STRATHCLYDE
DISCUSSION PAPERS IN ECONOMICS

THE ECONOMIC IMPACT OF PROJECTED AFFORDABLE HOUSING DEVELOPMENTS: DOES THE SUPPLY SIDE MATTER?

BY

STEPHEN BOYLE, KEVIN CONNOLLY, PETER G MCGREGOR AND MAIRI SPOWAGE

NO 20-13

DEPARTMENT OF ECONOMICS
UNIVERSITY OF STRATHCLYDE, GLASGOW

The Economic Impact of Projected Affordable Housing Developments: Does the Supply Side Matter? *

September 2020

By

Stephen Boyle

Kevin Connolly

Peter G. McGregor

and

Mairi Spowage

Fraser of Allander Institute

Department of Economics, University of Strathclyde

*This paper is based upon a report prepared for Shelter, funded by the Scottish Policy Foundation.

Abstract

A key current objective of Scottish policymakers is to increase the availability of affordable and social housing, with an expectation that this will have both societal and economic impacts. The purpose of this paper is to evaluate the potential economic impacts of meeting the projections of affordable housing needed in Scotland to combat homelessness. Typical economic impact assessments of social housing investment have focused exclusively on the effect of expenditures on demand, using input-output models (IO). However, recently some have argued that housing, like transport, should be treated as a type of infrastructure investment that is likely also to have potential supply side impacts – such as an increase in both labour supply and productivity. In this paper, we use both IO and Computable Generable Equilibrium (CGE) models to evaluate the economic impact of social housing investment, with a particular emphasis on the supply side impacts.

Keywords: Affordable housing, input-output, computable general equilibrium

JEL Codes: *D58, E16, R13, R22*

1. Introduction and background

Traditionally, the case for investment in social housing has been based around social and merit good arguments. Furthermore, assessments of the economic effects of such investments have typically been based on conventional impact analyses that focus exclusively on the effect of housing investment expenditures on demand. The best of these studies have been based on input-output (IO) models. (See e.g. National Housebuilding Federation, 2015.)

These impact analyses typically make a number of assumptions that limit their applicability. The most important of these is that the host region has an entirely passive supply side. This has two important implications. First, the impact of the expenditure changes translate directly into output and employment changes: induced price and wage changes, which would be expected in the presence of supply constraints, are precluded. This may have the effect of biasing upwards the likely impacts on the real economy.

Second, this assumption precludes the kind of beneficial supply side impacts that housing may be expected to generate. McLennan et al (2018a,b) argue persuasively that housing should be regarded as a type of infrastructure investment that is likely (in effect) to have potentially important beneficial supply side impacts, in a similar manner to transport investments. These may include, for example, labour productivity effects and savings in transport costs that impact labour supply. Neglecting such supply side impacts risks underestimating the economic impacts of housing.[1]

Conventional impact analyses also typically assume that housing expenditure impacts are effectively instantaneous, completed within the period that the expenditure occurs, whereas in general, there may be legacy effects because of, for example, the costs of adjusting capital stocks. Furthermore, these studies usually do not attribute impacts to different sources of funding, and could only do so in a restrictive manner.

In this paper we illustrate the application of a framework that allows us to relax the assumptions of conventional impact analyses in an illustrative study of the economic impact of meeting the projections of affordable housing need in Scotland provided by Dunning et al (2020).

Section 2 provides a conventional impact analysis of the expenditures associated with meeting the projected housing need. Section 3 shows how these impacts are modified if the presence of capacity and labour market constraints imply likely price and wage responses to the housing expenditures. Section 4 considers the effect of alternative sources of funding on the impact of the housing expenditure. Section 5 discusses possible supply side impacts of meeting affordable housing needs and Section 6 is a brief conclusion.

[1] However, as we show in Section 3, supply side responses may limit expenditure impacts through price and wage responses to demand changes.

2. Conventional impact analysis

While the demand and supply effects of housing occur simultaneously, it is instructive to consider them separately initially to: enable comparison of conventional impact analyses with our alternative approach; facilitate transparency and ease of interpretation of modelling results; reflect the fact that we generally have better information on the expenditure than the supply side impacts of housing. Furthermore, we are here dealing with impacts on demand that are predominantly transitory in nature, namely the capital spending on new social housing, while supply side impacts are likely to be permanent.

The conventional model allows us to isolate the demand effects of the temporary capital (and associated permanent maintenance) expenditures. We employ an augmented IO model, which is calibrated on the same underlying Social Accounting Matrix (SAM) database used by our computable general equilibrium (CGE) discussed below. This model assumes an entirely passive supply side, but treats income flows among households, firms and Governments more comprehensively than does IO, and so provides an improved analysis of changes in behaviour that are *induced* by expenditures on social housing.[2]

The scale of the demand-side stimulus

There are two elements of new expenditure associated with the planned increase in social housing. The estimated capital expenditure is derived in part from the report by Dunning et al (2020, Table 7.3, p70). They estimate that the overall requirement would be for 10,600 units per year in each of the five years 2021-22 to 2025-26. Of these, 66% would be 'RSL Social Rent' (i.e. the favoured scenario is as per the heading of the penultimate column of Table 7.3). That implies (approximately) 7,000 new social rent homes per year, which are the focus of our analysis. The estimated cost of construction is £150,000 per unit in 2020 prices[3] so that total capital expenditure is £1.05 billion per annum over the 5 years (7000*150,000). In 2021 prices the annual capital spend estimate is £1083.2 million.

The new capital spending will also generate continuing management and maintenance expenditure. We take as an estimate of this the £2.08k estimate reported by Scottish Government (2019) for Local Authority housing expenditure. In 2021 prices this is equivalent to £2.15k per unit of housing. Here we have 7,000 units per annum of new spending, so begins in year 2 with 7,000, and rises with the new stock of housing until it reaches 35,000.

Once we have the total of new spending, its allocation across sectors is required. This we obtain from an earlier FAI analysis of social housing construction costs. The pattern for both capital (CAPEX) and maintenance (OPEX) expenditure is given in Table 1.

[2] The model Is calibrated to a 2013 SAM for the Scottish economy.

[3] Data supplied by Shelter, but original source is the Scottish Government.

Table 1. Sectoral distribution of new capital and current expenditure on social housing.

Industry	CAPEX	OPEX
1. Agriculture, forestry and fishing		
2. Other primary		
3. Food and drink		
4. Textile, Leather, Wood, Paper, Printing		
5. Chemicals and Pharmaceutical		
6. Rubber, Cement, Glass, Metals		
7. Electrical Manufacturing		
8. Mechanical and Other Manufacturing (incl Repair)		
9. Electricity, transmission and distribution		1.54%
10. Gas; distribution of gaseous fuels through mains; steam and air conditioning supply		1.54%
11. Water, sewerage and Waste		1.54%
12. Construction – Buildings	90.67%	50.95%
13. Wholesale and Retail Trade, Transportation and Storage, accommodation, food and services	1.34%	2.90%
14. Information and Communication	0.84%	1.36%
15. Financial services, insurance and services		
16. Real Estate, professional act., R&D	7.15%	26.32%
17. Pub. Admin, Education and Health		13.85%
18. Other services		
Total	**100.00%**	**100.00%**

Table 2 presents the results of the SAM model's estimates of the aggregate economic impact of both the new capital spending on social housing and the management and maintenance expenditures that are likely to accompany it.

The table separately identifies the direct, indirect and induced effects of the new expenditure on social housing. The direct effects reflect simply the immediate effects of the new spend on output, value-added and employment, reflecting the pattern of spending associated with the new capital and maintenance expenditures. The indirect effects capture the knock-on effects of these expenditures through firms' intermediate purchases (reflecting the links in the base year IO table). The Type 1 entries in the table are the sum of the direct and indirect effects (which are the basis of the corresponding multiplier calculations). The induced effects reflect the fact that as demand expands, so too does labour income and households' consumption expenditure, which further stimulates economic activity. The Type 2 entries represent the sum of the direct, indirect and induced effects. (These reflect all the income-consumption links in the base year SAM.)

Table 2. The economic impact of the total capital and current expenditures on new social housing: IO / SAM model estimates

Year	1	2	3	4	5	6	7
Direct							
CAPEX							
Output (£m)	1,083.2	1,083.2	1,083.2	1,083.2	1,083.2	0.0	0.0
GVA (£m)	470.2	470.2	470.2	470.2	470.2	0.0	0.0
Employment (FTE)	7,433	7,433	7,433	7,433	7,433	0	0
OPEX							
Output (£m)	0.0	15.0	30.0	45.1	60.1	75.1	75.1
GVA (£m)	0.0	7.6	15.3	22.9	30.5	38.2	38.2
Employment (FTE)	0	130	260	390	520	651	651
Total							
Output (£m)	1,083.2	1,098.2	1,113.2	1,128.2	1,143.3	75.1	75.1
GVA (£m)	470.2	477.8	485.4	493.1	500.7	38.2	38.2
Employment (FTE)	7,433	7,563	7,693	7,823	7,953	651	651
Direct plus indirect							
CAPEX							
Output (£m)	1,685.5	1,685.5	1,685.5	1,685.5	1,685.5	0.0	0.0
GVA (£m)	725.8	725.8	725.8	725.8	725.8	0.0	0.0
Employment (FTE)	11,504	11,504	11,504	11,504	11,504	0	0
OPEX							
Output (£m)	0.0	33.8	67.5	101.3	135.1	168.9	168.9
GVA (£m)	0.0	17.3	34.6	52.0	69.3	86.6	86.6
Employment (FTE)	0	284	568	853	1,137	1,421	1,421
Total							
Output (£m)	1,685.5	1,719.3	1,753.1	1,786.9	1,820.6	168.9	168.9
GVA (£m)	725.8	743.1	760.4	777.7	795.0	86.6	86.6
Employment (FTE)	11,504	11,788	12,072	12,356	12,641	1,421	1,421
Direct plus indirect plus induced							
CAPEX							
Output (£m)	4,465.6	4,465.6	4,465.6	4,465.6	4,465.6	0.0	0.0
GVA (£m)	1,938.5	1,938.5	1,938.5	1,938.5	1,938.5	0.0	0.0
Employment (FTE)	30,624	30,624	30,624	30,624	30,624	0	0
OPEX							
Output (£m)	0.0	61.5	123.1	184.6	246.1	307.6	307.6
GVA (£m)	0.0	31.4	62.9	94.3	125.7	157.2	157.2
Employment (FTE)	0	537	1,074	1,612	2,149	2,686	2,686
Total							
Output (£m)	4,465.6	4,527.1	4,588.7	4,650.2	4,711.7	307.6	307.6
GVA (£m)	1,938.5	1,969.9	2,001.4	2,032.8	2,064.2	157.2	157.2
Employment (FTE)	30,624	31,161	31,698	32,236	32,773	2,686	2,686

The final nine rows of Table 2 summarise the economic impact of the new capital and current expenditure on social housing, including all direct, indirect and induced effects. There are a number of points worth noting about the results.

