Notation for a generic continuous-time deterministic optimization problem:

|  |  |
| --- | --- |
|  |  |
| State variables | for and |
| Action/Control variables | for and choice set |
| Transition function | for and |
| Return function |  |
|  |  |
| Value function |  |
| Policy function | for |

“Sequential problem” (**SP**):

for

(**HJB**):

FOC: for

Neoclassical growth model (NGM): ([slides](https://benjaminmoll.com/wp-content/uploads/2021/04/STEG_course.pdf) 16+, [Moll Julia code](https://github.com/chandlerlester/Radio_Free_Julia/tree/master/Moll_Code/Section15-General_Continuous_Time_Models/HJB_NGM_implicit))

Consumption saving model: (Moll [notes](https://benjaminmoll.com/wp-content/uploads/2020/06/HACT_Additional_Codes.pdf), [Julia code](https://github.com/chandlerlester/Radio_Free_Julia/tree/master/Moll_Code/Section15-General_Continuous_Time_Models/HJB_simple_implicit))

Can make more “generic”:

-Finite horizon “T”

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-Non time/state separable return (Epstein-Zin etc)

In examples w/ 1 state & 1 choice we can solve the transition function for the choice variable:

{cons @ lowest wealth if not borrowing}

{borrowing @ lowest wealth should make you weakly better off, MU is high}

{cons @ highest wealth if not saving}

{saving @ highest wealth should make you weakly better off, MU is low}

Moll code:

{should be LEQ?}

{should be GEQ?}

More generically:

-Consumption @ :