

# MODELLING THE MACROECONOMIC EFFECTS *of an increase in superannuation contributions*

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*In this paper we describe a new type of computable general equilibrium (CGE) model that integrates detail of the economy's financial sector with a traditional real-side CGE model. We use the model to explore the macroeconomic effects of the superannuation sector in Australia by simulating a one percentage point increase in the ratio of superannuation contributions to the national wage bill. This simulation has relevance to current policy debate on the merits of further increases in the compulsory contribution rate. Our results indicate that a rise in the superannuation contribution rate increases long-run real GDP, largely via an increase in the savings rate. At the same time, the structure of the superannuation sector's activities, relative to other savings vehicles, boosts short-run employment and housing investment.*

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For over half a century, CGE models of increasing complexity and detail have been used to elucidate a diverse range of economic policy questions. These have included matters related to trade, the environment, national security, macroeconomic disruption, taxation, health, productivity, labour markets, education, immigration, and competition (Dixon and Rimmer 2016). Use of these models to analyse financial markets has been less common. This is because traditional CGE models have focused on the economy's 'real side', that is, they have carried theory describing movements in physical quantity units (like hours of employment, quantities of output), and relative prices (like the real wage, i.e. the nominal wage deflated by a price index). Traditional CGE models have not included theory describing movements in the absolute price level, or the behaviour of financial intermediaries, like commercial banks and the superannuation sector.

Australia's superannuation sector has become both a major institution in allocating the nation's financial capital across asset classes, regions, and sectors, and a central intermediary in channelling the nation's savings into domestic capital formation and foreign asset accumulation. We model this important institution within an economy-wide setting by embedding explicit modelling of the sector within a model of the financial sector, and integrating the model of the financial sector with a traditional dynamic multi-sectoral CGE model of the real side of the economy.

Our model carries explicit treatment of: (i) financial intermediaries and the agents with which they transact; (ii) financial instruments describing assets and liabilities; (iii) the financial flows related to these instruments; (iv) rates of return on individual assets and liabilities; (v) links between the real and monetary sides of the economy; and (vi) traditional detailed modelling of the non-financial actions of economic agents.

We explore the economic effects of the superannuation sector by simulating a one percentage point increase in the ratio of superannuation contributions to the economy-wide nominal wage bill.

## A financial computable general equilibrium model of the Australian economy

This section summarises the key financial aspects of the financial CGE (FCGE) model used in the simulations described in the next section. For a detailed discussion of the model, see Dixon et al. (2015).

While fully integrated, the FCGE model can be conceived as having two parts:

- > a traditional CGE model describing the real side of the economy
- > a model of the behaviour of financial agents, the interactions between them, and their links with the real side of the economy.

The real side of the FCGE model is largely as described in Dixon and Rimmer (2002). It identifies: (i) many industries, which produce, transport and sell goods; (ii) many investors, which make industry-specific investment plans by comparing returns on physical capital against the costs of financial capital; (iii) households, who consume and save; (iv) a government sector, which undertakes public consumption and investment expenditures, raises direct and indirect taxes, and makes transfer payments; and (v) a foreign sector, which supplies imports and purchases exports.

Real-side CGE models with characteristics like these have been used for decades to answer diverse policy questions. They are, however, silent on, or treat implicitly, the question of how a number of important transactions are financed. For example, how is investment financed? How does the cost of financial capital affect the decision to invest in physical capital? Who is financing government borrowing? How is the current account deficit financed? Who decides on how household savings are allocated? An important role of the financial part of the FCGE model is to elucidate these and other related questions.

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The financial side of our FCGE model identifies 11 agents, each of whom is assumed to simultaneously act as an 'asset manager' (concerned with the composition of its holdings of five financial instruments on the asset side of its balance sheet)<sup>1</sup> and a 'liability manager' (concerned with the composition of its issuance of five financial instruments on the liability and equity side of its balance sheet). The core of the FCGE model is three arrays and the equations describing how these arrays change through time. The three arrays are:

$A(s,f,d)$ : the holdings by financial agent  $d$  in their capacity as an asset manager (e.g. households, superannuation) of financial instrument  $f$  (e.g. bonds, equity) issued by financial agent  $s$  in their capacity as a liability manager (e.g. government, industry).

$F(s,f,d)$ : the net flow of holdings by financial agent  $d$  in their capacity as an asset manager (e.g. households) of financial instrument  $f$  (e.g. equity) issued by financial agent  $s$  in their capacity as a liability manager (e.g. superannuation).

$R(s,f,d)$ : the rate of return on financial instrument  $f$  (e.g. bonds) issued by financial agent  $s$  in their capacity as a liability manager (e.g. foreigners) and held as an asset by financial agent  $d$  in their capacity as an asset manager (e.g. superannuation).

