In[1]:= (* Fits to log stable below. Starting with 90d worth of data from WETH/USDC .... *)

In[2]:= (* Import from csv *)

In[3]:= Directory[]

Out[3]= /Users/personal

In[4]:= Module[{directory = SystemDialogInput["Directory"]}, If[directory =!= $Canceled, SetDirectory[directory]]]

Out[4]= /Users/personal/Desktop/note7/points

In[5]:= (* Go back and download WETH/USDC data from cron. Look at that *)

In[6]:= tblWethUsdc90d = Import["90/data-1625069716_weth-usdc-twap.csv"]

Out[6]= {{, timestamp, twap}, {0, 1.61878×10^9, 2.23957×10^9}, {1, 1.61878×10^9, 2.24054×10^9}, {2, 1.61878×10^9, 2.23817×10^9}, {3, 1.61878×10^9, 2.25083×10^9}, {4, 1.61878×10^9, 2.25656×10^9}, {5, 1.61878×10^9, 2.25775×10^9}, {6, 1.61878×10^9, 2.25804×10^9}, ... 9164 ..., {9173, 1.62507×10^9, 2.13479×10^9}, {9174, 1.62507×10^9, 2.12846×10^9}, {9175, 1.62507×10^9, 2.1222×10^9}, {9176, 1.62507×10^9, 2.11587×10^9}, {9177, 1.62507×10^9, 2.11137×10^9}, {9178, 1.62507×10^9, 2.10661×10^9}, {9179, 1.62507×10^9, 2.10415×10^9}}

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In[7]:= Length[tblWethUsdc90d]

Out[7]= 9179

In[8]:= FromUnixTime[tblWethUsdc90d[[2]][[2]]]

Out[8]= Sun 18 Apr 2021 16:50:52 GMT-4.

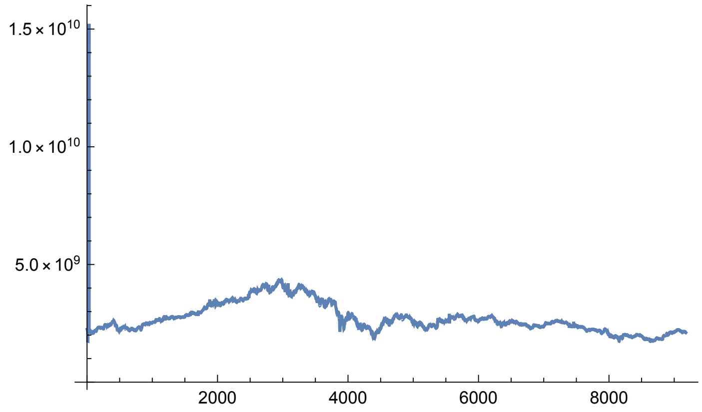
In[9]:= FromUnixTime[tblWethUsdc90d[[Length[tblWethUsdc90d]]][[2]]]

Out[9]= Wed 30 Jun 2021 12:09:58 GMT-4.

In[10]:= twapsWethUsdc90d = Table[tblWethUsdc90d[[i]][[3]], {i, 2, Length[tblWethUsdc90d]}]

In[11]:= `ListLinePlot[twapsWethUsdc90d, PlotRange → All]`

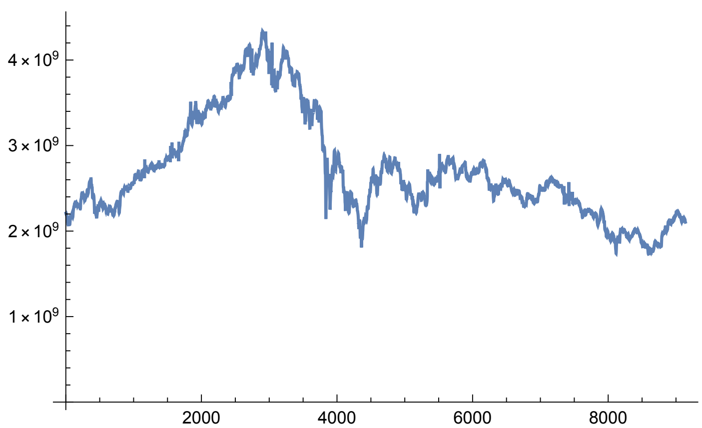
Out[11]=



In[12]:=
```
(* Same issues here for early data as UNI/WETH. Cut off first 40 elements *)
twapsWethUsdc90dFiltered =
 Table[twapsWethUsdc90d[[i]], {i, 40, Length[twapsWethUsdc90d]}]
```

In[13]:= `ListLinePlot[twapsWethUsdc90dFiltered, PlotRange → All]`

Out[13]=



In[14]:= `FromUnixTime[tblWethUsdc90d[[40]][[2]]]`

Out[14]= Mon 19 Apr 2021 17:14:44 GMT–4.