Note that the increase in capital expenditure (CAPEX) is constant, at £1,083.2 million (in 2020 prices) over the first five years of the project. The impacts of these expenditures are substantial, implying Type 2 multipliers of 4.12 for gross output, gross value added (GVA) and employment. The impact on total value-added (GDP) is also constant at £725.8 million per annum over 5 years. Gross output increases by £4,465.6 million and employment by 11,504 full time equivalents (FTE), across each of the five years duration. After the 5 years the new expenditures cease and there is no further change in CAPEX. This reflects the fact that the stimulus to capital spending on social housing is transitory and that, within the IO/SAM model, all of the effects of spending occur within the year in which they occur.

The operating expenditures (OPEX) are incurred over the entire lifetime of the new social housing, namely 40 years. While OPEX endure they do not begin until year 2 once construction activity in year 1 is complete and are of a much smaller magnitude than capital expenditures (although the Type 2 multipliers are of the same order of magnitude as for capital expenditure). OPEX builds up over the remaining four years of capital spend in line with the size of the new housing stock, reaching a maximum in year 6, when the increment to the housing stock is complete, after which expenditures are maintained at a constant £75.1 million per annum.

The total impacts (last three rows of Table 2) are simply the sum of capital and operating expenditures and so reflect both patters of effects identified above. The maximum impacts occur in year 5 since capital expenditure is still ongoing and operating expenditure has increased, with output, GVA and employment increasing by £4.7 billion, £2.1 billion and 32.8 thousand respectively. Operating expenditures continue for the remaining life of the new social housing stock, generating £307.6 million output, £157.2 million GVA and 2,686 employees per annum.

The overall scale of the Type 2 multipliers reflects a very substantial contribution from the induced effects captured within the SAM. For example, Type 1 output multipliers are typically around 1.56 for capital expenditure and 2.2 for (the more sectorally distributed) operating expenditures. Accounting for induced effects more than doubles the estimated impact of capital spending.

Cumulative impacts

The first three rows of Table 3 summarise the cumulative impacts of the new CAPEX on social housing on GVA and employment. The total GDP impact of CAPEX, £9,692 million, is the sum of total GVA effects (reported in the penultimate row of Table 2) over the five years of capital spending. The total employment figure for CAPEX reflects the sum of FTE employment over the period, which is 153,120 FTE employment years. Probably a more meaningful indicator of employment impacts is the level of employment averaged over the five years, reported in the third row of Table 3.

The aggregate estimates for OPEX are calculated in an analogous manner, but over the full lifetime of the project. Notice that, although the OPEX expenditures in each year are small relative to the capital spend, their duration implies that they contribute a more important share of the cumulative total impact of the project (but, of course, they are not part of the new capital spend budget).

Table 3. The cumulative impacts of the new spending on social housing on GDP and employment

Capex	**IO/SAM direct**	**IO/SAM indirect**	**IO SAM induced**	***IO/SAM Total***
GDP (£m)	*2,351*	*1,278*	*6,064*	*9,692*
Employment (FTE)	*37,163*	*20,356*	*95,601*	*153,120*
Employment (FTE per year av)	*7,433*	*4,071*	*19,120*	*30,624*
OPEX				
GDP (£m)	*1,604*	*2,033*	*2,964*	*6,601*
Employment (FTE)	*27,326*	*32,355*	*53,136*	*112,817*
Employment (FTE per year av)	*683*	*809*	*1,328*	*2,820*
Total				
GDP (£m)	*3,955*	*3,311*	*9,027*	*16,293*
Employment (FTE)	*64,489*	*52,711*	*148,737*	*265,937*

The simple summation of GDP impacts over time neglects the fact that the timing of GDP impacts matters in general. Given positive interest rates £1 received now is worth considerably more than £1 received 40 years from now. To account for this, Table 4 reports the present value (PV) of real GDP impacts

Table 4. The present values of the cumulative impacts of the new spending on social housing on GDP (and employment)

Capex	**IO/SAM direct**	**IO/SAM indirect**	**IO SAM induced**	***IO/SAM Total***
GDP (£m)	*2,197*	*1,194*	*5,667*	*9,059*
Employment (FTE)	*37,163*	*20,356*	*95,601*	*153,120*
Employment (FTE per year av)	*7,433*	*4,071*	*19,120*	*30,624*
OPEX				
GDP (£m)	*780*	*988*	*1,441*	*3,208*
Employment (FTE)	*27,326*	*32,355*	*53,136*	*112,817*
Employment (FTE per year av)	*683*	*809*	*1,328*	*2,820*
Total				
GDP (£m)	*2,977*	*2,183*	*7,108*	*12,267*
Employment (FTE)	*64,489*	*52,711*	*148,737*	*265,937*

Note: We assume a 3.5% discount rate throughout.

Of course, all the GDP estimates in Table 4 are lower than those in Table 3, because all GDP changes after year one are now subject to a discounting process, the importance of which increases the further into the future such impacts arise. This is most evident from a comparison of the impact of the discounting process on CAPEX and OPEX. In the former case the impact is fairly modest (around 7%), whereas in the latter case PV is less than 50% of the simple sum of OPEX impacts on GDP. This, of course, reflects the fact that OPEX is distributed over 40 years, whereas CAPEX impacts apply only to the first five years and so are much less sensitive to the discounting process.

The PV of the cumulative GDP effects is £12,267 million (compared to the simple cumulative sum of £16,293 million).

So far, the reported results focus on the total impact of the spending on new social housing, whether funded by grant or privately. This, and issues relating to the financing of the grant element are revisited below.

3. The demand-side impacts of social housing expenditures in the presence of capital and labour scarcity

Recall that the IO/ SAM estimates of expenditure effects of new social housing investment typically assume the presence of both spare capacity and unemployment; neither capital nor labour are supply constrained.[4] In this section we explore the consequence of such scarcity for the overall impacts of new expenditure on social housing. This requires the use of a Computable General Equilibrium (GCE) model which we briefly outline in the next section. We then explore the effects of capital and labour scarcity and, finally, compare these and our SAM results.

An overview of the CGE model

The CGE model is an eighteen-sector version of the AMOS modelling framework, calibrated on the same 2013 SAM used for the conventional impact analysis[5]. In addition to the 18 sectors/commodities, within the model there are three internal institutions - households, firms and governments - and two external, the rest of the UK (RUK) and the rest of the world (ROW). Scotland is considered a small, open economy so that external RUK and ROW prices are taken to be exogenous. Commodity markets are assumed to be competitive. Financial flows are not explicitly modelled, and the interest rate is assumed to be exogenously determined at UK level.

The model allows for a degree of flexibility in the choice of model closures and parameters, the version used in this paper assumes myopic expectations. Fundamentally, the model assumes that producers minimise cost using a nested multilevel production function. The combination of intermediate inputs with RUK and ROW inputs is based on the Armington function (Armington, 1969). Output is produced from a combination of composite

[4] The supply of labour can also be assured, in the long-run, by the presence of interregional migration.
[5] Full model listing can be found in Figus et al (2018).

intermediates and value added, where labour and capital combine in a constant elasticity of substitution (CES) function to produce value added, allowing for substitution between these factors in response to relative price changes.

There are four components of final demand in the model: household consumption, investment, government expenditure and exports. Household consumption is a linear function of real disposable income. Government expenditure is constant in the model, while exports are determined again based on an Armington function and so are dependent on relative prices.

All simulations are run in a multi-period setting, with the periods interpreted as years as both the SAM and behavioural relationships are benchmarked using annual data. The model is initially assumed to be in steady-state equilibrium, implying that with no exogenous disturbance, the model simply replicates initial values over all subsequent time periods.

The supply side of the economy determines the use of capital and labour in the model. Capital, in the first period, is fixed but in subsequent periods each sectors sector's capital stock is updated through investment, which responds partially to the gap between the desired and actual (adjusted for depreciation) levels of capital stock – in line with the neoclassical investment formulation (Jorgenson, 1963).

There are three wage closures available within the model – fixed nominal wage, fixed real wage and wage bargaining. In the wage bargaining closure the wage rate is inversely related to the unemployment rate:

$$\ln\left[\frac{w^s}{cpi^s}\right] = c - 0.113\ln[u^s] \qquad (1)$$

From Equation 1 c is a calibration parameter with w^s the net of tax nominal wage, u^s the unemployment rate and cpi^s the consumer price index. The real wage is indirectly related to the log of unemployment with an elasticity of -0.113 – from Layard (1991).

