is largely a policy choice. Finally, the domestic sector mostly contains firms operating in the national economy. Consequently, domestic conditions are the main driver for these firms. This description also fits the firms and agents operating in the construction sector, but in turn they have characteristics that justify a separate treatment from the rest of the domestic sector. For example, activity in the construction sector is more impacted by financial developments and demographic factors and tends to have a different labour intensity than other firms operating for the domestic market.

Within COSMO, demand is disaggregated along standard national accounting lines (household consumption, public consumption, investment, exports, and imports). Tensions between supply and demand feed back into the economy through the price system. Households make consumption decisions based on the current income and holdings of wealth (financial and non-financial). They also supply labour, with the supply of labour dependent on after-tax wages and migration, as well as demographic assumptions. The labour market is open and through migration is influenced by conditions in alternative labour markets. Firms employ labour and make investment decisions, with their factor demands derived from the underlying production functions. Wages are determined in a bargaining model, and influenced by the factors that affect the supply and demand for labour – e.g. prices, taxes. The government sector raises taxes, transfers income to households, employs labour and invests in capital. Any deficit accumulates onto the government debt stock, and interest must be paid on this debt. While monetary policy is exogenously set by an external ECB, borrowing rates include an endogenous margin, which depend on the state of the economy and the health of the banking system.[7]

2.2. *COSMO's construction sector*

COSMO's construction sector is modelled in a similar way to the other sectors in COSMO and it consists of nine estimated equations, a calibrated production function as well as a number of identity equations.[8]

[6] The original COSMO had three main production sectors – traded, non-traded and government. As outlined in Egan & Bergin (2022), the non-traded sector was split into the domestic sector and the construction sector to facilitate a better understanding of how shocks to the real economy propagate to the construction sector and vice versa, given its overall importance to the Irish economy.

[7] A schematic of some of the key interlinkages and relationships within COSMO can be seen in Appendix 1.

[8] As discussed in the context of the wider COSMO model, the majority of the construction sector is estimated in an error-correction framework. For more details on the estimation methodology within COSMO in general see Bergin et al. (2017). Estimated coefficients and Identity equations are not presented in the interest of brevity but are available by request. Information on all variables used in the construction sector equations including description and source can be found in the Appendix of this paper.

As discussed in detail in Bergin et al. (2017), all COSMO sectors including the construction sector have an underlying production function that drives medium-term growth and a 'production gap' will feed back through prices to guide output towards capacity. This production function is a 3-factor, 2-level normalised nested constant elasticity of substitution (CES) production function with constant returns to scale and labour augmenting technical progress. The construction production function therefore consists of the three factors in the sector and the two levels of a composite of capital and energy as well as labour.

$$Y_{ct} = \gamma_{1,ct}\left[\delta_{1,ct} z_{ct}^{-\rho_{1,ct}} + (1-\delta_{1,ct})(h_{ct}e^{\lambda_{ct}t})^{-\rho_{1,ct}}\right]^{-1/\rho_{1,ct}} \tag{1}$$

where Y_{ct} is output measured as the construction sector's gross value added, h_{ct} is labour measured as total hours worked, λ_{ct} is labour augmenting technological progress, δ_{1ct} is the share parameter, γ_{1ct} is a constant term that centres the function around the level of actual output, ρ_{1ct} is the substitution parameter and z denotes a composite of capital, k, measured as the net productive capital stock and energy, er, measured as fossil fuel consumption. The composite of capital and energy is given by

$$z_{ct} = \gamma_{2,ct}\left[\delta_{2,ct} k_{ct}^{-\rho_{2,ct}} + (1-\delta_{2,ct}) er^{-\rho_{2,ct}}\right]^{-1/\rho_{2,ct}} \tag{2}$$

The level of production in the construction sector, $ypr_{ct,t}$, is measured by gross value added (GVA) and is determined by the level of investment in the construction sector, $ipr_{ct,t}$, as well as the number of new dwelling completions, s_{t-1}.

$$\Delta ypr_{ct,t} = \delta(ypr_{ct,t-1} - ipr_{ct,t-1} - s_{t-1}) + \Delta ipr_{ct,t} + \Delta s_t \tag{3}$$

The level of investment, $ipr_{ct,t}$, calculated by the gross fixed capital formation of NACE sectors F (Construction) and L (Real Estate Activities), is determined by the overall level of output in the economy, yer_t, while an investment deflator ipd_{ct}, is estimated based on the GDP deflator yed_t.