In[15]:= `FromUnixTime[tblWethUsdc90d[[Length[twapsWethUsdc90dFiltered]]][[2]]]`

Out[15]= Wed 30 Jun 2021 04:33:51 GMT–4.

In[16]:= `(* Calculate the rs ... *)`

In[17]:=
```
rsWethUsdc90dFiltered = Differences[Log[twapsWethUsdc90dFiltered]]
```

Out[17]=
```
{-0.00120673, 0.000176452, -0.0000603568, -0.000373722,
 -0.000389599, 0.000559858, -0.00092094, -0.00154871, -0.000905547,
 -0.000584311, -0.00172231, -0.00371162, … 9115 …, 0.00150055,
 0.000591025, 0.000421125, -0.000241228, -0.000868266, -0.00297129,
 -0.00294238, -0.00298715, -0.00213101, -0.00225849, -0.00116666}
```

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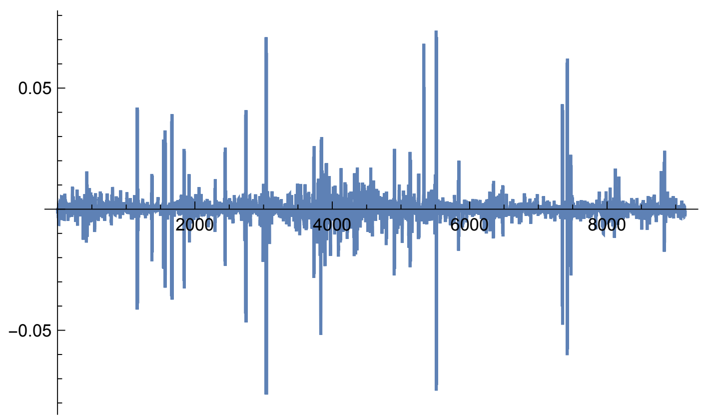
In[18]:=
```
rsWethUsdc90dFiltered[[100]]
```

Out[18]=
```
-0.00443888
```

In[19]:=
```
ListLinePlot[rsWethUsdc90dFiltered, PlotRange → All]
```

Out[19]=



In[20]:=
```
Length[rsWethUsdc90dFiltered]
```

Out[20]=
```
9138
```

In[21]:=
```
edistWethUsdc90dFiltered = EstimatedDistribution[rsWethUsdc90dFiltered,
   StableDistribution[1, aWU90d, bWU90d, locWU90d, scaleWU90d]]
```

Out[21]=
```
StableDistribution[1, 1.46465, -0.0496207, -0.000010553, 0.00154277]
```

In[22]:=
```
(* This seems more reasonable. more data from weth/usdc lead
 to decrease in alpha because included massive run up to $4k *)
```

In[23]:=
```
FromUnixTime[tblWethUsdc90d[[5000]][[2]]]
```

Out[23]=
```
Fri 28 May 2021 06:16:07 GMT-4.
```

In[24]:=
```
FromUnixTime[tblWethUsdc90d[[Length[tblWethUsdc90d]]][[2]]]
```

Out[24]=
```
Wed 30 Jun 2021 12:09:58 GMT-4.
```

In[25]:=
```
(* Seems a good place to estimate k
 values would be 1h candles (from note-7.nb) *)
```

In[26]:=

In[27]:=
```
(* Some concrete numbers below in terms of funding rate ... *)
```

In[28]:=
```
(* What does e^{mu * T + sig * (T/a)^(1/a) * F^{-1}(1-alpha)}
 translate to for ETH/USDC fit? *)
```

In[29]:=
```
(* And if d = f * e^{mu * T + sig * (T/a)^(1/a) * F^{-1}(1-alpha)},
what f value should we use across the board
  to get k max interest rates on order of 1-10% daily? *)
```