In their roles as asset holders and liability issuers, the model's financial agents are constrained optimisers. As liability managers, financial agents adjust the composition of their financial instruments on issue to minimise the cost of servicing their total liabilities, subject to constraints that prevent them moving to unrealistic corner solutions. Similarly, as asset managers, financial agents adjust their portfolio asset weights within realistic bounds to maximise the return from their portfolio. The solutions to these optimisation problems generate return-sensitive supply equations for the stocks of financial instruments issued as liabilities by financial agents, and return-sensitive demand equations for the holding of these instruments as assets by financial agents. The solution to these supply and demand equations determines rates of return across financial instruments.

Results from the real side of the FCGE model (while determined jointly with the model's financial side) can be viewed as providing important constraints on the financial side. Similarly, results for variables in the financial side (while again, determined jointly with the real side) exert an important influence on outcomes in the real side. For example:

- > the public sector borrowing requirement determines new liability issuance by government
- > gross fixed capital formation by industry determines new liability issuance (equity, debt) by industry
- > household saving determines new asset acquisitions by households
- > the current account deficit determines new asset acquisitions by foreigners
- > superannuation contributions determine new liability issuance by the superannuation sector
- > changes in the weighted average cost of financial capital influence the desirability of undertaking gross fixed capital formation.

At the same time, linkages within the financial sector are modelled. For example, the commercial banking sector's roles as a liability manager and as an asset manager are modelled, allowing representation of the sector's activities in raising local and foreign deposit, bond and equity finance, and deploying these funds in purchases of financial instruments such as loans to domestic industry and households for capital formation and purchases of dwellings. In this system, changes in the prospects for one financial agent can flow through to consequences for the costs of funds to other agents.<sup>2</sup>

### **Simulation design and key results**

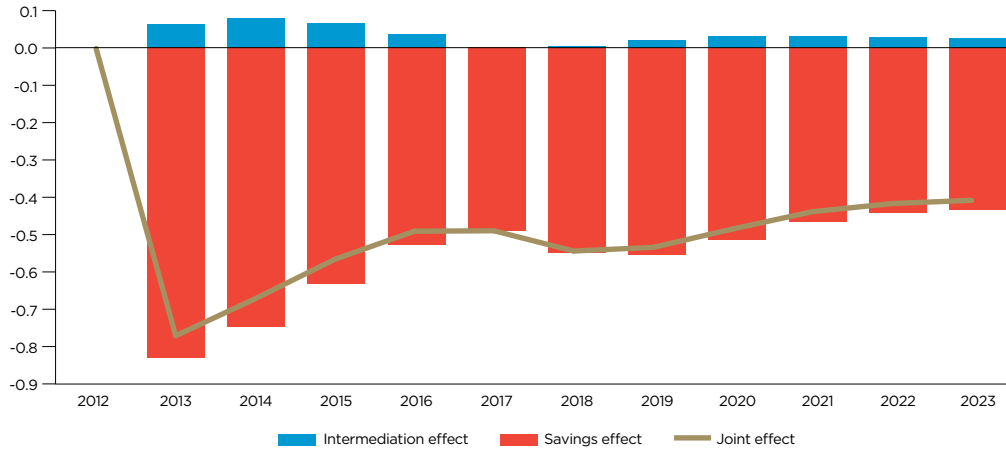
We explore the interactions between the superannuation sector and the economy by simulating a one percentage point increase in the proportion of the national wage bill allocated to superannuation. We decompose the effects into two parts:

- > *the intermediation effect*: the effects of a rise in the proportion of national savings that is intermediated by the superannuation sector rather than allocated across financial instruments by households directly
- > *the savings effect*: effects flowing from changes in the national savings rate caused by changes in the savings rates of those households which would have saved less if not for the influence of compulsory superannuation.<sup>3</sup>

Figures 1 to 14 report the main macroeconomic results, distinguishing the intermediation effect, the savings effect, and the total (or joint effect). We explain these results as a sequence of cross-referenced arguments.

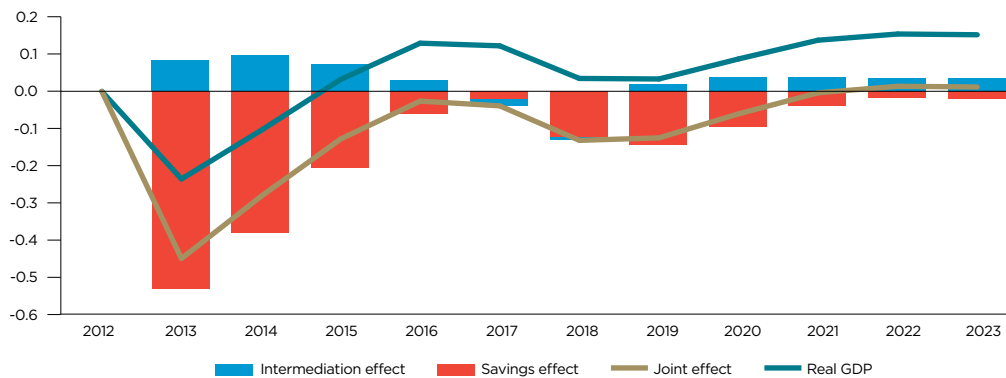
1. **Private consumption falls relative to baseline over the simulation period, largely due to the savings effect (Figure 1).** This reflects the increase in the average household savings rate generated by the rise in the superannuation contribution rate.