$$\Delta ipr_{ct,t} = \delta(ipr_{ct,t-1} - yer_{t-1}) + \Delta yer_t \tag{4}$$

$$\Delta ipd_{ct,t} = \delta(ipd_{ct,t-1} - yed_{t-1}) + \Delta yed_t \tag{5}$$

Supply and demand in the labour market is estimated in a system of simultaneous equations to avoid the potential of biased estimators from standard single equation OLS estimation. The level of employment and wages in the construction sector, $lnn_{ct,t}$ and $wn_{ct,t}$, are determined by factors including the level of production ($ypr_{ct,t}$), labour productivity ($lat_{ct,t}$), and hours worked in the sector ($h_{ct.t}$) as well as macroeconomic variables such as the level of pres (pcd_t) and the unemployment rate (urx_t).

$$\begin{aligned}\Delta(\ln n_{ct,t} * h_{ct,t}) = \delta\Bigg[&\left(\frac{wn_{ct,t-1}}{ypd_{ct,t-1}}\right) + \frac{(1-\sigma)}{\sigma} * lat_{ct,t-1} - \frac{1}{\sigma} \\ &* \frac{\frac{ypr_{ct,t-1}}{\ln n_{ct,t-1}}}{h_{ct.t}}\Bigg] + \Delta ypr_{ct,t} + \Delta lat_{ct,t} + + \Delta\frac{wn_{ct,t}}{ypd_{ct,t}} \\ &+ \Delta(\ln n_{ct,t-1} * h_{ct,t-1}) \\ &+ \Delta(\ln n_{ct,t-2} * h_{ct,t-2}) \\ &+ \Delta(\ln n_{ct,t-3} * h_{ct,t-3}) + \Delta(\ln n_{ct,t-4} * h_{ct,t-4})\end{aligned} \tag{6}$$

$$\Delta wn_{ct,t} = \delta\left[\left(\frac{wn_{ct,t-1}}{ypd_{ct,t-1}}\right) + \frac{(1-\sigma_1)}{\sigma_1} * lat_{ct,t-1} - \frac{1}{\sigma_1} * \frac{\frac{ypr_{ct,t-1}}{\ln n_{ct,t-1}}}{h_{ct.t}}\right] + \Delta\left(\frac{wn_{ct,t-1}}{pcd_{t-1}} - urx_{t-1}\right) + \Delta pcd_t + \Delta dthx_t \tag{7}$$

The level of profits of companies operating in the construction sector, $cpn_{ct,t}$, is estimated as a function of the level of real production in the sector ($\frac{ypr_{ct,t}}{ypd_{ct,t}}$) adjusted for the numeration of the sectors employees and the depreciation of buildings and equipment ($win_{ct,t-1} - dep_{ct,t-1}$).

$$\Delta cpn_{ct,t} = \delta\left(cpn_{ct,t-1} - \frac{ypr_{ct,t-1}}{\frac{ypd_{ct,t-1}}{100 - win_{ct,t-1} - dep_{ct,t-1}}}\right) + \Delta\left(\frac{ypr_{ct,t-1}}{\frac{ypd_{ct,t-1}}{100 - win_{ct,t-1} - dep_{ct,t-q}}}\right) \tag{8}$$

Fossil fuel consumption, $er_{ct,t}$, is determined by factors such as the level of capital stock ($kr_{ct,t}$) and user cost of capital in the sector ($rpr_{ct,t}$) as well as exogenous global factors including the price of oil expressed in euros (poe_t/rex_{ust}).

$$\Delta er_{ct,t} = \delta(er_{ct,t-1} - kr_{ct,t-1}) + \sigma_2 * \frac{poe_{t-1}}{\frac{rex_{ust-1}}{\frac{ypd_{ct,t-1}}{rpr_{ct,t-1}}}} + \Delta(kr_{ct,t}) + \Delta\left(\frac{poe_t}{\frac{rex_{us_{t-1}}}{ypd_{ct,t-1}}}\right) + \Delta rpr_{ct,t} \tag{9}$$

The indicator of average hours, $h_{ct,t}$, is largely determined by measures of strength of the overall labour market which are represented by the unemployment rate (urx_t) and the percentage of females in the total labour force ($\frac{lfn_{t-1}}{p15f_{t-1}}$). The later is included to reflect the fact that female participation in Ireland is very responsive to changing labour market conditions

$$\Delta h_{ct,t} = \delta\left(h_{ct,t-1} - lffx_{t-1} * \frac{lfn_{t-1}}{p15f_{t-1}} - urx_{t-1}\right) + \Delta lffx_{t-1} * \frac{lfn_{t-1}}{p15f_{t-1}} + \Delta urx_{t-1} \tag{10}$$

