Delta Discoveries

1. Why aren’t the distributions of asset holdings and CIT as progressive as we would have thought?

Recall we fixed the quintiles according to households’ taxable income and, as a consequence, retirees with large asset holdings (but no labor income) might fall in a low quintile. They drive the asset holdings/CIT of low quintiles up.

1. Why is the delta for CIT (for all quintiles) so low?

We compute static variables holding prices fixed and the ‘effective capital return rate’, that is, capital return rate minus expensing subsidies, decreases around 60% in the counterfactual economy with respect to the static economy (for the open economy with low capital return). This price effect, part of the dynamic effect, reduces CIT (and capital revenues) even though total capital in the economy goes up.

1. Why does total tax revenues decrease in the open economy with low capital return?

Due to the dynamic effect mentioned in item 2, we have a reduction of capital revenues that drives total revenues down.

1. Why do labor income and GDP percentage changes differ in the closed economies?

Convergence error. In the closed economy code, we use capital-labor ratio guesses so they don’t necessarily equal capital-labor ratio in the model (our tolerance parameter right now is 1e-3). In the open economy, capital-labor ratio is set by closed form conditions, so the difference in that case is a numerical error.

1. Why do Social Security benefits deltas are NaN for some percentiles?

When we define the percentiles according to total income without Social Security benefits in the first year of transition, three percentile-like groups display a SS benefits sum equal to zero (in both the baseline and the static economies). In those groups (60-80 p, 80-90 p, and 90-95 p), there is a zero mass of retired households. As a result, the calculated deltas are NaN.

The reason is the interaction between the assets grid, total return rates, and total income thresholds for each percentile. Note that total income without SS benefits is equal to assets income for retired households. For our current parameters, a retired household with asset holdings in the 9th grid point earns enough (USD 133,887) to be placed in the top 5% total income without SS benefits. However, a retired household with asset holdings in the 8th grid point is already far back in the bottom 60% (USD 50,273). Income inequality results in thresholds that are not too far apart from each other in the first percentiles.

|  |  |  |
| --- | --- | --- |
| Percentile | Top income threshold | |
| Model units | USD |
| 0 – 20 p | 0.2754 | 6,659 |
| 20 – 40 p | 1.4494 | 35,046 |
| 40 – 60 p | 2.1679 | 52,419 |
| 60 – 80 p | 3.0001 | 72,542 |
| 80 – 90 p | 3.4753 | 84,031 |
| 90 – 95 p | 3.8305 | 92,620 |
| 95 – 100 p | 95.5898 | 2,311,342 |

The table above shows values without subtracting the corporate capital earnings from income. Doing so results in the following:

|  |  |  |
| --- | --- | --- |
| Percentile | Top income threshold | |
| Model units | USD |
| 0 – 20 p | 0.2061 | 4,983 |
| 20 – 40 p | 1.3718 | 33,171 |
| 40 – 60 p | 2.0664 | 49,967 |
| 60 – 80 p | 2.8466 | 68,831 |
| 80 – 90 p | 3.2665 | 78,985 |
| 90 – 95 p | 3.5941 | 86,907 |
| 95 – 100 p | 77.5738 | 1,875,719 |

1. Why do we use kpricescale to re-price assets?

To answer this question, I’ll describe what happens in the economy when capital tax rates go down. In this case, capital gains are realized and we use kpricescale as means to boost households’ asset holdings. We choose not to create a separate term for capital gains in the budget constraint because the presence of expensing and taxation would distort any new investment derived from that extra source. In other words, the extra value accrued to assets new pricing shows up in the household budget constraint as an increase in the overall asset holdings.

We also take the stand that CIT and PIT are applied to asset holdings at these “correct/updated” prices. Hence those taxes include capital gains/losses. We should revisit totrates definition because, although caprates are measured in units of physical capital, totrates incur over assets measured in model units.

The advantage of rescaling the entire asset grid versus creating a new term for the capital gain lays in the computational efficiency of the code. When we re-scale the whole grid, the operation is done once as opposed to calculating the capital gain for each household type and sum it to the budget constraint.

1. Why do assets in the first period of transition differ from assets in the steady state?

Population growth and bequests. It is easy to see that when we create a new aggregate variable “savings” in generate\_aggregates function as follows:

Aggregate.savings = f(OPTs.SAVINGS).

Since in steady state households’ policy functions are unchanged, their savings rule is the same and in the aggregate we have:

Aggregate.savings(steady) / Aggregate.assets\_0(steady) = 1.0078;

Where 0.78% is the population growth rate.

Then, using the savings variable, the precise way to impute total assets for the first period of transition is:

assets\_0(1st period of transition) = Savings(steady) - bequests(steady).

This equation has consequences for the level of physical capital in the economy. In the open economy, because we have the portfolio composition (capshares) fixed, one can interpret that households literally save assets in physical units, which will be there in the next period. Hence:

caps\_dom(1st period of transition) = ( savings(steady) - bequests(steady) ) \* capshares\_0(steady).

Notice that we omitted the steady-state price of capital that should be dividing all the RHS in the equation because it is one.

In the closed economy tough, that equation fails since the portfolio composition endogenously adjusts such that markets clear (instead of having foreign capital clearing the market for capital). In this case, although the interpretation is still appropriate, the equation becomes:

caps\_dom (1st period of transition) = (savings(steady) -.bequests(steady)) .\* capshares\_0(1st period of transition).

We should have been able to compute capshares\_0(1st period of transition) in the steady state, but we don’t have enough information (output path) to predict the composition in the transition (using the debt-to-GDP ratio), something trivial in the transition path. The correct approach would be to compute next period’s debt from the equation:

D(1st period of transition) = D(steady) (1 + r\_g(steady)) + Ctilde(steady) + Bens(steady) – Ttilde(steady) – Revs(steady) – Ctilde(steady)

and compute what share it represents in ‘Savings(steady) - bequests(steady)’. But if we do that we end up with a much smaller debt level in the 1st period of transition than what it is because the residuals are zero in the steady state. For instance, now we want to match a debt-to-GDP ratio of 0.7647 in the steady state. If we use the formula above to compute debt in the 1st period of transition, we would end up with a ratio of 0.6207 instead of the desired 0.7824.

An alternative is to assign a value to one of the residuals (let’s say, Gtilde) such that the debt-to-GDP ratio predicted by the OG model matches that from the microsim. That is:

Gtilde(steady) = debttoout(1st period of transition)\*(outs(steady) \*1.0078) - debts(steady) \*( 1 + bondFundDividends(steady) ) - bens(steady) + revs(steady).

Then, instead of matching debttoout in the 1st period of transition ignoring that assets are brought from the steady state, we could just import the Gtilde (and, as a consequence, in the 1st period of transition) and implied capshare in ‘Savings(steady) - bequests(steady)’ from steady state.