**FIGURE 1: Real private consumption (% deviation from baseline)**



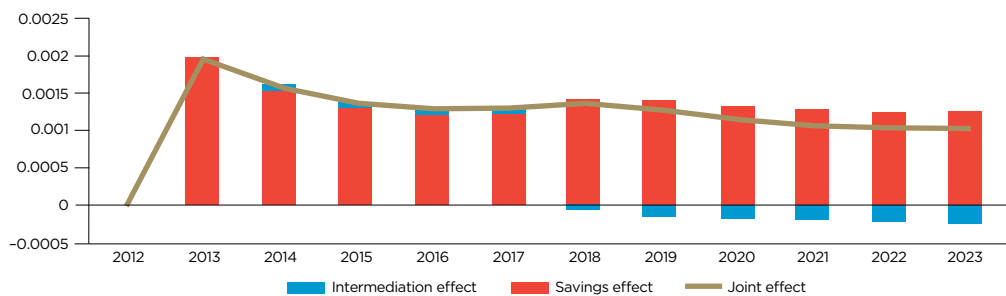
2. **The real gross national expenditure (GNE) deviation is below the real GDP deviation (Figure 2).** With private consumption below baseline (point 1) and public consumption unchanged from baseline, the GNE deviation is dampened relative to the GDP deviation throughout the simulation.

**FIGURE 2: Real Gross National Expenditure (GNE) (% deviation from baseline)**



3. **The balance of trade (BoT) moves towards surplus, largely due to the savings effect (Figure 3).** The savings effect causes consumption to fall relative to GDP (point 1), dampening the deviation in GNE relative to GDP (point 2). This requires the BoT to move towards surplus throughout the simulation.

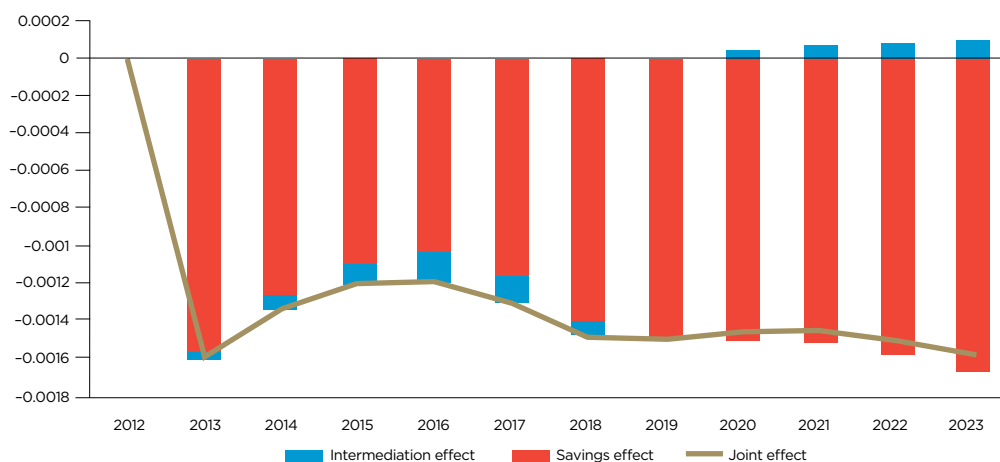
**FIGURE 3: Ratio of the Balance of Trade (BoT) to GDP (% deviation from baseline)**



4. **The current account deficit (CAD) falls, largely due to the savings effect (Figure 4).**

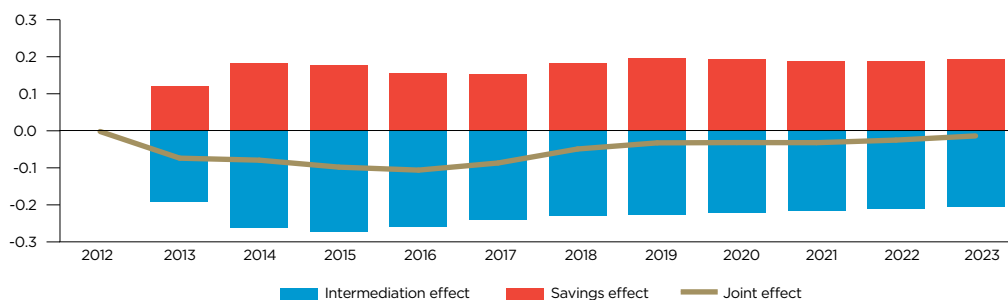
The movement in the BoT towards surplus (point 3) causes the ratio of the CAD to GDP to fall relative to baseline for the duration of the simulation period. Consistent with the savings effect being the dominant factor in explaining the movement in the BoT, so too is it the dominant factor in explaining the movement in the CAD. Because the intermediation effect has little impact on the ratio of GNE to GDP, and thus little effect on the BoT, it also has little effect on the CAD.