Building costs ($bcost_{ct,t}$) are a key transmission channel between the financial block, construction sector and the real economy. Equation 9 shows that building costs are represented by a function of overall import prices (mtd_t)and wages in the construction sector ($wn_{ct,t}$).

$$\Delta bcost_t = \delta(bcost_{t-1} - wn_{ct,t} - mtd_t) + \Delta wn_{ct,t} + \Delta mtd_{ct,t} \tag{11}$$

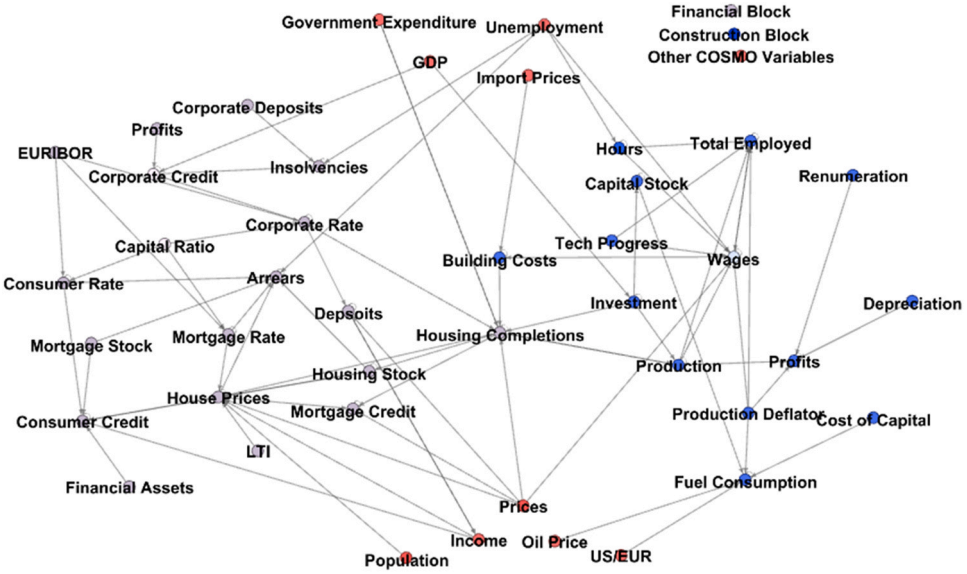

Fig 2. Simplified Dependency of Construction Sector, Financial Block & Wider COSMO.
Source: Author's calculations.

In addition to Equations 1–11, there are also a number of identity equations which calculate non-estimated variables. These include, for example, the calculation of certain deflators relating to the construction sector and the level of capital stock which is calculated using a simple capital accumulation equation based on the level of previous capital stock, investment, and a measure of depreciation.

Fig 2 presents a simplified dependency graph which outlines the channels through which the construction sector, financial block and real economy are related. The construction block is represented by blue nodes, the financial block by grey and the wider COSMO variables by red. The illustration shows that the construction sector and financial block are mainly linked through the level of new housing completions and building costs. Both the construction sector and financial block are also indirectly connected through key macro variables such as GDP, unemployment and import prices. As an example of the transmission mechanism, an increase in the strength of the overall economy, measured by GDP, will feed into investment in the construction sector which, in turn, will positively influence the level of housing completions in the financial block. On the other hand, a lower level of unemployment will also serve to put upward pressure on wages in the constructions sector. This in turn will serve to increase the cost of building materials, as outlined in Eq. (11), and will off-set the initial increase in completions. Another key mechanism is the role of both the private and public sector in determining the level of new dwelling completions in the financial block which is determined by variables such as the corporate lending rate, the cost of building materials, private sector investment in the construction sector as well as the level of government expenditure. The latter represents a key policy lever regarding the construction sector and the rationale behind this will be discussed in more detail in Section 3.

The linkages outlined in Fig 2 allow us to examine dynamics which are key to the policy debate regarding housing supply and residential property prices. This includes a mechanism to

examine the impact of changes in government spending or investment in construction on the level of housing completions, the impact that changes in completions have on house prices and the impact that changes in house prices have on the financial side of the economy as well as the construction sector. This is a key consideration in the context of the Irish Government's *Housing for All* initiative given its key mandate of supporting homeownership through increased affordability. As the construction sector and financial block also have several common macro variables, the impact of external shocks to these key variables can also be examined.