As the focus of the paper is impacts of constructing and operating affordable housing along with associated supply impacts, the housing market is not explicitly modelled within the CGE. Rather the costs of construction/operation are introduced as demand shocks to the relevant sectors and the supply impacts are modelled as productivity changes.

The impact of capital scarcity

We begin by assuming that labour is freely available at the prevailing real wage, so that capital is the only source of scarcity. Applying the same set of expenditure shocks to the CGE model generates the results summarised in Table 5.

Table 5 The economic impact of the total capital and current expenditures on new social housing: CGE model estimates with passive labour supply (percentage change from base; £million for GDP; FTE for employment)

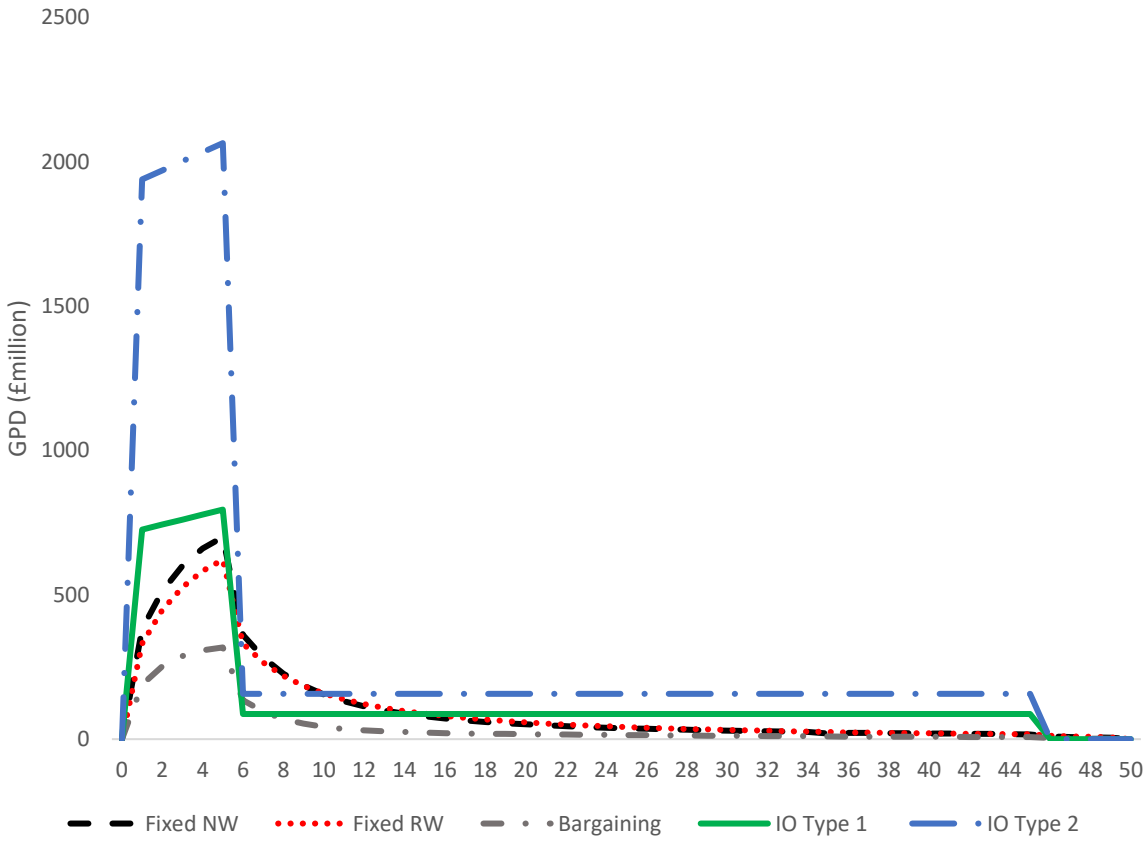
Fixed real wage	SR	Year 5 (end of CAPEX)	Year 45 (end of OPEX)	LR
GDP	0.25%	0.53%	0.06%	0.00%
GDP (£m)	*330.62*	*713.02*	*76.90*	*0.00*
Household Consumption	0.30%	0.38%	0.03%	0.00%
Investment	1.17%	0.88%	0.06%	0.00%
Total Exports	0.86%	1.20%	0.11%	0.00%
Export RUK	-0.62%	-0.39%	0.00%	0.00%
Export ROW	3.28%	3.80%	0.28%	0.00%
Total Imports	0.94%	0.77%	0.05%	0.00%
Nominal wage	0.17%	0.14%	0.00%	0.00%
Real Wage	0.00%	0.00%	0.00%	0.00%
CPI	0.17%	0.14%	0.00%	0.00%
Unemployment rate	-0.37%	-0.57%	-0.05%	0.00%
Employment	0.39%	0.60%	0.06%	0.00%
Employment (FTE)	*9,681*	*14,883*	*1,362*	*0*
Transfers to HH from Gov	0.17%	0.14%	0.00%	0.00%
Real Scottish Government Consumption	0.00%	0.00%	0.00%	0.00%

In this case, as before, the stimulus to new social housing expenditure increases demand, which in turn increases consumption and general investment expenditure and stimulates GDP, by 0.25% or £330.6 million, and employment, by 0.39% or 9,681 FTEs in the short-run (Year 1). However, given that sectoral capital stocks are fixed in the short-run (SR) rental rates/ profits are bid up as a consequence. While the real wage is by assumption unchanged the increase in rental rates pushes up prices as reflected in the increase in the CPI of 0.17%. This induces a loss of competitiveness, reflected in a decline in exports and an increase in imports, which partially crowds out the initial stimulus. This accounts for the much smaller year 1 impact in this case as compared to the IO results reported in the final rows of the first column of Table 2.

From the second period onwards the impact on GDP gradually increases as capital stocks rise in response to the increase in investment stimulated by the increase in rental rates. However, the investment process is extended with capital stocks adjusting only partially each year to gaps between their actual and desired levels. As the supply side restrictions relax a little the real effects on GDP, consumption and employment increase, while the pressure on prices relaxes somewhat. However, the capital expenditure on social housing ceases in year 5, long before the full adjustment in other capital stocks can be completed. In fact, capital stock adjustments continue beyond the end of operating expenditures given the gradual adjustment process, so that there are "legacy effects" for a number of years, and also beyond the end of operational expenditures in year 45. However, ultimately, the impact of even the operational expenditures falls to zero; hence the long-run, zero-impact results reported in Table 4 (and in Figure 1).

As in the IO case, peak effects occur in year 5, with GDP increasing by 0.53% (£713.02 million) but unlike in the IO case, these impacts do not fall off dramatically in year 6 – there is a more gradual adjustment despite the ending of the capital spending. Again, there are legacy effects associated with the new social housing capital expenditure that extend beyond the completion of that spending. This is apparent from a comparison of the IO/ SAM results in Figure 1 (where IO Type 1 results report only the direct and indirect effects, whereas the IO Type 2 results allow for endogenous household incomes impact on consumption) with those of the fixed real wage (Fixed RW) CGE model simulation.

Figure 1. The impact of increased capital and operating expenditures on GDP for various IO/SAM and CGE models.



The most dramatic difference from the IO results, which is again apparent from Figure 1, is the fact that the scale of the impacts is very substantially below that implied by the IO/ SAM results. The IO/ SAM Type 2 results suggest a maximum GDP impact in period 5 of £2.06 billion, whereas according to the CGE results it is £713 million. Relaxation of the assumption of excess capacity has a major impact on estimated results.

The cumulative sum of the GDP impact in this case is £5.18 billion and its present value is £4.20 billion compared to £9.69 and £9.06 billion for the SAM/IO case. The greater impact of discounting on the estimated present value of GDP in the CGE case again reflects the time distribution of the impacts, as is apparent from Figure 1.

The impact of capital and labour scarcity

In general, we might expect increased demand to enhance workers' bargaining power, stimulate employment, reduce unemployment and thereby generate a rise in real wages. There is considerable evidence, over the longer term, that real wages are inversely related to the unemployment via a wage curve that reflects the impact of bargaining power on real wages. Of course, if this relationship holds it reinforces the tendency for prices to rise due to capital fixity: labour as well as capital are scarce in this case and so the adverse impact on competitiveness is greater.[6]

Not surprisingly, the scale of estimated impacts declines further if we allow wages to respond to the fall in unemployment implied by the results in Table 5. While we have noted that there are doubts about the applicability of this "bargaining" case in present circumstances, it is useful to consider its implications. If the wage curve relationship is restored then we would expect the enhanced bargaining power of workers to lead to pressure for higher wages. The results in Table 6 confirm this.