**FIGURE 4: Ratio of the Current Account Deficit (CAD) to GDP (% deviation from baseline)**



5. **The savings effect creates pressure for nominal appreciation (Figure 5).** The savings effect reduces Australia's call on foreign savings to finance the CAD (point 4). But it has little direct effect on rates of return on Australian financial assets. With the CAD financing requirement lower, foreign agents must be induced to supply less financial capital to Australia. This is achieved by nominal appreciation. For any given ratio of domestic rates of return to foreign rates of return, nominal appreciation increases the foreign currency value of foreign holdings of Australian assets above desired levels, inducing an offsetting reduction in foreign fund supply to Australia, consistent with the lower CAD financing requirement.

**FIGURE 5: Nominal exchange rate (% deviation from baseline)**

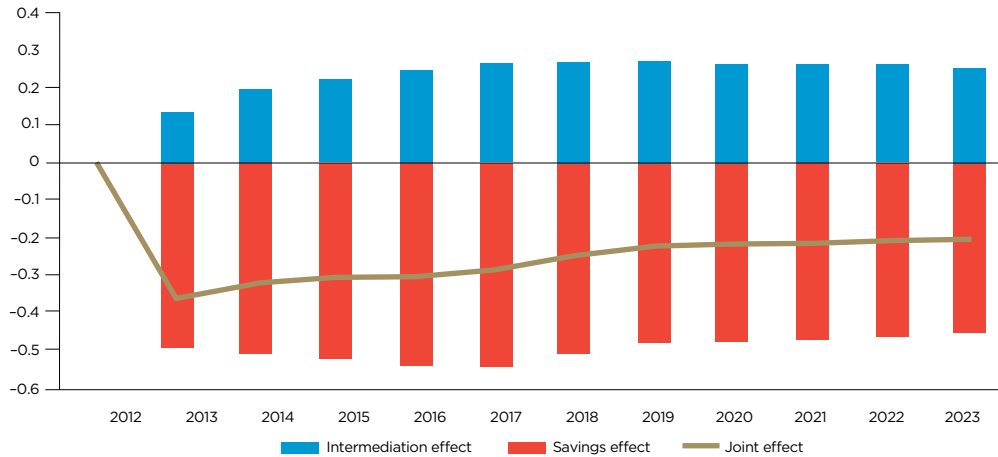


6. **The intermediation effect creates pressure for nominal depreciation (Figure 5).**

The superannuation sector has a much higher propensity to purchase foreign financial assets than does the household sector directly. As a result, an increase in the proportion of household savings intermediated by the superannuation sector generates an increase in Australian purchases of foreign financial assets. But the intermediation effect has little effect on the CAD (see point 4). Hence, foreign financial agents must be induced to increase financial inflows to offset the increase in financial outflows by the superannuation sector. This is achieved by depreciation of the nominal exchange rate relative to baseline throughout the simulation period (Figure 5). Nominal depreciation reduces the value, in foreign currency terms, of foreign holdings of Australian financial assets. For any given ratio of domestic rates of return to foreign rates of return, this induces a countervailing rise in foreign fund supply to Australia.

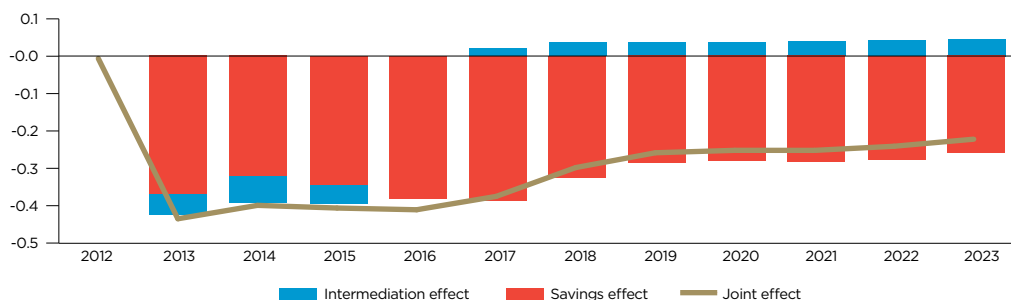
7. **The savings effect puts downward pressure on the GDP deflator (Figure 6).** The savings effect causes the nominal exchange rate to appreciate relative to baseline (point 5). This reduces the price of traded goods, and thus places downward pressure on domestic prices. As will be discussed in point 10, with sticky short-run nominal wages, the downward pressure on domestic prices raises the real producer wage in the short-run.