3. Government spending as a determinant of Irish housing supply

As discussed in the Government's "*Housing for All*" plan, policy makers aim to create an environment such that an annual average of at least 33,000 housing units per year will be introduced to the market. This involves the Government playing a key role in contributing directly to housing completions along with the private sector. According to the Irish Government's Budget 2023, total gross voted capital expenditure in the budget stood at €12.4 billion for the period 2021–2025 with a significant proportion of this being allocated to housing. There are, however, several risks and challenges with increasing government funding in the housing sector in this manner. This includes capacity constraints in the construction labour market, increased construction material costs as well as restrictions imposed by the planning process which could increase project costs and duration. Taking account of these trends, there is an obvious danger that the effects of significantly increased government funding for housing may be diminished by rising construction cost and house price inflation (Department of Housing, Local Government and Heritage, 2021). Examining the impact of targeted government spending not only on the level of housing supply but also on the housing market in general as well as the wider economy represents the key policy related motivation for this paper.

The international literature suggests the impact of government spending on residential investment and house prices has been ambiguous. As the Government has committed to intervene in the market for housing along with the private sector, such an increase in government spending cannot be modelled in the same way as previous studies which have applied an economy wide style shock to fiscal policy (see for example Afonso and Sousa, 2012 and Adrès, Bosca and Ferri, 2015). Accordingly, we make modifications to the financial block of COSMO discussed in Section 2 as first outlined in Bergin et al. (2017) and updated in Egan, McQuinn, and O' Toole (2022). The block is composed of 13 equations across the housing and banking sectors. It models three specific credit markets (mortgage market, consumer credit, and non-financial corporate loans) with separate interest rate equations. It provides macro-financial equations to measure mortgage arrears and corporate insolvencies which allows for a monitoring and analysis toolkit for financial distress. Finally, it models house prices and the level of housing supply. For the latter, COSMO applies the direct estimation of the aggregate supply function approach where supply is typically hypothesised as a function of house prices and cost shifters. Studies by DiPasquale and Wheaton (1994), Poterba (1984), Poterba (1991) and Topel and Rosen (1988) all estimate supply functions of the housing market directly. COSMO's housing supply s_t (represented by new dwelling completions) is therefore estimated as a function of house prices ($\frac{hp_t}{pcd_t}$), the interest rate to non-financial corporations ($nfcrat_t$), representing the cost of credit to property developers involved in house building, building costs ($bcost_t$) and the level of investment in the construction sector ($iprc_{ct,t}$). Estimated in COSMO's ECM form, the equation is;

$$\Delta s_t = \delta\left(s_{t-1} - \frac{hp_{t-1}}{pcd_{t-1}} - nfcrat_{t-1} - bcost_{t-1} - iprc_{ct,t-1}\right) + \Delta s_{t-1} + \Delta\frac{hp_{t-1}}{pcd_{t-1}} + \Delta nfcrat_{t-1} + \Delta bcost_{t-1} + \Delta ipr_{t-1} \quad (12a)$$

There is no direct avenue for government interaction or expenditure in this specification. Instead, the model posits that private sector actors control the amount of new dwelling completions. In this situation, government spending has an indirect effect on housing supply through the larger economy, such as increased investment in the construction sector as a result of the general economic impact from the fiscal stimulus.

To account for increased Government involvement in the supply of housing, we modify the equation for housing supply in Eq. (12a) above by allowing new dwelling completions, s_t, to be directly influenced by government expenditure. The equation for housing supply therefore becomes:

$$\Delta s_t = \delta\left(s_{t-1} - \frac{hp_{t-1}}{pcd_{t-1}} - nfcrat_{t-1} - bcost_{t-1} - iprc_{ct,t-1} - gcr_{t-1}\right) + \Delta s_{t-1} + \Delta\frac{hp_{t-1}}{pcd_{t-1}} + \Delta nfcrat_{t-1} + \Delta bcost_{t-1} + \Delta ipr_{t-1} + \Delta gcr_{t-1} \quad (12b)$$

The equation for housing supply (12b) now includes the variable gcr_t, net expenditure by central and local government on current goods and services. This variable represents the key government spending lever in COSMO. As a behavioural rule government consumption is modelled as rising in line with the economy's potential output. This variable can be adjusted to represent a positive or negative shock to government spending. It is included in the housing supply equation to allow housing supply to be driven directly by government intervention along with the other determinants such as the corporate lending rate, house prices and building costs.

4. Policy simulations – target versus economy wide government spending

In this section we examine two policy scenarios using the structural macroeconomic model discussed in Section 2. The first simulation applies a standard 1 % expansion of government spending which filters through the structural model from the 'top down' into the various production sectors. This simulation is carried out using Eq. (12a) as described in Section 3, which only allows for an indirect effect on housing supply from Government spending. The second simulation applies the same 1 % expansion of government spending but instead assumed that housing supply is explained by Eq. (12b), which allows for a direct impact on housing supply from Government spending.