Table 6. The economic impact of the total capital and current expenditures on new social housing: CGE model estimates with labour and capital scarcity (percentage change from base; £million for GDP; FTE for employment)

Bargaining wage	SR	Year 5 (end of CAPEX)	Year 45 (end of OPEX)	LR
GDP	0.14%	0.27%	0.02%	0.00%
GDP (£m)	*189.23*	*364.47*	*31.40*	*0.00*
Household Consumption	0.36%	0.41%	0.03%	0.00%
Investment	0.84%	0.45%	0.03%	0.00%
Total Exports	0.69%	0.82%	0.06%	0.00%
Export RUK	-0.78%	-0.75%	-0.05%	0.00%
Export ROW	3.10%	3.40%	0.23%	0.00%
Total Imports	0.96%	0.81%	0.05%	0.00%
Nominal wage	0.62%	0.77%	0.05%	0.00%
Real Wage	0.36%	0.46%	0.03%	0.00%
CPI	0.26%	0.31%	0.02%	0.00%
Unemployment rate	-0.19%	-0.24%	-0.02%	0.00%
Employment	0.20%	0.25%	0.02%	0.00%
Employment (FTE)	*4,912*	*6,216*	*441*	*0*
Transfers to HH from Gov	0.26%	0.31%	0.02%	0.00%
Real Scottish Government Consumption	0.00%	0.00%	0.00%	0.00%

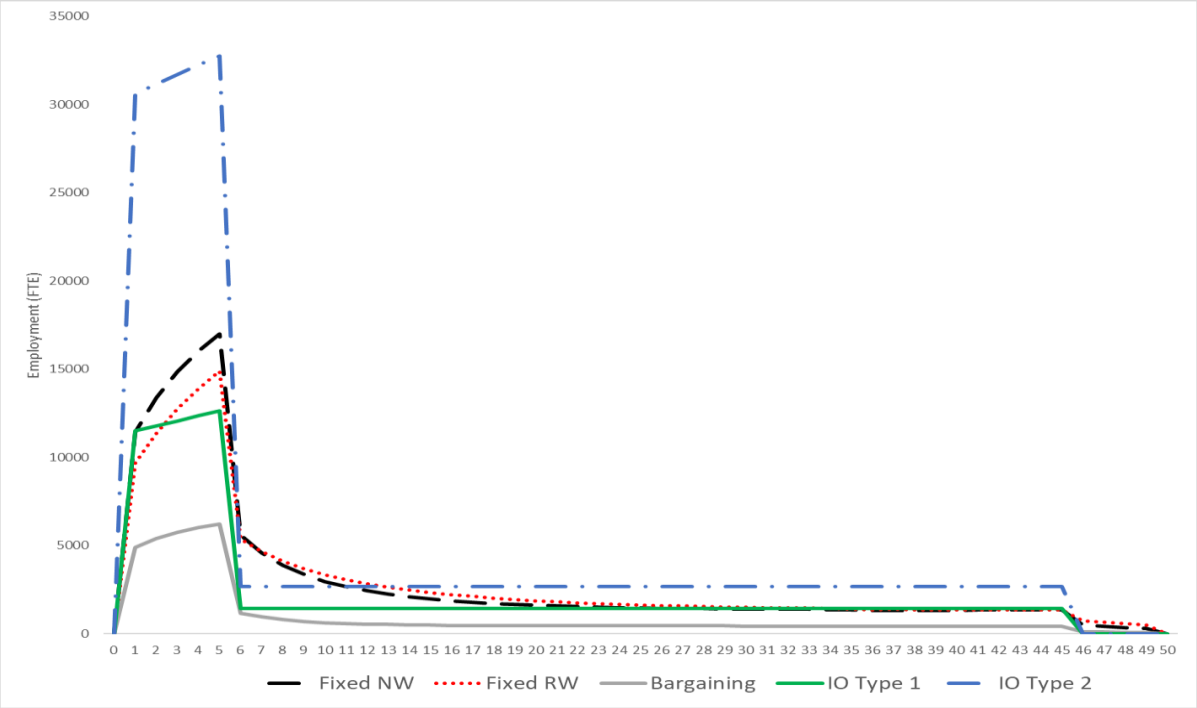
The qualitative effects reported in Table 6 are very similar to those already described for the results reported in Table 5. However, here even in the short-run the real wage is pushed up (by 0.36%) and the CPI increases by substantially more than previously (0.26% as compared

[6] If we were to consider income-tax-funded grant financing that would introduce a further potentially negative effect, namely wage bargainers' responses to the rise in income tax rates.

to 0.17%). This induces a greater loss of competitiveness, reflected in a greater decline in exports and larger increase in imports (despite a smaller increase in GDP). The degree of crowding out of the initial stimulus increases in the short-run as a consequence of the impact of labour market tightening on the real wage.

Again, subsequently the impact on GDP gradually increases as capital stocks rise in response to the increase in investment and consumption and employment continue increase, but the impacts are moderated by gradually increasing pressure on the real wage. Again capital stocks continue to adjust beyond the end of period 5 as do the impacts of capital expenditure on the on GDP (Figure 1) and employment (Figure 2) for this Bargaining case.

Figure 2. The impact of increased capital and operating expenditures on employment for various IO/SAM and CGE models.



As in the previous CGE case, the economic impacts fall off more gradually from year 6 than is the case with IO; there is a more gradual adjustment process despite the ending of the capital spending. Legacy effects of the new social housing capital expenditure extend beyond the cessation of spending. We find for the fixed real wage case legacy employment of 2,448 FTEs, and 373 FTEs in the bargaining case, that are generated in years 46-50 after all expenditures cease.

The scale of the impacts of the expenditure stimulus is substantially below that implied by the IO/ SAM results. Recall that the SAM results suggest a maximum GDP impact in period 5 of £2.06 billion, whereas according to the CGE results it is £713 million if real wages are fixed

and only £364 million (implying a value-added multiplier of less than unity) if real wages respond to labour market tightening.[7]

The results so far assume that real government expenditure is unchanged by the increase in spending on social housing, despite the fact that it generates an increase in tax revenue – including the revenues of taxes that are now devolved to the Scottish Government. Allowing for the recycling of these taxes permits the Scottish Government to increase its real expenditure, by 0.25% in the fixed real wage case and by 0.35% under wage bargaining when activity is at a peak (year 5). This creates a further (more labour intensive) demand stimulus, so that GDP and employment impacts are enhanced, with GDP rising by 0.27% (0.16%) in the short run and 0.58% (0.30%) in the peak year for the fixed real wage (bargaining) case.

The present values of the GDP impacts are, of course, also increased to £5.79 billion in the fixed real wage case and £2.45 billion under bargaining.

Overall comparison of cumulative demand side impacts across different models

Table 7 summarises the present value of GDP impacts of the new expenditure on social housing over the lifetime of the project for a number of models. As we have already noted caution should be exercised in interpreting the employment results: these are simply the sum of (undiscounted) FTE employment years over the lifetime of the project. However, for capital and operational expenditures separately we also report the more meaningful average employment impact over five years and the lifetime of the project. The purpose is to provide a brief overview of economic impacts of the demand stimulus (based on a 40-year lifetime of new housing).

Table 7. Comparison of total economic impacts across different models (Present value of GDP; employment in FTE years or averaged over 5 years (CAPEX) or life of project (OPEX)[8]

Capex	**IO/SAM direct**	**IO/SAM indirect**	**IO SAM induced**	***IO/SAM Total***	***Fixed nominal***	***Fixed real wage***	***Bargaining***
GDP (£m)	*2,197*	*1,194*	*5,667*	*9,059*	3,769	3,531	1,551
Employment (FTE)	*37,163*	*20,356*	*95,601*	*153,120*	*97,792*	*97,488*	*31,706*
OPEX							
GDP (£m)	*780*	*988*	*1,441*	*3,208*	1,835	1,820	715
Employment (FTE)	*27,326*	*32,355*	*53,136*	*112,817*	51,896	49,680	17,277
Total							
GDP (£m)	*2,977*	*2,183*	*7,108*	*12,267*	*5,604*	*5,351*	*2,266*

[7] Note that in the bargaining case the rise in real wages and fall in the unemployment rate could induce in-migration, which would tend to relax the labour supply constraint and so push the macroeconomic results more towards those reported for the fixed real wage case.

[8] The impacts attributed to OPEX in the CGE simulations are obtained by subtracting the CAPEX from the Total impacts. (The non-linearity of the CGE model implies that the impact of OPEX and CAPEX considered separately do not exactly add to the estimated impact of the total new capital expenditure on social housing.)

Employment (FTE)	*64,489*	*52,711*	*148,737*	*265,937*	*149,688*	*147,168*	*48,983*
Capex Employment (FTE per year 5 average)	*7,433*	*4,071*	*19,120*	*30,624*	*14,536*	*12,515*	*5,657*
Capex Employment (FTE per year 50 average)	-	-	-	-	1,956	1,950	634
Opex Employment (FTE per year average)	*683*	*809*	*1,328*	*2,820*	1,153	1,104	384

Table 7 summarises the cumulative effects on the present value of GDP and on FTE employment years (and average employment) across the four models we have already discussed plus an additional one which assumes a Fixed Nominal Wage. This is another variant of the labour market representation within the CGE model. It basically assumes that wage bargaining is conducted at the national level in the UK, and Scotland acts as a nominal wage taker. In the face of the demand expansion considered here the fixed nominal wage implies that the real wage actually falls slightly as the cpi rises, and this moderates the adverse competitiveness effects – albeit to a modest degree in this case.

Note that the last three columns relate to the CGE simulations, which incorporate all indirect and induced effects, but do not separately identify them. Accordingly, these results should be compared to the IO/ SAM Total in the fourth column. The main message of Table 7 is that the estimated cumulative economic impacts of the expenditure on social housing depends importantly on what is assumed about the supply side. Across all models there is a significant increase in (the PV of) GDP, but the estimated effects are substantially greater under the IO/ SAM assumptions of a totally passive supply side. Furthermore, the tighter the supply side restrictions the smaller the impact of the demand stimulus on the real economy. In the IO/SAM model the PV of GDP is estimated to be £12.3 billion, which is 2.3 times the estimate from the fixed nominal wage model and 5.6 times that of the bargaining model. The differences in cumulative FTE employment years is not as dramatic, but the IO/SAM results are 5.4 and 1.8 times the estimates of the corresponding CGE models. The average employment impact over the 5 years of capital spending is 265.9 thousand according to the IO/SAM model, an estimate which is 1.6 times the estimate of the fixed nominal wage model and 4.9 times that of the bargaining model. For operating expenditures the IO/SAM estimate of the associated average annual employment impact is 2820 FTEs, which is 2.4 times the corresponding estimate for the fixed nominal wage case, but over 7 times the bargaining case.