**FIGURE 6: GDP deflator (% deviation from baseline)**



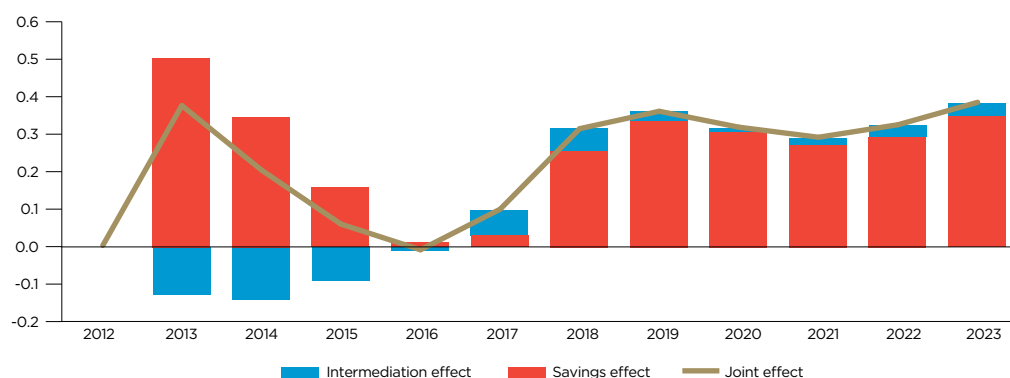
8. **The intermediation effect puts upward pressure on the GDP deflator (Figure 6).** The intermediation effect causes the nominal exchange rate to depreciate relative to baseline (point 6). This increases the prices of traded goods, thus placing upward pressure on domestic prices. As will be discussed in point 10, with sticky nominal wages in the short-run, the upward pressure on domestic prices lowers the real producer wage in the short-run.
9. **The net impact on the GDP deflator is towards negative deviation. With little change in the nominal exchange rate, this implies a net negative deviation in the real exchange rate (Figure 7).** The impacts of the savings and intermediation effects on the nominal exchange rate are close to offsetting, leaving only a small net negative movement (points 5 and 6). However the movement in the GDP deflator is more substantially negative, producing real exchange rate depreciation. The real exchange rate depreciation is a corollary of the movement towards surplus of the real BoT (point 3). That is, the movement towards real BoT surplus must be facilitated by a fall in domestic prices relative to foreign prices, by real depreciation. Because the movement towards surplus in the real BoT is largely attributable to the savings effect (point 3) it follows that the real depreciation must also be due largely to the savings effect.

**FIGURE 7: Real exchange rate (% deviation from baseline)**



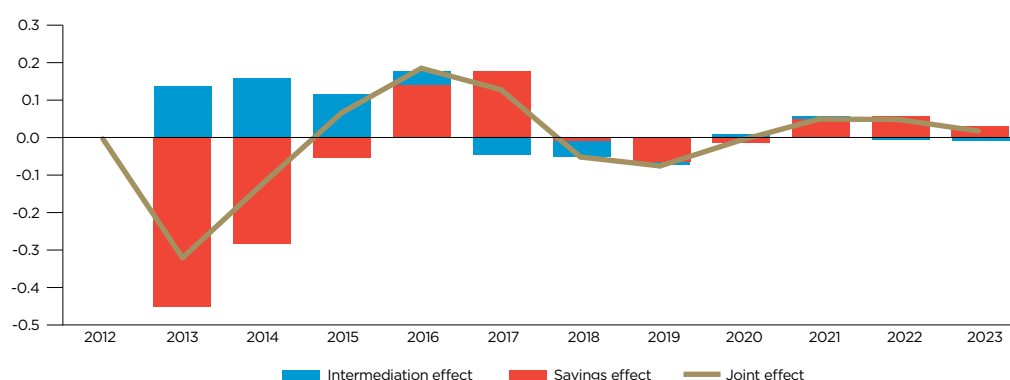
10. ***In the short-run, the savings effect imparts upward pressure on the real producer wage, while the intermediation effect imparts downward pressure (Figure 8).*** With the nominal wage sticky in the short-run, movements in the GDP deflator (points 7 and 8) generate short-run movements in the real producer wage. The savings effect causes a negative deviation in the GDP deflator, thus making a positive contribution to the real producer wage (Figure 8) in the short-run. The intermediation effect causes a positive deviation in the GDP deflator, thus making a negative contribution to the real producer wage in the short-run. In the long-run, the real producer wage deviation is positive, and due largely to the savings effect. This is consistent with the long-run return of employment to baseline (point 11) and the long-run increase in the capital stock (point 14).