4.1. Economy wide shock

In this scenario, there is no direct role played by government in the supply of houses. Instead, the level of housing completions is directly determined by the private sector. In this case, government expenditure does not directly impact the level of completions but rather influences indirectly from the wider economy. The responses to this economy wide shock are shown in Fig

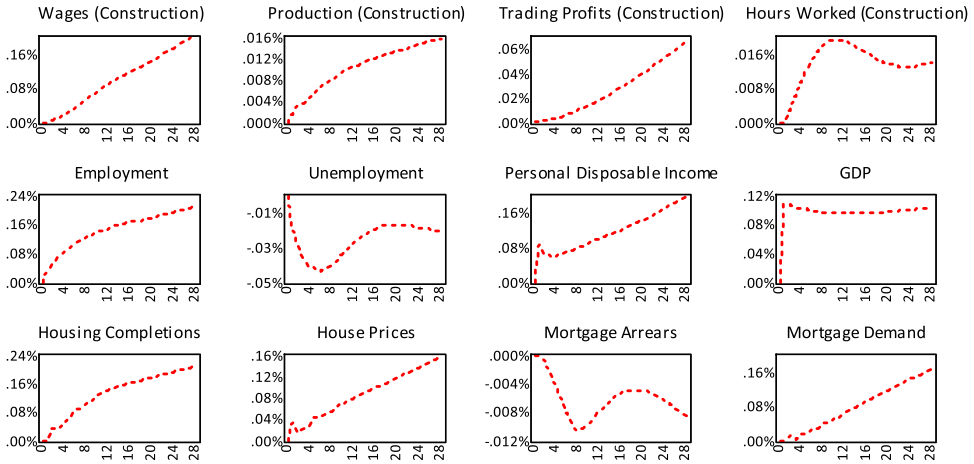

Fig 3. Response of 1 % economy wide shock to government spending - % deviations from baseline.
Source: Author's Calculations.

3. Here, we present the response of variables across the construction sector of the economy, the macroeconomy, as well as variables relating to Ireland's housing market and financial sector.[9]

The impulse responses in Fig 3 show that the generic 1 % positive shock to government expenditure has a corresponding positive impact on the construction sector in the proceeding twenty-eight quarters, although the impacts are relatively small. At the end of the simulation period $t + 28$, hours worked, wages, trading profits of companies and the overall level of production in the construction sector have all increased relative to the baseline. The fiscal expansion also has the expected positive impact on the main macroeconomic variables. Employment rises across the sectors relative to the baseline which ultimately leads to an increase in the overall level of employment and a subsequent fall in the level of unemployment. The increase in wages seen in the construction sector will be mirrored in other sectors of the economy[10] which in turn will increase the level of income with GDP also increasing around 0.12 % above its baseline owing to the stronger level of economic activity. Finally, and most importantly in the context of this paper's policy question, we examine the impact on the level of housing completions and related housing market variables. The increased level of activity in the construction sector from the economy wide expansion of government spending sees the number of new dwelling completions increase by approximately 0.2 % by the end of the twenty-eight quarter simulation period. Interestingly, house prices also increase and are 0.16 % higher than the baseline in $t + 28$. In the corresponding mortgage market, the number of customers in arrears falls as incomes and housing wealth increases. Finally, mortgage demand also increases by around 0.16 %, itself being determined within COSMO's financial block by both house prices and the number of dwelling completions.

[9] For brevity we have only reported the twelve impulse responses shown but all impulses responses of endogenous COSMIO variables are from the authors by request.

[10] As described in Section 2, COSMO contains four main production sectors – traded, domestic, construction and government.

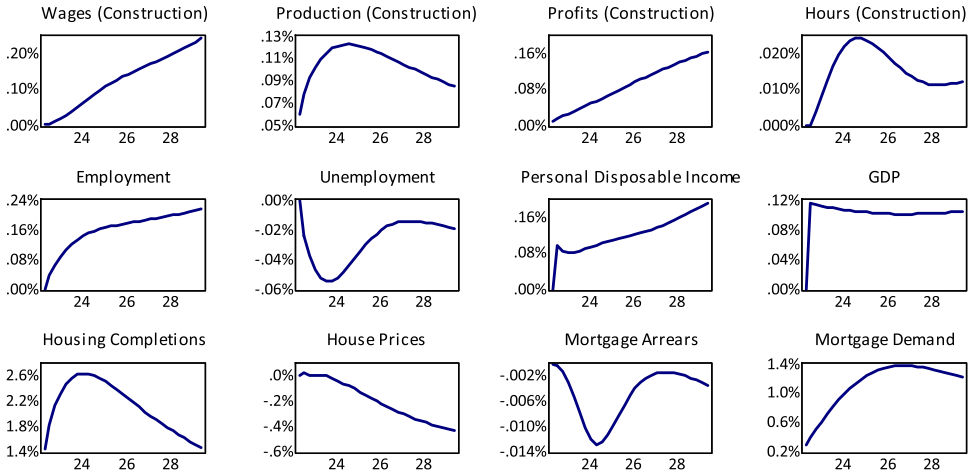

Fig 4. Response of 1 % Targeted Shock to Government Spending, % Deviations from Baseline.
Source: Author's Calculations.