In[30]:=
```
(* e.x. d = 1.0014649 for T=10m results in 10% per day funding rate *)
```

In[31]:=
```
edistWethUsdc90dFiltered
```

Out[31]=
```
StableDistribution[1, 1.46465, -0.0496207, -0.000010553, 0.00154277]
```

In[32]:=
```
InverseCDF[edistWethUsdc90dFiltered, 0.99]
```

Out[32]=
```
0.0124991
```

In[33]:=
```
InverseCDF[edistWethUsdc90dFiltered, 0.95]
```

Out[33]=
```
0.00479452
```

In[34]:=
```
InverseCDF[edistWethUsdc90dFiltered, 0.90]
```

Out[34]=
```
0.0032239
```

In[35]:=
```
Exp[InverseCDF[edistWethUsdc90dFiltered, 0.95]]
```

Out[35]=
```
1.00481
```

In[36]:=
```
Exp[InverseCDF[edistWethUsdc90dFiltered, 0.99]]
```

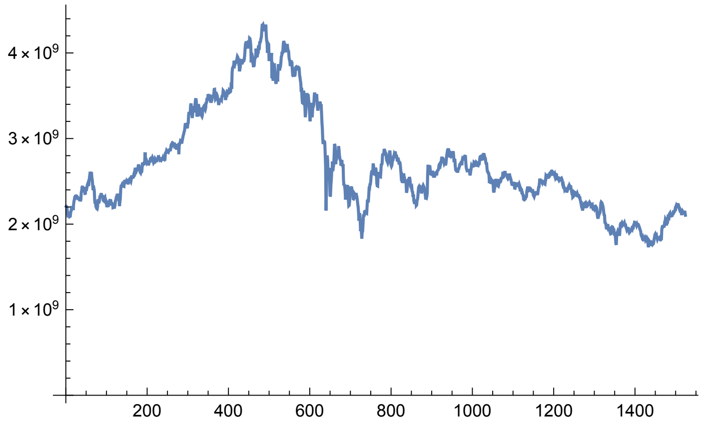
Out[36]=
```
1.01258
```

In[37]:=
```
(* Produce 1 hour candles from 10min cron data to use in k analysis ... *)
```

In[38]:=
```
twapsWethUsdc90dFiltered1HourCandle =
 Table[twapsWethUsdc90dFiltered[[i]], {i, 1, Length[twapsWethUsdc90dFiltered], 6}]
```

In[39]:=
```
ListLinePlot[twapsWethUsdc90dFiltered1HourCandle]
```

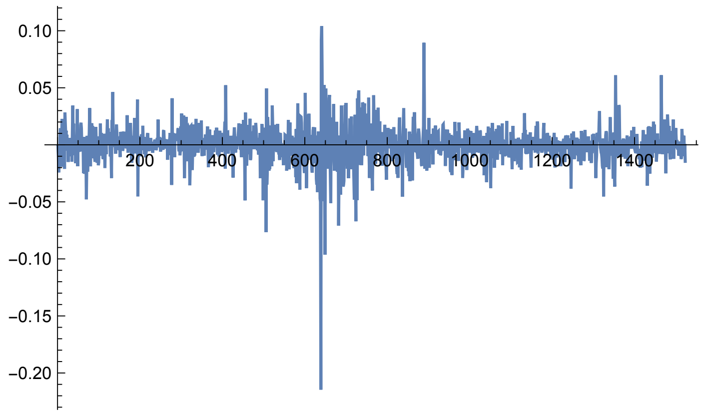
Out[39]=



In[40]:=
```
rsWethUsdc90dFiltered1HourCandle =
  Differences[Log[twapsWethUsdc90dFiltered1HourCandle]]
```