**FIGURE 8: Real producer wage (% deviation from baseline)**



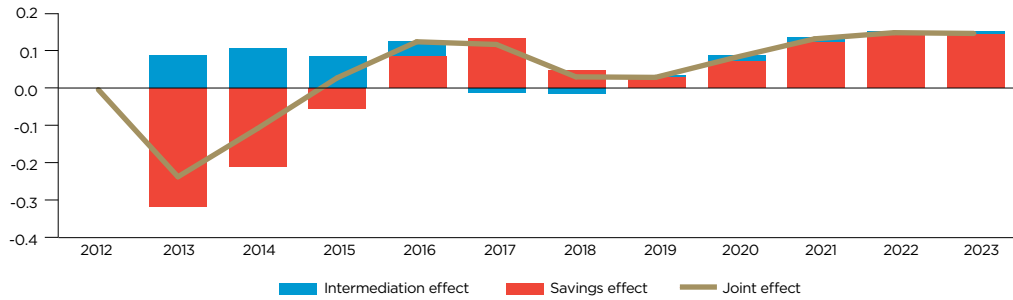
11. ***In the short-run, the savings effect depresses employment, while the intermediation effect raises employment (Figure 9).*** In the short-run, the savings effect raises the real producer wage (point 10). This makes a negative contribution to the short-run employment deviation (Figure 9). The intermediation effect lowers the producer real wage in the short-run (see point 10), making a positive contribution to short-run employment (Figure 9). In the long-run, wage adjustment (Figure 8) ensures that employment returns to its baseline level. That is, neither the savings effect nor the intermediation effect exerts a permanent influence on employment.

**FIGURE 9: Employment (% deviation from baseline)**



12. ***Real GDP falls relative to baseline in the short-run, but rises relative to baseline in the long-run (Figure 10).*** In the short-run, there is little scope for the capital stock to adjust (point 14). Hence, movements in short-run GDP are largely attributable to movements in employment. Consistent with the negative contribution to short-run employment made by the savings effect (point 11), the savings effect makes a negative contribution to short-run GDP (Figure 10). Likewise, with the intermediation effect making a short-run positive contribution to employment (point 11), we find in Figure 10 that the intermediation effect makes a short-run positive contribution to GDP. In the long-run, the employment deviation returns to baseline (point 11). Nevertheless, the GDP deviation remains positive in the long-run (Figure 10). This is due to the positive deviation in the capital stock (point 14).

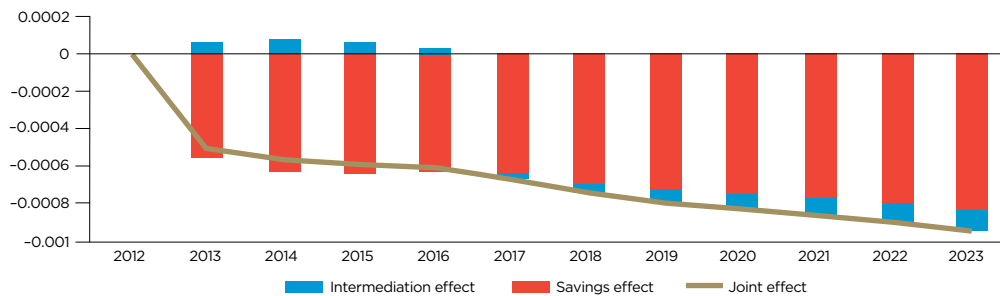
**FIGURE 10: Real GDP (% deviation from baseline)**



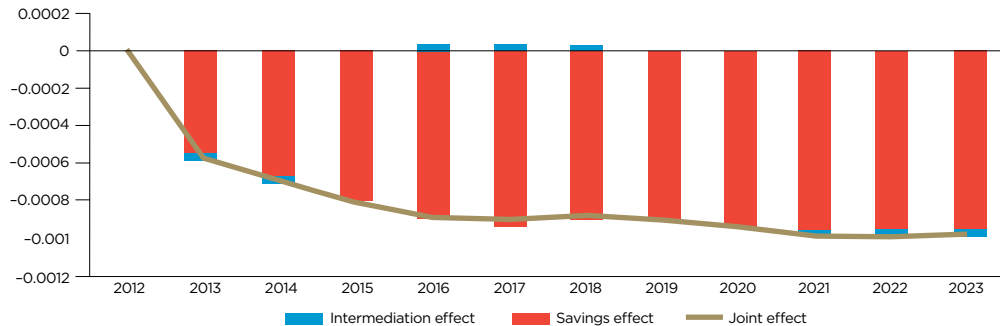
13. **The weighted average cost of capital falls relative to baseline (Figures 11 and 12).**

The savings effect generates a rise in demand for financial instruments by financial agents in their roles as asset managers. Ceteris paribus, this lowers the rate of return that capital creating financial agents, (industries and reproducible housing) in their capacities as liability managers, need to offer to raise a given amount of funds to finance physical capital formation. As a result, the weighted average cost of capital falls.