4.2. Targeted shock

The impulses for the same generic 1 % shock to government spending are illustrated in Fig 4. As housing completions enter construction sector output through Eq. (1), the impact of the 1 % shock to government expenditure has a noticeable impact on the level of wages, profits and the number of hours worked in the sector which all increase relative to the baseline, as does the level of production in the sector itself. Overall macroeconomic output is likewise positively impacted by the government spending expansion as expected. Compared to the baseline, employment increases across all sectors, which ultimately raises total employment levels and lowers unemployment rates. Due to the increased level of economic activity, the rise in wages witnessed in the construction industry is mirrored in other areas of the economy, increasing income levels. Finally, in the housing market and financial block, there is a considerable increase in the number of new dwelling completions from the targeted shock. The inclusion of the government spending variable in the housing supply equation sees a 1 % shock to government spending result in as much as a 2.6 % increase relative to the baseline just six quarters after the initial shock. While this increase dissipates over time, it is still 1.4 % above the baseline by the end of the simulation period $t + 28$. House prices, which are in part determined by the total housing stock[11] fall 0.5 % below the baseline by the end of the period. This fall in house prices coupled with the increase in personal disposable income indicates an increase in affordability for potential homeowners, a key motivation of the Irish Government's housing policy. Mortgage arrears also falls despite the decline in house prices suggesting that the positive benefits from the affordability channel of the mortgage arrears equation outweigh the negative impacts in the equity channel owing to the fall in household equity from the decline in house prices. Mortgage demand, which is modelled as a function of both the price and availability of houses also increases due to the strong rise in dwelling completions.

[11] Housing stock is calculated as the previous periods stock plus one minus the rate of obsolescence plus new dwelling completions.

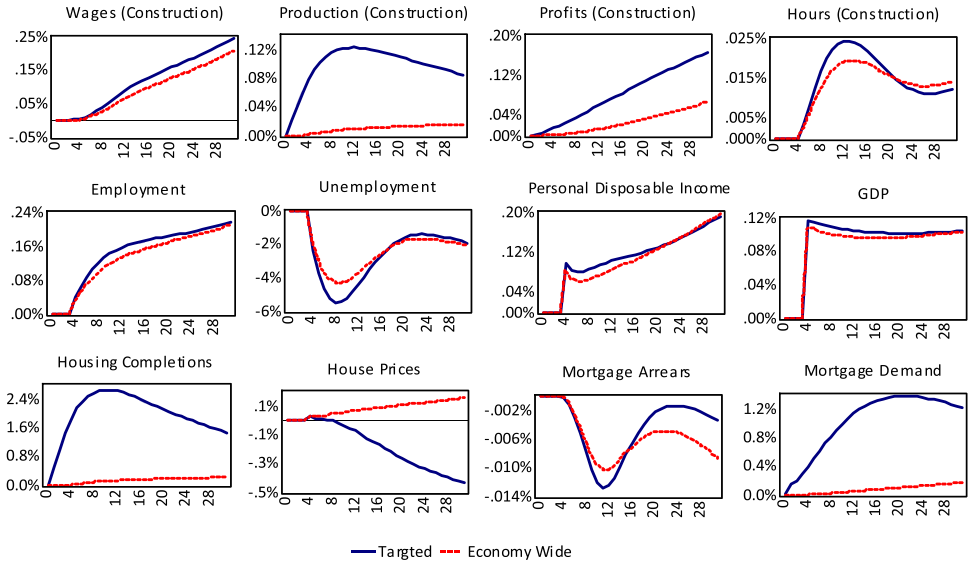

Fig 5. Response of both a 1 % targeted and economy wide shock to government spending.
Source: Author's Calculations.