If the expenditures were to occur in a coronavirus-hit economy (once lockdown restrictions relax), the entirely passive supply side might seem a reasonable starting assumption since there is considerable excess capacity and unemployment. However, we would expect that as the economy gradually recovers, capacity and labour market constraints may become more important. Determining the “appropriate” assumptions about the supply side in present circumstances is clearly a matter of judgement.

It may well be the case that the assumptions about wage responses could vary through time with excess capacity in the initial years, which gradually diminishes with a return to a situation in which supply constraints begin to bite. However, such a process would be difficult to capture within the CGE (at least for transitory expenditure changes), and so the outcomes would likely reflect some weighted average of the cases explored above. The very uncertainty surrounding the appropriate treatment of labour availability and existing capacity motivates the adoption of a range of possibilities here. However, prevailing circumstances provide a more compelling motivation for favouring results towards the IO/SAM end of the spectrum.

Of course, as we have already noted the scale of the macroeconomic impacts are further increased if the endogeneity of government revenues and their recycling to current government expenditure is accommodated.

4. Attributing impacts between grant-funded and non-grant-funded expenditures

Extracting grant-funded expenditure

Recall that the most common, but typically implicit, assumption in impact studies is that new expenditure is funded through some increase in the intergovernmental transfer of funds to the Scottish Government through the Barnett mechanism. Here there is (as a first approximation) no cost to the Scottish people or Government. In this instance we can easily assess the impact of grant-funding by hypothetically extracting it from the estimated total impact. The extraction is hypothetical because the private funding can only be encouraged as a consequence of the grant funding.[9] Operational expenditures are unaffected, since these are tied to the total increase in the stock of social housing.

Grant funding varies between housing associations and local authorities (Dunning et al 2020, Table 7.3, p70). We assume that the 7,000 units are split between 68:32 between housing associations (Has) and local authorities (Las), reflecting the distribution between the two in recent years. Applying this split to the five markets in Dunning (2020, Table 7.3) gives annual totals of 4,800 HA units and 2,200 LA units. The grants for Has are as set out in the third column of Table 7.3, headed 'RSL Social Rent – Greener Benchmark'. For example, the grant in Market 1 is £72,000 per unit while in Market 3 it is £74,000 per unit. The grants for Las are a uniform £59,000 per unit (advice from Shelter). This allows us to estimate the grant-funded element of the new capital spending on social housing as £489.9 million, so that non-grant-funded expenditure is £593.3 million (giving a total of £1083.2 million) per annum. The results of applying this stimulus to expenditure are reported in Table 8.

[9] This is a very straightforward example in which we only hypothetically extract an element of final demand. In the wider IO/SAM literature the term typically refers to whole or partial extraction of a particular sector or sectors.

Table 8. The cumulative economic impacts of non-grant-funded expenditure on social housing (PV for GDP; total employment years; average total employment years)

	IO/SAM direct	IO/SAM indirect	IO SAM induced	*IO/SAM Total*	*Fixed nominal*	*Fixed real wage*	*Bargaining*
GDP (£m)	*1,983*	*1,643*	*4,545*	*8,170*	*3,722*	*3,542*	*1,527*
Employment (FTE)	*47,681*	*43,505*	*105,500*	*196,686*	*106,965*	*104,668*	*35,188*
Capex Employment (FTE per year 5 average)	*4,071*	*2,230*	*10,473*	*16,774*	*8,233*	*7,078*	*3,218*
Capex Employment (FTE per year 50 average	-	-	-	-	1,111	1,108	362
Opex Employment (FTE per year average)	*683*	*809*	*1,328*	*2,820*	1,142	1,094	379

While the capital expenditure stimulus in this case is only 55% of the total expenditure on new social housing, the impacts as a share of total cumulative impacts are substantially in excess of this. So the privately funded expenditure generates 67% of the discounted GDP impact in the IO/SAM model and a very similar share of the corresponding GDP impacts implied by the various CGE models. This reflects the fact that we assume that the OPEX expenditures are the same in both cases, and this limits the loss of GDP associated with the smaller, privately funded share of capital spending. In fact, the non-grant-funded share of the total FTE employment years impact is even greater – 74% in the IO/SAM model and over 71% in each of the CGE models. The greater employment shares reflect the fact that the employment intensity of OPEX is greater than that for CAPEX (which here falls relative to OPEX and to the shock analysed in Table 3)

The impact of funding the grants through reduced public expenditure

What if the grant component of new expenditure on social housing has to be directly funded by the Scottish Government? Given restrictions on borrowing the Government can either reduce other government expenditure or seek to raise revenue by increasing devolved tax rates. We consider it very unlikely that the Scottish Government would choose to alter tax rates – most obviously the income tax rate – to fund purely transitory expenditures, so we focus primarily on the case where the funding comes through a reduction in Government spending. Table 9 provides summary results for the cumulative impact of the new social housing, which is funded by an across the board reduction in current government expenditure (the composition of which is the same as that in our base year data).[10] That is to say that we impose a shock to the model that comprises a £1083.2 million per annum stimulus to new social housing (as is the case for Section 3) and a simultaneous reduction in current

[10] For simplicity we assume that current government expenditure has no immediate supply side impact. Of course, this is questionable for e.g. aspects of education expenditure, which represent an investment in human capital.

Government spending of £489.9 million (to fund the grant element of total spending on housing).

Table 9. The cumulative economic impacts of new expenditure on social housing, where the grant element is funded by a reduction in current Government spending (PV for GDP; total employment years; average total employment years)

	IO/SAM direct	**IO/SAM indirect**	**IO SAM induced**	***IO/SAM Total***	***Fixed nominal***	***Fixed real wage***	***Bargaining***
GDP (£m)	*1,575*	*1,768*	*3,018*	*6,362*	*3,277*	*3,113*	*1,573*
Employment (FTE)	*24,416*	*41,138*	*32,124*	*97,678*	*90,945*	*88,486*	*29,929*
Capex Employment (FTE per year average)	-582	1,757	-4,202	-3,028	*3,810*	*3,215*	*1,502*
Capex Employment (FTE per year 50 average	-	-	-	-	790	784	257
Opex Employment (FTE per year average)	*683*	*809*	*1,328*	*2,820*	1,144	1,096	379

It is useful to compare these results with those of Table 8, which simply extract the grant-funded expenditure. The IO/SAM model now suggests that the PV of GDP would be £6.4 billion, only 78% of the £8.2 billion implied by simple extraction. The difference reflects the fact that the GDP multiplier associated with general current government spending is greater than that associated with new capital spending on social housing; substituting the latter for the former reduces the overall GDP impact.

In fact, the cumulative employment impact, of 97,678 FTE employment years, is only 50% of the estimated impact using the simple extraction method, a reflection of the very labour intensive nature of public administration. Indeed, the difference in labour intensities is so great that substitution of the capital spending on social housing for current spending on government expenditure causes a fall in average employment of 3,028 FTEs per annum associated with the former.

The same qualitative cumulative impacts on the PV of GDP and on FTE years are observed for the two "fix-wage" CGE simulation results, but the scale of the difference is much reduced. The qualitative effects continue to reflect the different compositions of current government expenditure and new spending on social housing. But here the PV of GDP is estimated to be 88% of the impact under simple extraction and cumulative FTE employment years is 85% of its corresponding level. The price flexibility of these CGE models moderates the impact of negative demand shocks on the real economy (the reduction in government expenditure) as well as the impact of positive ones (the increase in expenditure on new social housing). Indeed, the bargaining model even registers a slight increase in GDP (of around 3%); net, the flexibility of prices and real wages in this case generates a positive impact.

It should be noted, however, that there are likely to be elements of total government spending (such as expenditure on roads) that are closer in character to investment in new social housing. The results of financing the housing grants through reductions in government spending does, in general, depend importantly upon the assumed composition of such spending.

The impact of funding the grants through a rise in income taxation

While we do not regard income-tax-financing of the temporary grant expenditures to be realistic, we illustrate the possibility through the bargaining CGE model, since this is the context in which workers bargain for a net of tax real wage.[11] The temporary rise in the income tax rate required to fund the grant element of the overall expenditure on new social housing stimulates an adverse supply shock through workers seeking to restore their real take home wage. This operates simultaneously with a transitory reduction in consumption demand in response to lower disposable incomes, although this is dominated by the (larger) increase in non-grant-funded expenditure. The overall impact depends on the strength of the adverse supply effect relative to the (net) demand stimulus. In general, the net outcome of these forces is an empirical issue, but given that here the tax rise has to cover less than half of the total expenditure stimulus, we would anticipate that the change would still have an overall expansionary impact on the economy.

Simulating the joint impact of the transitory capital and permanent operation expenditures on new social housing with an increase in the income tax rate sufficient to fund the grant element of capital spending does indeed reveal an overall expansionary impact with the PV of GDP rising by £1.5 billion, or 96% of the corresponding figure for the government expenditure funded grant case (Table 8). However, the cumulative employment effect is estimated to be 35 thousand FTE employment years, which is 17% higher than the estimate when grants are funded by reduced government expenditure. This method of funding avoids any contraction in the very labour intensive public sector, and so improves the employment outcome.

The main message of the current analysis is that the demand-side impact of housing is clearly sensitive to assumptions about how it is financed. Furthermore, where funding is through reductions in government spending the composition of that spending may be critical to the overall economic impact of the investment in new housing.