**FIGURE 11: Weighted average cost of capital to industry (% deviation from baseline)**



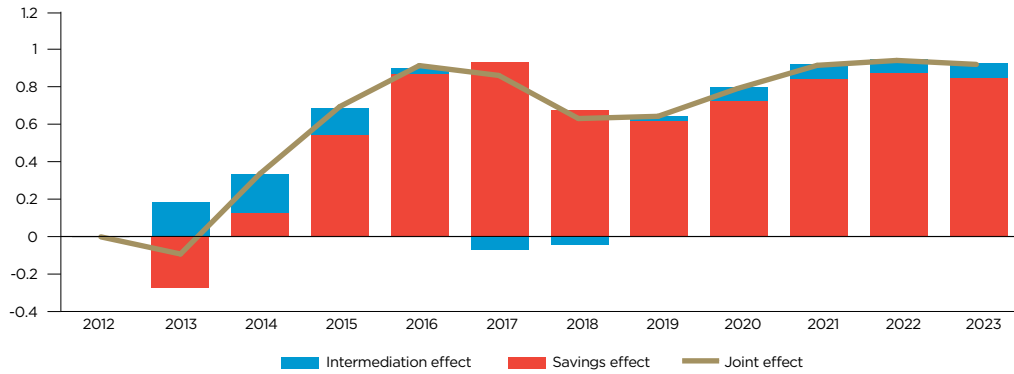
**FIGURE 12: Weighted average cost of capital to housing (% deviation from baseline)**



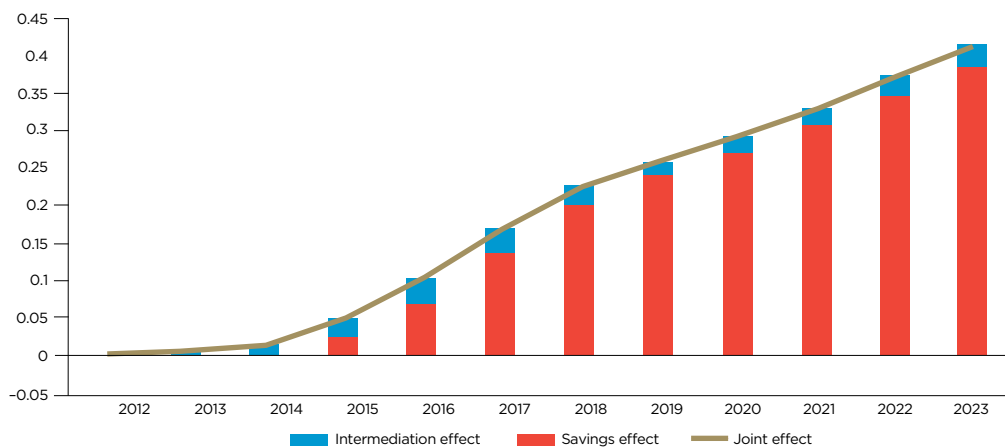
14. **Aggregate investment rises relative to baseline (Figure 13) causing the physical capital stock to rise relative to baseline (Figure 14).** The fall in the weighted average cost of capital (point 13) lowers the cost of financial capital relative to the return on physical capital. This causes real investment to rise relative to baseline (Figure 13). This generates a positive deviation in the physical capital stock (Figure 14), which accounts for the long-run increase in real GDP (point 12). Much of the investment deviation (and thus the capital deviation) is due to the savings effect.