4.3. Comparison of targeted versus economy wide shock and lessons for policy

Fig 5 compares the simulation results of the economy wide and target government policy shocks as described in Sections 4.1 and 4.2. The comparison of the two responses provides some interesting findings in the context of the Irish Government objectives of increase housing supply levels through multi-annual spending. Unsurprisingly, government spending targeted at boosting the number of new dwelling completions directly has a stronger impact on the level of production in the construction sector than the economy wide government stimulus. This also leads to higher profits, wages and number of hours worked within the construction sector. The second row of impulses in Fig 5 indicates that there is no loss to the macroeconomy as a whole from the targeted compared to the economy wide policy, with the former showing a slightly stronger response in terms of employment, unemployment, the level of income and GDP.

What is most relevant about the comparison of results across the two simulations from a policy perspective however is the reaction of the variables in the housing market and financial sector. First, it is no surprise to see that the deviation from the baseline for housing completions is much stronger in the targeted versus the economy wide shock. However, the impulse response of house prices is also significantly different with a positive reaction in the economy wide shock compared to a negative response to the targeted policy. In the economy wide simulation, while the 1 % change in government expenditure shock does serve to marginally increase the level of housing supply, house prices subsequently increases vis a vis the baseline. This increase is a result of the comparatively stronger income effects of the economy wide expansionary government policy putting upward pressure on house prices. On the other hand, the targeted policy shock seems to show that Irish house prices are significantly elastic to levels of housing supply. This would seem to be confirmed by the deflationary movement of house prices from the significant increase in the number of dwelling completions which override other

inflationary pressures such as increasing incomes seen in the economy wide simulation. Finally, the percentage of people in mortgage arrears also falls marginally more in the targeted policy while mortgage demand increases significantly more.

These simulation results have important lessons for Irish housing policy. The simulation results suggest that an economy wide expansion of government expenditure will only marginally increase the level of housing completions and may serve to actually increase house prices through other income effects. On the other hand, an expansion which targets completions directly means that the more significant increase in completions will outweigh any income effects and lead to a significant deflationary effect on house prices. This highlights the importance of targeting the level of housing completions and construction sector directly if the main goal is to reduce pressure on house prices and that a 'top down' approach, while serving to marginally increase the level of housing completions, may not have the deflationary effect on house prices as desired. The simulations suggest therefore that the targeted policy, such as that outlined in the Irish Governments *Housing for All* plan may be optimum compared to an economy wide stimulus in terms of meeting the social and economic objectives such as increasing the number of dwellings and making housing more affordable by curbing house price inflation.

5. Conclusion

Recent policy initiatives by the Irish Government have outlined plans for significant spending aimed at increasing the numbers of housing completions in an effort to tackle the country's housing crisis. In particular, in the *Housing for All* plan, the Government has committed to increasing housing supply to improve access to a home to purchase or rent at an affordable price. Using a structural econometric model of the Irish economy with a specific construction block, this paper examines the response of key variables related to the construction sector, macroeconomy and housing market using both a targeted and an economy wide government spending shock. The results of our simulations found that in the economy wide shock, where housing completions are directly determined by the private sector only, the increase in the number of dwelling completions is marginal and house prices rise as result of the comparatively stronger income effects of the expansionary government spending policy. In the targeted policy simulation, we allow housing completions to be determined directly by government spending reflecting the commitment that the public sector become a key driver of the supply of houses over the next decade. In this case, the significant increase in housing completions as a result of the shock to government expenditure offsets the income effects of the expansionary fiscal policy and house prices fall below the baseline.

We believe the empirical results presented in this paper offer crucial lessons for Irish housing policy. Expanding government spending throughout the entire economy will only slightly boost the number of housing completions and may merely help to drive up prices via other income impacts. On the other hand, an expansion that focuses solely on completions will have a substantial deflationary impact on housing prices since the greater rise in completions will surpass any income effects. This emphasises the importance of directly targeting the construction industry if the primary objective is to remove pressure on house prices. A "top down" strategy, while serving to marginally increase the amount of housing completions, may not have the deflationary effect on home prices as anticipated. Therefore, in order to achieve social and economic goals like increasing the number of dwellings and making housing more affordable by containing house price inflation, a targeted policy, such as that described in the Irish Government's *Housing for All* plan, may be preferable to an economy-wide stimulus.