5. Model estimates of the likely supply-side impacts of new social housing.

The previous section explored the expenditure/ demand-side impacts of the investment in new social housing. While these demand-induced, supply side responses are adverse in that they act to moderate the effects of new expenditure of social housing on economic activity, there may also be positive supply side effects associated with such investment. We discuss

[11] See Emonts-Holley et al (2018).

these effects and their possible scale next. We then present the results of the supply side simulations.

Supply side impacts of new social housing

McLennan et al (2019) explore two major supply side mechanisms, both of which reflect the fact their focus is on housing investments that brought occupants closer to local labour markets. One emphasises the impact of housing investment on travel to work costs and effective labour supply. The second focusses on the effect of housing investment on labour productivity through better job matching. While it is clear that the planned new Scottish investment in social housing is going to be concentrated in urban areas it is not clear that the same kind of improved spatial "access" for both suppliers and demanders of labour will be a key feature. Furthermore, we do not have the data to facilitate Scottish-specific estimates of these effects. It is also worth noting that while the Australian study focusses essentially on the impact of households changing locations, here the emphasis is on providing housing for the homeless.

This emphasis on the homeless suggests alternative plausible routes through which the expenditures could stimulate the supply side of the economy - through increases in labour supply and labour productivity. While the same variables are impacted as in the Australian case, the transmission mechanisms are rather different and more directly related to Shelter's primary objectives.

The increase in labour supply

First, consider the possible impact on labour supply that would result from targeting the new social housing exclusively at the homeless.[12] The employment rate among homeless people is around 30% (Bramley et al, 2019), while among the general population it is around 75%. We know that moving from homelessness to being housed results in people being more likely to secure and to sustain employment (e.g. Bridge et al, 2003; Whelen and Ong, 2008). Thus, there is a plausible argument that building the houses and moving people into homes will lead to a rise in labour supply and in employment. There were 43,206 people in Scotland who were homeless (in 2018-19), of whom 14,043 were children. Assume the remaining 29,163 were of working age. Currently, around 8,750 of them are working. If we assume that when people are housed the employment rate among the previously-homeless increases from ~30% to 53% (i.e. halfway between 30% and 75%), this would add 6,708 to Scottish labour supply.

Table 10 summarises the calculation of the increase in labour supply in each year of the expenditure on new social housing. The first column summarises the position prior to the start of the new spending. The first row identifies the number of units available corresponding to the year indicated by the column heading. (This increases by 7,000 in each of the five years.) The second row identifies the number of adults impacted (on the assumption of one per

[12] Of course, this is a simplifying assumption, which in effect would mean the current stock of homeless people could be fully housed with the investment in social housing.

household). The third row identifies the number of these adults who would be employed if they retain the employment rate of the homeless (30%). The fourth row identifies the number of these adults who will be employed if the employment rate of previously homeless adults increases to 53%. The implied increase in employment – the difference between employment in the fourth and third rows – is reported in row five. Finally, this is added to total employment in the previous period to yield total current employment.

As noted above, the impact on labour supply builds up to 6,708 FTE equivalents by year 6 (a 0.257% increase) and remains at that level for the lifetime of the new increment to the social housing stock. The time pattern of the shock applied to the CGE model is the percentage increased in labour supply implied by the final row of 10.

Table 10. The impact of the new social housing on total labour supply.

Year	**1**	**2**	**3**	**4**	**5**	**6**
No of units operational	0	7,000	14,000	21,000	28,000	35,000
Adults	0	7,000	14,000	21,000	28,000	29,163
Current homeless in employment	0	2,100	4,200	6,300	8,400	8,749
New homeless Employment	0	3,710	7,420	11,130	14,840	15,456
Difference	0	1,610	3,220	4,830	6,440	6,708
Total current employment	2,606,651	2,608,261	2,609,871	2,611,481	2,613,091	2,613,359
Model Shock	**1.00000**	**1.00062**	**1.00124**	**1.00185**	**1.00247**	**1.00257**

Source for human capital estimates: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/humancapitalestimates/2004to2018/relateddata. Table 9.

The stimulus to labour productivity

A rather widespread literature (albeit much of it based on US evidence) provides reason to believe that homelessness in childhood leads to adverse labour market outcomes in adulthood and that the main transmission mechanisms are through education and health. Furthermore, Scottish data on human capital, summarised in Table 11 are wholly consistent with this view (although do not, of course, establish causality).

It is clear from Table 11 that human capital outcomes for the "cared for/ homeless" lie significantly below those of the population as a whole. Most strikingly, some 41% of the Scottish population have a degree or equivalent qualification, compared to just 4% among the "cared for/ homeless", and this is the group that has the highest human capital per head.

Table 11. Human capital per head: outcomes for the "cared for/ homeless" and for the population as a whole.

	Human capital per head (2018£)	Outcomes (cared/homeless)	Outcomes (full pop)
Degree or equivalent	£564,249	4%	41%
Further education	£452,506	45%	27%
A level, GCSE grades A - C or equivalent*	£446,632	27%	28%
Other qualifications	£398,204	10%	2%
No qualifications	£277,141	14%	2%

Source for outcomes: https://www.gov.scot/publications/education-outcomes-looked-children-2017-18/pages/4/

These data, together with base year employment estimates allow us to derive a number of measures of the stock of human capital. Column 1 of Table 12 calculates the human capital of the Scottish working population by category of qualification (using the information in columns 1 and 3 of Table 11 and the estimate of total employment (2,606,501 FTEs). The second column estimates what the human capital of the cared for/ homeless children would ultimately become if they were to retain the educational outcomes of the homeless (using the information in columns 1 and 2 of Table 12 and the total number of homeless children (14,043)). This figure for the "homeless" represents around 4.7% of total human capital in Scotland. The final column is what the human capital of the previously homeless children could ultimately become if, in the long-run, they take on the characteristics of the population as a whole. (Here we use the information in columns 1 and 2 in Table 11, together with the total number of homeless children.) This would imply an estimated increase in the human capital of the previously homeless of £936 million or 0.073% of the total human capital of Scottish employment. This is the estimate of the productivity gain from greater social housing that we employ in our simulations below.

Our simulation results should be regarded as illustrative for a number of reasons. First, we are assuming quite a radical change in behaviour given that the homeless are often associated with multiple deprivation characteristics. The previously homeless are being assumed to exhibit a 15.6% increase in productivity. However, the fact that the impact on labour productivity in Scotland as a whole is very small simply reflects the small numbers of homeless relative to total employment. Second, we focus only on the steady state impacts, which would apply only when all the children were old enough to enter the workforce with the assumed distribution of qualifications.

Table 12. The stock of human capital: outcomes for the "cared for/ homeless", for the population as a whole and for the previously homeless (now in new social housing).

	Human capital (base full pop £m)	Human capital (base homeless)	Human capital (Formerly homeless)
Degree or equivalent	603,028	317	3,249
Further education	318,472	2,860	1,716
A level, GCSE grades A - C or equivalent*	325,980	1,693	1,756
Other qualifications	20,760	559	112
No qualifications	14,448	545	78
Total	**1,282,688**	**5,974**	**6,910**
Difference in homeless capital	936		
New capital full population	1,283,624		
Labour shock	**1.000729957**		

The results of the supply-side simulations.

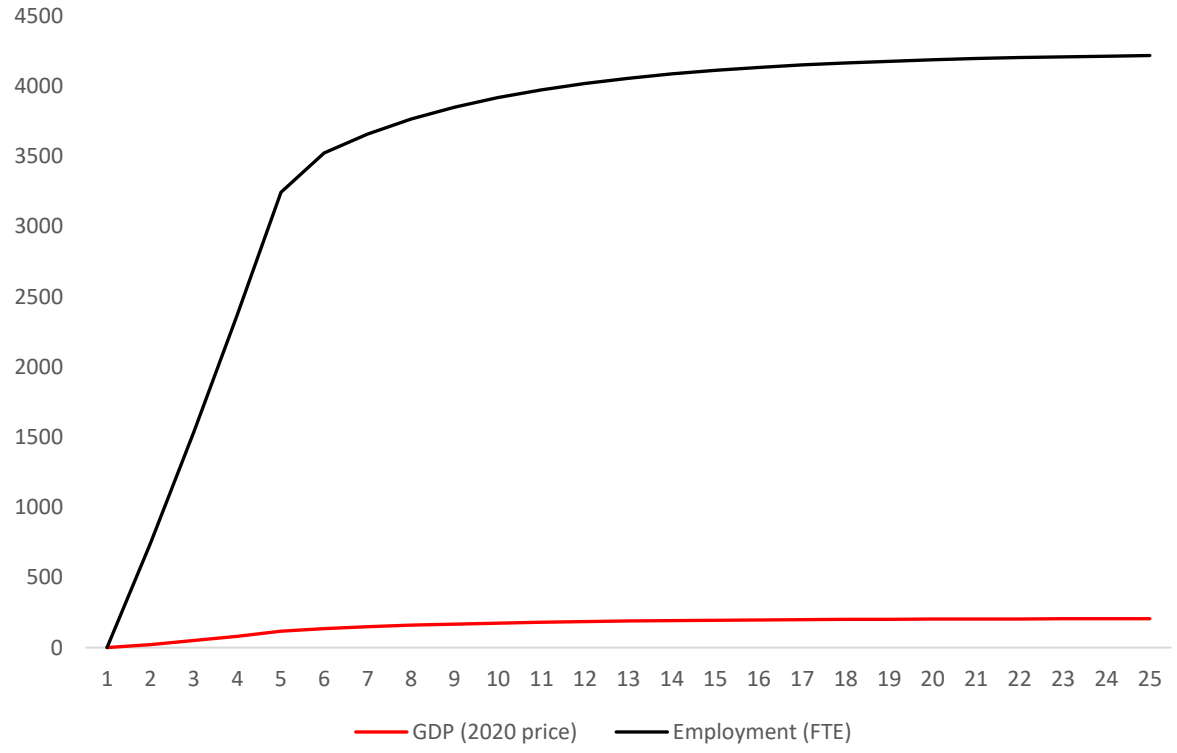
The first column of Table 13 summarises the long run results of implementing the labour force changes summarised in the final row of Table 10 to the CGE model, assuming that the real wage bargaining model captures the wage determination process. The eventual permanent 0.26% stimulus to the labour force essentially reduces labour's bargaining power at any given unemployment rate and so there is downward pressure on wages and prices. The nominal wage falls by 0.24% and the CPI by 0.09%, with the real wage falling by 0.15% (0.24%-0.09%). This improvement in competitiveness stimulates exports to the rest-of-the world (ROW) and the rest-of-the UK (RUK) by 0.22% and imports fall (by 0.01%). This ultimately raises GDP by 0.15% or £207.8 million and employment by 0.17% or 4,240 FTEs. These effects are "permanent" in that they last as long as the new social housing stock (here assumed to be 40 years). Note that, while employment increases, the unemployment rate actually rises. This reflects the fact that, while the real wage falls, it does not fall sufficiently to ensure that the whole of the increase in the labour force is absorbed by employment – that would require complete wage-inelasticity in labour supply (the exogenous labour supply case).