**FIGURE 13: Real investment (% deviation from baseline)**

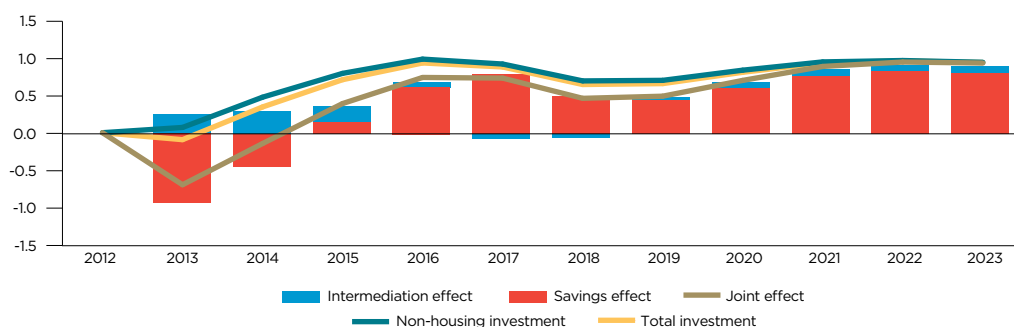


**FIGURE 14: Capital stock (% deviation from base)**

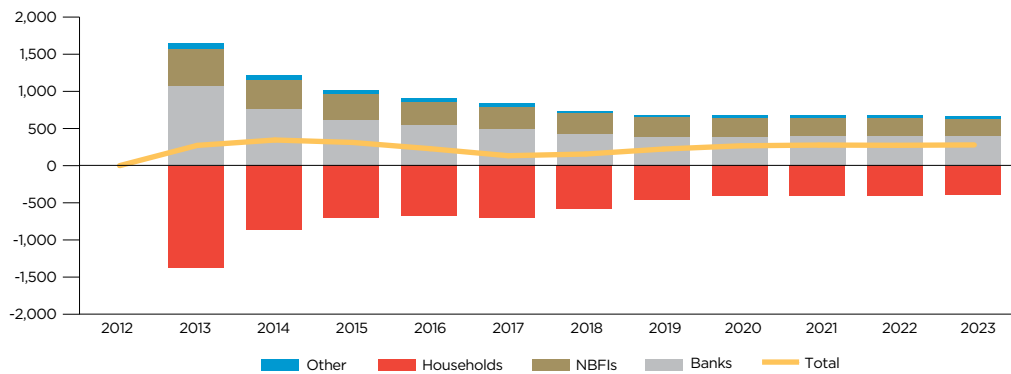


15. **Housing investment falls in the short-run, but rises together with general investment in the long-run (Figure 15).** A common conjecture is that superannuation dampens housing investment by reducing owner equity financing by more than the increase in housing-directed flows from superannuation. However, in Figure 15, we see that while housing investment is below baseline in the short-run, it rises relative to baseline in the long-run by an amount equivalent to non-housing investment (for comparison, Figure 15 also plots the deviations in non-housing and total investment). The short-run negative deviation in housing investment is due to the savings effect. In particular, the transitory short-run employment loss (point 11) depresses consumption spending, and with it, rates of return on housing capital. An interesting attribute of Figure 15 is the positive contribution to housing investment made by the intermediation effect. Figure 16 reports the deviation in the flow of funds to housing investment attributable to the intermediation effect alone, and decomposes this into contributions made by key financial agents. Consistent with the common conjecture, we see household funding of housing investment falling by an amount that greatly exceeds the increased direct flows from superannuation (which are aggregated within ‘Other’ in Figure 16). But bank and NBF1 funding rises to more than offset the loss from direct household financing. This reflects purchases of bank and NBF1 liability instruments as assets by the superannuation sector.

**FIGURE 15: Real housing investment (% deviation from base)**



**FIGURE 16: Fund flows to housing investment, intermediation effect only (\$m deviation from base)**



## Conclusion

Our FCGE model shows that mandated contributions to superannuation raise real GDP in the long-run. This is largely due to the savings effect: mandated contributions raise total Australian savings thereby raising the supply of investable funds to Australian industries and increasing the nation's capital stock. Application of a traditional real-side CGE model would have produced a similar finding. But such a model would miss important long-run and short-run effects captured by the FCGE model. For example, the FCGE model recognises that the superannuation sector has a higher propensity to invest offshore than the household sector. Thus, the FCGE model shows that diversion of funds into superannuation offsets some of the long-run gain to the Australian capital stock from the increase in total savings. A short-run effect captured by the FCGE model, but missed by a real-side model, is the depreciation of the nominal exchange rate induced as the economy increases its acquisition of foreign financial assets. With sticky nominal wages, depreciation has a useful employment stimulating effect.

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## Notes

1. The financial agents are: commercial banks, the Reserve Bank of Australia, foreigners, government, households, industries, non-bank financial institutions, superannuation, life insurance, non-reproducible housing, reproducible housing. The financial instruments are: cash, deposits/loans, bonds, equity, gold and special drawing rights (SDRs). We divide the housing sector into 'reproducible' and 'non-reproducible' housing in anticipation of future applications concerned with property price bubbles. For non-reproducible housing (inner-city houses in established suburbs) it is conceivable that asset prices can depart from construction costs. For reproducible housing (apartments, units, and houses outside the inner city) we might expect construction costs to anchor asset prices.
2. With some important caveats. For example, while the model carries details of balance sheet connections between financial agents, it does not yet contain specific theory elucidating the systemic risk possibilities of these connections that might arise from fire-sale feedbacks, counterparty risk perceptions, and self-fulfilling asset price expectations. Also, the model presently has one representative household, limiting its capacity to elucidate the financial consequences of demographic change.
3. The movement in the propensity to save is calibrated on the basis of the findings of Connolly (2007), which suggest that each \$1 of additional superannuation contribution displaces approximately \$0.30 of other savings.

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