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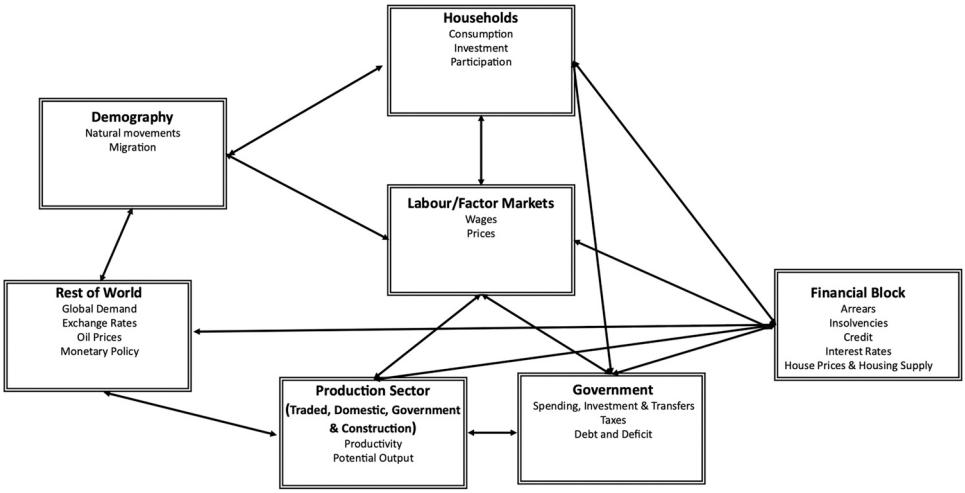
Appendix 1. Schematic of updated COSMO's key mechanisms

The key mechanisms within the model can be summarised as follows:

- There are four sectors in the model: traded, domestic, construction and government. There is an underlying production function for each sector that drives medium-term growth and a 'production gap' will feed back through prices to guide output towards capacity.
- Output in the traded sector is driven by world demand and cost competitiveness. The domestic and construction traded sector are driven by domestic demand. The public sector is policy-driven, and includes the treatment of borrowing and debt accumulation.
- The labour market is open and through migration is influenced by conditions in alternative labour markets.
- Wages are determined in a bargaining model, and influenced by the factors that affect the supply and demand for labour – e.g. prices, taxes.
- Households make consumption decisions based on current income and net holdings of wealth (financial and non-financial)
- Households and firms demand credit based on activity levels (including income), cost of credit and collateral values, while banks set interest rates as a variable mark-up over funding costs.



Appendix 2. Variable, description & source

The table below provides Information on all variables used in COSMO's construction sector equations outlined in this paper.

Variable	Description	Source
$ypr_{ct,t}$	Gross value added at basic prices, Mn €,	Eurostat, namq_10_a10
$ipr_{ct,t}$	Productive gross fixed capital formation, Mn €,	Eurostat, nama_10_a64_p5
s_t	New Dwelling Completions	CSO, NDQ01 and authors calculations
$ipd_{ct,t}$	Productive gross fixed capital formation, deflator	Eurostat, nama_10_a64_p5
$ipd_{ct,t}$	Productive gross fixed capital formation, Mn €,	Authors calculations
$\ln n_{ct,t}$	Employed persons, thousands	Eurostat, namq_10_a10_e
$h_{ct,t}$	Hours worked, thousands	Eurostat, namq_10_a10_e
$wn_{ct,t}$	Average wage, Thousands €	Eurostat, namq_10_a10_e
$lat_{ct,t}$	Labour augmenting technical progress	Authors calculations
$cpn_{ct,t}$	Domestic trading profits of companies, Mn €	CSO, N2001
win_{ct}	Remuneration of employees + income of traders, Mn €	Eurostat, namq_10_a10
$dep_{ct,t}$	Provision for depreciation, Mn €	CSO, N2002
$er_{ct,t}$	Fossil fuel consumption, 1000 Tons of Oil Equivalent	CSO, SEI06
$kr_{ct,t}$	Net productive capital stock, Mn €,	CSO, CSA02
$rpr_{ct,t}$	User cost of capital	Authors calculations
$ypotr_{ct,t}$	Potential output, basic prices, Mn €,	Authors calculations
$bcost_{ct,t}$	Building Cost Index	Dept. of H,LG & H & CSO
yer_t	Gross domestic product at market prices, Mn €,	CSO, NQQ48
yed_t	Gross domestic product at market prices, deflator	CSO, NQQ48
pcd_t	Personal consumption of goods and services, deflator	CSO, NQQ49
urx_t	Unemployment rate, %	CSO, MUM01
$dthx_t$	Personal tax rate (effective), decimal scale	CSO, N2009
poe_t	Oil price, average. Brent and Dubai spot prices, $ per barrel	ECB SDW
rex_{ust}	Exchange rate, $/€	ECB SDW
$lffx_t$	Females share of labour force, decimal scale	CSO, QLF01
lfn_t	Labour force, total, thousands	CSO, QLF01
$p15f_t$	Population, Female, 15 + , thousands	CSO, PEA1
mtd_t	Imports of goods and services, deflator	CSO, NQQ49
$nfcrat_t$	Lending rate to non-financial corporations	Central Bank of Ireland

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