In[41]:=
```
ListLinePlot[rsWethUsdc90dFiltered1HourCandle, PlotRange → All]
```

Out[41]=



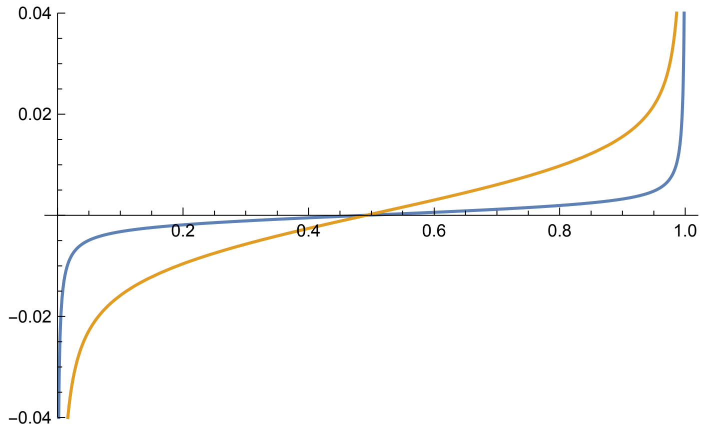
In[42]:=
```
edistWethUsdc90dFiltered1HourCandle =
  EstimatedDistribution[rsWethUsdc90dFiltered1HourCandle,
   StableDistribution[1, aWU90dC1h, bWU90dC1h, locWU90dC1h, scaleWU90dC1h]]
```

Out[42]=
```
StableDistribution[1, 1.59768, -0.0971292, -0.000157254, 0.00790013]
```

In[43]:=
```
(* Interesting ... compound less on the funding payments,
have more leeway. How does that make sense wrt inverse cdf exponentiation? *)
```

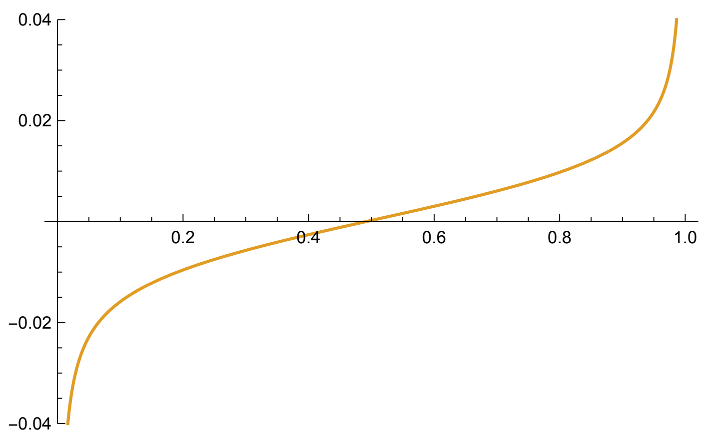
In[44]:=
```
Plot[{InverseCDF[edistWethUsdc90dFiltered, x],
  InverseCDF[edistWethUsdc90dFiltered1HourCandle, x],
  InverseCDF[edistWethUsdc90dFiltered4HourCandle, x]},
 {x, 0, 1.0}, PlotRange → {-0.04, 0.04}]
```

Out[44]=



In[45]:=
```
Plot[{, InverseCDF[edistWethUsdc90dFiltered1HourCandle, x]},
 {x, 0, 1.0},  PlotRange → {-0.04, 0.04}]
```