Table 13. The long-run effects of the labour supply and labour efficiency impacts of the new social housing.

Long run	Labour supply	Labour efficiency	Labour total
GDP	0.154%	0.069%	0.223%
GDP (£m)	207.9	92.6	300.7
Household Consumption	0.025%	0.011%	0.037%
Investment	0.146%	0.065%	0.212%
Total Exports	0.218%	0.097%	0.315%
Export RUK	0.219%	0.098%	0.317%
Export ROW	0.215%	0.096%	0.311%
Total Imports	-0.010%	-0.004%	-0.014%
Nominal wage	-0.240%	-0.034%	-0.274%
Real Wage	-0.149%	0.007%	-0.143%
CPI	-0.091%	-0.040%	-0.131%
Unemployment rate	0.080%	-0.003%	0.076%
Employment	0.172%	0.004%	0.176%
Employment (FTE)	4,240	90	4,332
Real Scottish Government Consumption	0.000%	0.000%	0.000%
Cumulative totals			
Present Value GDP (£m)	3,808.4	1,513.9	5,323.9
Employment (FTE employment years)	173,400	814	174,240

Of course, as is apparent from the final row of Table 10 the stimulus to labour supply builds up gradually and reaches a maximum during the fifth year of the programme and is then sustained. Naturally this pattern is reflected in the timing of the GDP and employment effects as is clear from Figure 3. Note, however, that the economic impacts of the increase in labour supply do not level off in year 6, when the shock reaches 0.26% (and is maintained at that level thereafter). At this point GDP is, at £135.3 million, some 65% of its long-run level of £207.9 million and employment is at 83% of its long-run level. It takes some time for the economy fully to respond to the labour supply stimulus. In particular, the stimulus leads to new investment and capital accumulation especially in those sectors impacted by improved competitiveness, and this adjustment process is protracted.

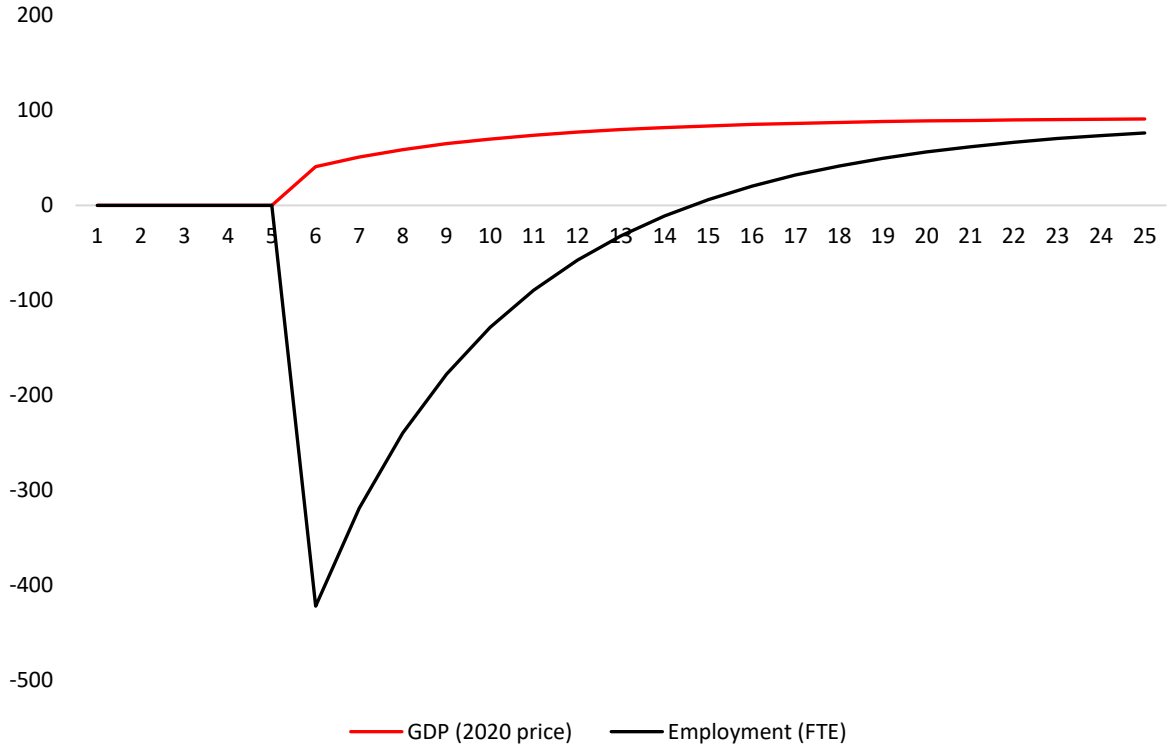
Figure 3. The impact of the stimulus to labour supply on GDP (£m) and employment (FTEs)



The ultimate impact of the productivity stimulus generated by providing housing for homeless children is summarised in the second column of Table 13. In effect the stimulus to labour productivity reduces the price of an efficiency unit of labour and so increases the demand for labour in efficiency units. This reduces production costs and prices, so that the CPI here falls by 0.04%, and the improvement in competitiveness boosts exports by 0.10% and reduces imports. GDP ultimately increases by 0.07% or £92.6 million, and employment by 0.004% or 90 FTEs.

Figure 4 shows the time path of the response to a permanent 0.07% increase in productivity, which starts once the new capital stock is in place. Of course, this is not an attempt to capture the timing of the impacts of the productivity stimulus accurately, but is presented here simply to emphasise the nature of the employment response. Initially, employment actually falls in response to the productivity stimulus, reflecting that fact that less labour is now required to produce the same output. However, over time the competitiveness effects tend to stimulate employment and, as we have seen, this eventually increases. This reflects the fact that the responsiveness of labour demand to the real wage increases through time as capacity constraints relax and output (and employment) are able to expand further. In practice the adjustment paths are likely to be significantly more complex and subject to a much more gradual build up reflecting the age distribution of the initially homeless children and the extent of their investment in human capital.

Figure 4. The impact of the stimulus to labour productivity on GDP (£m) and employment (FTEs)



The final column of Table 13 aggregates the long-run impacts of the labour supply and labour productivity stimuli. Of course, since the increase in labour supply has an impact on GDP and employment, for example, that is more than double that of productivity, the pattern of the aggregate results reflects that. For example, the unemployment rate increases. Overall, GDP increases by 0.22% (£300.7 million) and employment by 0.18% (4,332 FTEs).

Note that the final row of Table 13 reports the Present Value (PV) of GDP for each of the simulations and for their combined effect. The PV of GDP associated with the labour supply stimulus is over 2.5 times that generated by the productivity stimulus, on the assumption that the time path was the hypothetical one depicted in Figure 5.2. Since in practice many of the productivity effects would not arise until later, in some cases much later, than assumed in Figure 4, the gap between the PV of GDP in the two cases is in fact likely to be significantly greater still.

The supply side impacts allowing for the recycling of government revenues

The simulation results reported in Table 13 assume that real Scottish Government expenditure is kept constant. This allows us to assess the impact of the labour supply and labour efficiency shocks in isolation. However, in both cases the revenues of the Scottish Government are stimulated by the increases in GDP and incomes that result. Furthermore, since the implementation of the Smith Commission recommendations the Scottish

Government (eventually) benefits from increases in devolved taxes (most notably income tax) and can use these revenues to increase current government expenditure. Table 14 presents the results of including the impact of endogenous tax revenues and their use to stimulate current government expenditure. Here we assume, for simplicity, that current government expenditure has no immediate supply side impacts; it represents a pure demand-side stimulus.[13]

Table 14. The long-run effects of the labour supply and labour efficiency impacts of the new social housing, with devolved taxes recycled to increase government expenditure

Long run	Labour supply	Labour efficiency	Labour total
GDP	0.162%	0.074%	0.236%
GDP (£m)	218.9	99.5	318.7
Household Consumption	0.042%	0.022%	0.065%
Investment	0.149%	0.067%	0.215%
Total Exports	0.188%	0.078%	0.266%
Export RUK	0.189%	0.078%	0.268%
Export ROW	0.186%	0.077%	0.263%
Total Imports	0.014%	0.011%	0.025%
Nominal wage	-0.207%	-0.013%	-0.220%
Real Wage	-0.129%	0.020%	-0.109%
CPI	-0.079%	-0.032%	-0.111%
Unemployment rate	0.069%	-0.010%	0.058%
Employment	0.184%	0.011%	0.195%
Employment (FTE)	4,525	273	4,802
Transfers to HH from Gov	-0.079%	-0.032%	-0.111%
Real Scottish Government Consumption	0.111%	0.072%	0.183%
Cumulative Totals			
GDP (£m)	4,031.2	1,642.4	5,676.9
Employment (FTE employment years)	185,293	8,032	193,413

The main difference from the results reported in Table 13 is the increase in real Scottish Government consumption reported in the final row of Table 14, which generates a further increase in GDP and employment in each case. The supply side shocks are now augmented with a positive demand shock as government spending increases. So GDP now increases by

[13] Elements of government expenditure that are included in current spending in fact have some characteristics of investment expenditure, for example, spending on education and health. For simplicity here we abstract from any supply side impacts of current spending and assume that it is allocated in the same proportions as our base year data.

an additional £11 million in response to the labour supply stimulus and by a further £6.9 million in response to the rise in productivity due to the increase in Government spending that is now facilitated by greater devolved tax revenues. The corresponding increases in employment are 285 FTEs and 183 FTEs respectively for the labour supply and productivity shocks. However, the demand stimulus tends to moderate the competitiveness gain, as in isolation it would tend to put upward pressure on wages and prices. Accordingly, the increases in net exports are reduced in this case relative to the results reported in Table 5.4.