Out[45]=



In[46]:=
```
InverseCDF[edistWethUsdc90dFiltered1HourCandle, 0.99]
```

Out[46]= 0.0472398

In[47]:=
```
InverseCDF[edistWethUsdc90dFiltered, 0.99]
```

Out[47]= 0.0124991

In[48]:=
```
Exp[0.012499142980299232`]
```

Out[48]= 1.01258

In[49]:=
```
Exp[0.1072270317901139`]
```

Out[49]= 1.11319

In[50]:=
```
(* Hmmm, so maybe plot e^(mu * T + sig * (T/a)^(1/a) * F^{-1}(1-alpha)) as a
 function of update times T. What does this tell us vs d we're looking for? *)
```

```
In[51]:= edistWethUsdc90dFiltered1HourCandle
Out[51]= StableDistribution[1, 1.59768, -0.0971292, -0.000157254, 0.00790013]

In[52]:= (* Define mu, sig functions for exponential term in d *)

In[53]:= mu[a_, loc_] := loc

In[54]:= sig[a_, scale_] := scale / (1 / a) ^ (1 / a)

In[55]:= (* Apply to our case *)

In[56]:= muWethUsdc90dFiltered1HourCandle =
          mu[1.597679462042982`, -0.00015725436055898914`]
Out[56]= -0.000157254

In[57]:= sigWethUsdc90dFiltered1HourCandle = sig[1.597679462042982`, 0.007900125269736371`]
Out[57]= 0.0105925

In[58]:= aWethUsdc90dFiltered1HourCandle = 1.597679462042982`
Out[58]= 1.59768

In[59]:= edistWethUsdc90dFiltered1HourCandleNormalized =
          StableDistribution[1, aWethUsdc90dFiltered1HourCandle, 0, 0, 1]
Out[59]= StableDistribution[1, 1.59768, 0, 0, 1]

In[60]:= InverseCDF[edistWethUsdc90dFiltered1HourCandleNormalized, 0.90]
Out[60]= 1.98681

In[61]:= InverseCDF[edistWethUsdc90dFiltered1HourCandleNormalized, 0.95]
Out[61]= 2.81905

In[62]:= InverseCDF[edistWethUsdc90dFiltered1HourCandleNormalized, 0.99]
Out[62]= 6.31376

In[63]:= factorWethUsdc90dFiltered1HourCandle[t_, alpha_] :=
          Exp[muWethUsdc90dFiltered1HourCandle * t + sigWethUsdc90dFiltered1HourCandle *
             (t / aWethUsdc90dFiltered1HourCandle) ^ (1 / aWethUsdc90dFiltered1HourCandle) *
             InverseCDF[edistWethUsdc90dFiltered1HourCandleNormalized, 1 - alpha]]

In[64]:= factorWethUsdc90dFiltered1HourCandle[1, 0.01]
Out[64]= 1.05098

In[65]:= (* TODO: Redo this analysis! ... Below is in line with 4 hour candle above :) *)

In[66]:= factorWethUsdc90dFiltered1HourCandle[4, 0.01]
Out[66]= 1.12542
```

In[67]:= `factorWethUsdc90dFiltered1HourCandle[8, 0.01]`

Out[67]= `1.19967`

In[68]:= `(* Over 24 hours you can see the difference substantially at different confidence levels ... *)`

In[69]:= `factorWethUsdc90dFiltered1HourCandle[24, 0.01]`

Out[69]= `1.4345`

In[70]:= `factorWethUsdc90dFiltered1HourCandle[24, 0.10]`

Out[70]= `1.11735`

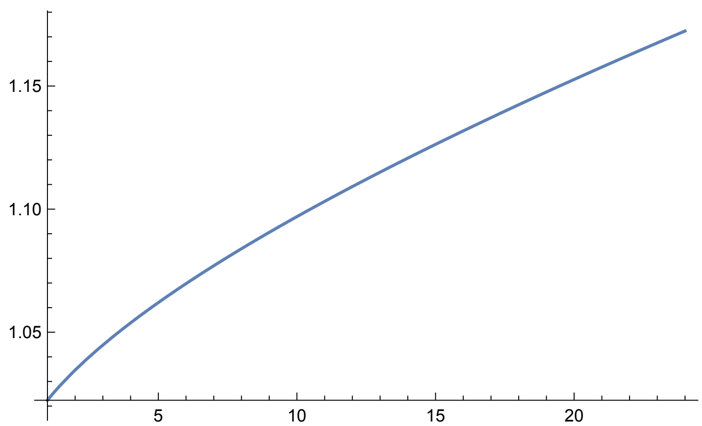
In[71]:= `factorWethUsdc90dFiltered1HourCandle[24, 0.05]`

Out[71]= `1.17235`

In[72]:= `(* VaR at 95% seems good here in terms of usability for trading. 15% draw down in a day worst case on ETH/USDC is not terrible in terms of funding rate max *)`