Comparison with demand-side impacts

The most appropriate comparator for the supply side impacts reported above, which are based upon the bargained real wage model, are the demand side effects associated with the same model. However, it is interesting to consider how the scale of the supply impacts considered above, with the bargaining CGE model, relates to the demand side impacts identified by all of the models considered.

Consider, first, the present value of GDP results reported in the last row of Table 13, which we compare with the demand-side results reported in the first row of Table 8. The PV of the GDP impact of the labour supply stimulus is £3.8 billion, or 46.6% of that associated with the IO/SAM model. However, this result is actually greater than the demand-side impacts as measured by the fix-wage CGE models - by 2.3% and 7.5% in the case of the fixed nominal and real wage cases respectively. Furthermore, the estimated labour supply impact on cumulative GDP is 2.4 times the impact on the demand side, estimated from the same bargaining model.

The productivity impacts are, of course, smaller with a PV of GDP of £1.5 billion, but this still amounts to: 18.5% of the IO/SAM estimate of the PV of GDP; 40.7% of the fixed nominal wage case; 42.7% of the fixed real wage case and 99.1% of the bargaining case. The results for the total supply side impacts – the combination of labour supply and productivity effects – are naturally even more striking: the supply side impacts are 65.2% of the IO/SAM estimate of demand side effects, and actually exceed all of the CGE model estimates of demand side effects, by 40%-50% in the fix wage cases and by a factor of nearly 3.5 in the bargaining model.

Note that demand and supply side impacts cannot simply be added together and this is especially so across different models. For example, the passive supply side assumption of the IO/SAM model would effectively preclude the possibility of the beneficial impact on labour supply since firms have all the labour they need at the prevailing wage rate anyway. It would be possible to combine demand and supply effects within a given CGE model, however.

These results are striking and unexpected given how modest the supply side impacts appear to be in any given year. However, their persistence considerably enhances their cumulative impact, even after discounting. Of course, there are many questions about the precise scale of these supply side effects, but what appear to be plausible estimates raise serious questions about the appropriateness of neglecting supply side effects in conventional impact analyses and while the productivity estimate is undoubtedly too high (given that it assumes formerly homeless children take on the characteristics of the average child and must take some time to be established), recall that we have only allowed for this among formerly homeless children

(with no corresponding effect on adults). Furthermore, there may be other supply side factors, as those noted in Maclennan et al (2018a, 2018b, 2019), that would further enhance the supply side impacts. Certainly it seems inappropriate to neglect the potential supply side economic impacts of investment in social housing.

6. Conclusions

In this paper we develop and apply a framework which incorporates a number of improvements relative to conventional "impact analyses" of expenditure on (social) housing. First, we use a SAM-based model to analyse demand-side expenditure effects, which extends the IO approach that underlies the best of such analyses to provide a fuller account of income transfers among transactors and facilitates improved modelling of endogenous household consumption. Application to the expenditures required to meet projected social housing needs in Scotland over the next five years confirms major stimuli to economic activity and employment.

Second, while our SAM analysis, like IO, is predicated upon an assumption of an entirely passive supply side, we also consider the likely impact on these estimates of allowing for price and wage flexibility (reflecting the presence of resource constraints) in response to the new expenditures on social housing. We show that this can substantially reduce estimated expenditure impacts. While it seems likely that the impact of COVID-19 has created excess capacity[14] and labour market slack, providing some motivation for the simpler supply side assumptions of SAM/ IO analysis, in general allowance for wage and price responses is likely to prove a significant extension.[15]

Third, our analysis considers the impact of alternative methods of financing the new housing expenditures and attributing overall impacts between grant-funded and private-funded expenditures. This includes hypothetical extraction of grant-funding, reductions in government expenditure and a rise in income taxes, all of which generate significantly differentiated results. The source of funding matters for economic impact, but it is typically ignored in conventional impact analyses.

Fourth, following Maclennan et al (2018a, 2018b, 2019) we make the case for analysing the supply-side impacts of new social housing. This is the first application in the UK, and the first to emphasise, and attempt to quantify, the potential beneficial supply-side economic impacts associated with housing the homeless. While these impacts appear to be modest on a per annum basis, their cumulative effect may be substantial because their impact is typically permanent.

Finally, we allow for the fact that the current fiscal regime generates additional revenues from devolved taxes, resulting in more substantial demand and supply side impacts, since in all

[14] Once lockdown restrictions are fully relaxed.
[15] Footnote on alternative motivation for passive supply for regional economy.

cases devolved tax revenues (per capita) rise, which allows an increase in current Government expenditure. This provides a further stimulus to demand.

Overall, the answer provided by the paper to the question posed in its title is in the affirmative: the supply side impacts of housing expenditure really do matter, both in governing the likely responses to the associated demand stimulus, and in providing lasting stimuli through labour supply and productivity enhancements.

While this study represents a significant extension of previous impact studies, much remains to be done to improve our understanding of the economic impact of social housing. First, it would be useful to incorporate more explicit modelling of housing markets within the modelling frameworks. Second, there is considerable scope for improving both the identification and measurement of potential supply side impacts. Third, the approach could be extended to the multi-region case, which would allow the modelling of cities and their host regional economies to capture explicitly the spatial dimension emphasised by McLennan et al (2019).

References

Armington, P. (1969) A theory of demand for products distinguished by place of production. *IMF economic review. vol* 16, pp 159–178.

Bramley, G., Fitzpatrick, S., Wood, J., Sosenko, F., Blenkinsopp, J., Littlewood, M., Frew, C., Bashar, T., McIntyre, J. and S. Johnsen (2019) *Hard Edges Scotland: New conversations about severe & multiple disadvantage.* https://lankellychase.org.uk/wp-content/uploads/2019/06/Hard-Edges-Scotland-full-report-June-2019.pdf

Bridge, C., Flatau, P., Whelan, S., Wood, G. and J. Yates (2003) *Housing assistance and non-shelter outcomes.* Australian Urban and Housing Research Institute, Final Report 40. https://www.ahuri.edu.au/__data/assets/pdf_file/0016/2167/AHURI_Final_Report_No40_Housing_assistance_and_non_shelter_outcomes.pdf

Jorgenson, D. W., (1963) Capital Theory and Investment Behavior. American Economic Association 53(2): 247–259.

Dunning, R., Ferrari E., Hoolachan, J., Keskin, B., Moore, T., O'Brien, P. and R. Powel (2020) *Affordable Housing Need in Scotland post 2021.*

Emonts Holley, T., Greig, A., Lecca, P., Lisenkova, K., McGregor, P. G. and Swales, J.K. (2019) "A Scandinavian "high-tax, high-spend" model for regions? The impact of enhanced regional fiscal autonomy", *Spatial Economic Analysis*, vol.14, pp 321-338.

Figus, G., Lisenkova, K., McGregor P.G,. Roy, G and Swales, J.K. (2018) The long-term economic implications of Brexit for Scotland: An interregional analysis. *Papers in Regional* Science. vol.9, pp 91-117.

Layard, R., Nickell, S., & Jackman, R. (1991). Unemployment macroeconomic performance and the labour market. JSTOR.

Maclennan, D., Crommelin, L., van den Nouwelant, R. and B. Randolph (2018a) *Making Better Economic Cases for Housing Policies*, City Futures Research Centre, University of New South Wales, Sydney.

Maclennan, D. (2018b) *Making Better Economic Cases for Housing Policies: Modelling*, City Futures Research Centre, University of New South Wales, Sydney.

Maclennan, D., Crommelin, L., Randolph, B., Witte, E. Kestov, P. Scealy, B. and S. Brown (2019) *Strengthening Economic Cases for Housing Policies*, City Futures Research Centre, University of New South Wales, Sydney.

Scottish Government (2019) Housing Revenue Account (HRA) Statistics: Scottish local authority housing income and expenditure accounts for 2018-2019 (actuals) and 2019-20 (estimates). https://www.gov.scot/publications/housing-revenue-account-hra-statistics-scottish-local-authority-housing-income-expenditure-2018-19-actuals-2019-20-estimates/pages/6/

Whelan S. and R. Ong (2008) "Econometric modelling of housing market assistance and labour market participation", Research Report 6, Australian Urban and Housing Research

Institute.
https://www.ahuri.edu.au/__data/assets/pdf_file/0021/2685/NRV1_Research_Paper_6.pdf