In[73]:= `Plot[factorWethUsdc90dFiltered1HourCandle[t, 0.05], {t, 1, 24}]`

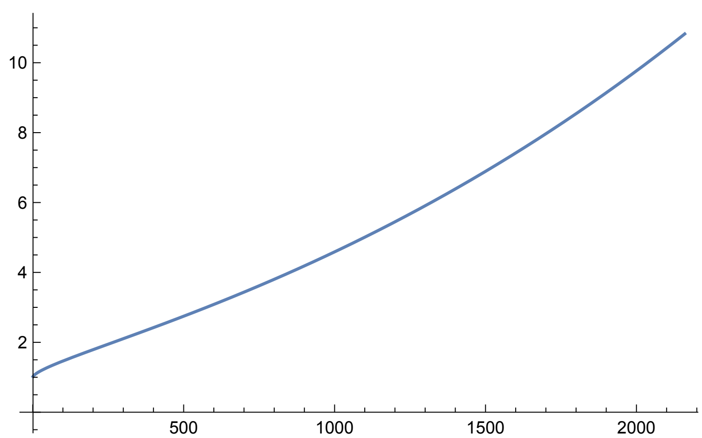
Out[73]=



In[74]:= `(* Interesting S shape here ... Due to the Exp[t^(1/1.5)] term *)`

In[75]:= `Plot[factorWethUsdc90dFiltered1HourCandle[t, 0.05], {t, 1, 24*30*3}]`

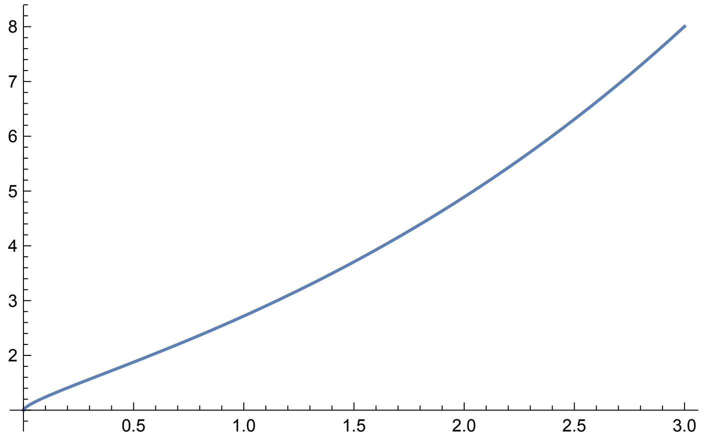
Out[75]=



```
(* So takes on order of 2 months to
 reach a 5x price cap on price bracket amount *)
```

In[76]:=
```
Plot[Exp[(t)^(1/1.5)], {t, 0, 3}]
```

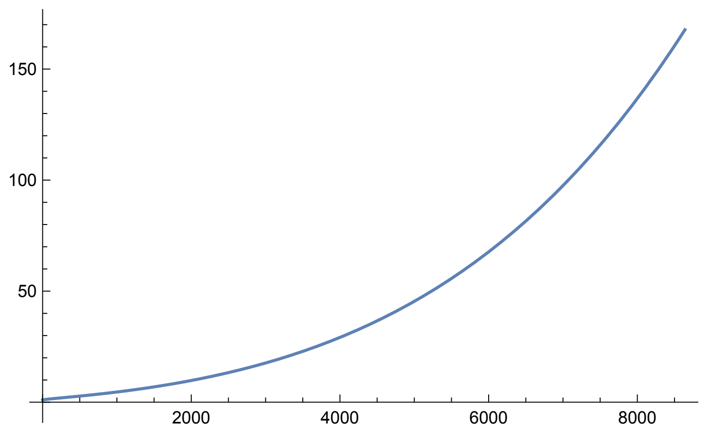
Out[76]=



In[77]:=
```
(* This is where caps become very good :) *)
```

In[78]:=
```
Plot[factorWethUsdc90dFiltered1HourCandle[t, 0.05], {t, 1, 24*30*12}]
```

Out[78]=



In[79]:=
```
(* Plot k AND (1-k)^m where m is diff depending on number of times we compound *)
```

In[80]:=
```
(* Assume k min is determined by factor value
 at 95% confidence for different number of periods T *)
```

In[152]:=
```
dmin95WethUsdc90dFiltered1HourCandle[t_] :=
 factorWethUsdc90dFiltered1HourCandle[t, 0.05]
```

In[82]:=
```
kmin95WethUsdc90dFiltered1HourCandle[t_] :=
 (1 - 1/dmin95WethUsdc90dFiltered1HourCandle[t]) / 2
```

In[83]:=
```
(* Look at different time periods ... 1 (1h),
4 (4h), 6 (6h), 8 (8h), 12 (12h), 24 (1d), 168 (7d) *)
```

In[84]:=
```
kmin95T1hWethUsdc90dFiltered1HourCandle = kmin95WethUsdc90dFiltered1HourCandle[1]
```

Out[84]=
```
0.0109354
```

In[85]:=
```
kmin95T4hWethUsdc90dFiltered1HourCandle = kmin95WethUsdc90dFiltered1HourCandle[4]
```
Out[85]= 0.0255287

In[86]:=
```
kmin95T6hWethUsdc90dFiltered1HourCandle = kmin95WethUsdc90dFiltered1HourCandle[6]
```
Out[86]= 0.0325961

In[87]:=
```
kmin95T8hWethUsdc90dFiltered1HourCandle = kmin95WethUsdc90dFiltered1HourCandle[8]
```
Out[87]= 0.0387123

In[88]:=
```
kmin95T12hWethUsdc90dFiltered1HourCandle =
 kmin95WethUsdc90dFiltered1HourCandle[12]
```
Out[88]= 0.0492077

In[89]:=
```
kmin95T1dWethUsdc90dFiltered1HourCandle = kmin95WethUsdc90dFiltered1HourCandle[24]
```
Out[89]= 0.0735077

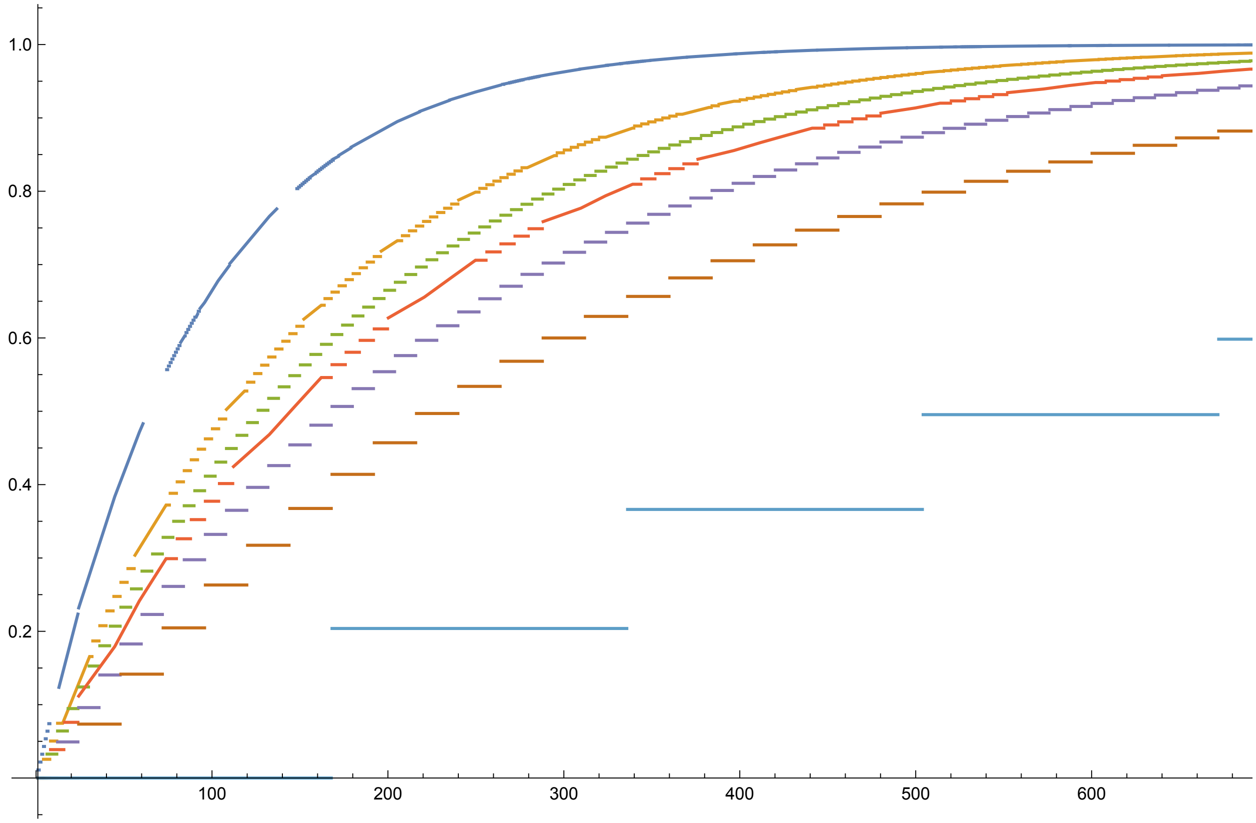
In[90]:=
```
kmin95T7dWethUsdc90dFiltered1HourCandle =
 kmin95WethUsdc90dFiltered1HourCandle[168]
```
Out[90]= 0.203882

In[91]:=
```
(* Interesting ... around minimum of 3.26% every 6 hr
 compounding. Can work with that to have some buffer in event bad fit *)
```

In[92]:=
```
drawDownMin95WethUsdc90dFiltered1HourCandle[t_, m_] :=
 1 - (1 - kmin95WethUsdc90dFiltered1HourCandle[m]) ^ (Floor[t / m])
```

In[93]:=
```
Plot[{drawDownMin95WethUsdc90dFiltered1HourCandle[t, 1],
  drawDownMin95WethUsdc90dFiltered1HourCandle[t, 4],
  drawDownMin95WethUsdc90dFiltered1HourCandle[t, 6],
  drawDownMin95WethUsdc90dFiltered1HourCandle[t, 8],
  drawDownMin95WethUsdc90dFiltered1HourCandle[t, 12],
  drawDownMin95WethUsdc90dFiltered1HourCandle[t, 24],
  drawDownMin95WethUsdc90dFiltered1HourCandle[t, 168]}, {t, 1, 24 * 30}]
```

Out[93]=

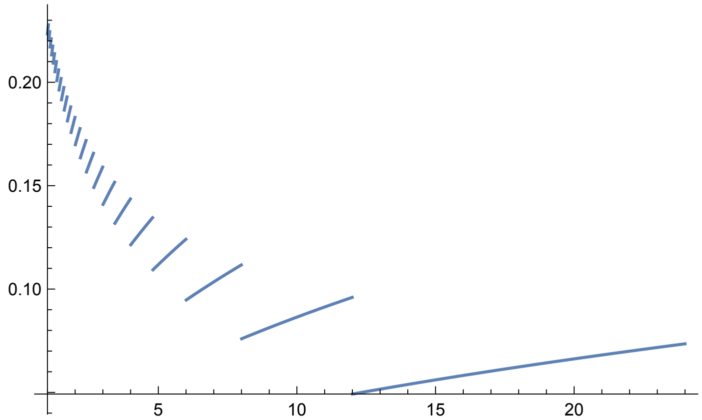


In[94]:=
```
(* Should like compare ratio of price bracket to d^(t/m). When set m for d,
setting point at which d^m =
 price bracket[m].. But d is NOT an interest rate... k = (1-1/d)/2 makes this
   interesting in terms of traders view on draw down to their OI ... *)
```

In[95]:=
```
(* Plot the actual interest rates seen per day for different values of m *)
```

In[96]:=
```
Plot[drawDownMin95WethUsdc90dFiltered1HourCandle[24, m], {m, 1, 24}]
```

Out[96]=



In[97]:=
```
drawDownMin95WethUsdc90dFiltered1HourCandle[24, 1]
```

Out[97]= 0.231947

In[98]:=
```
drawDownMin95WethUsdc90dFiltered1HourCandle[24, 4]
```

Out[98]= 0.143723

In[99]:=
```
drawDownMin95WethUsdc90dFiltered1HourCandle[24, 8]
```

Out[99]= 0.111699

In[100]:=
```
drawDownMin95WethUsdc90dFiltered1HourCandle[24, 12]
```

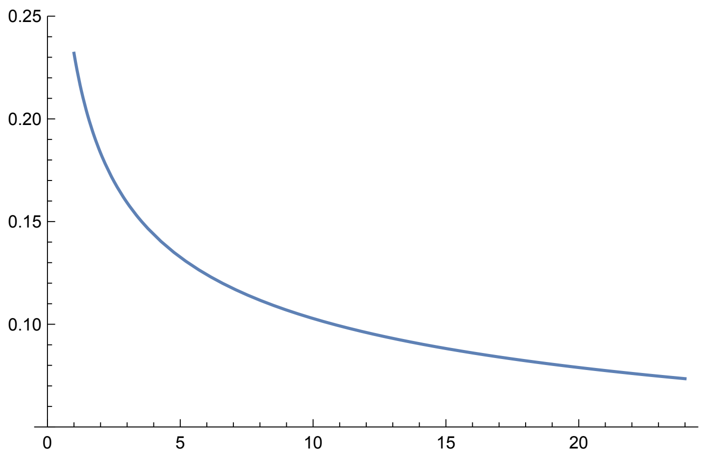
Out[100]= 0.095994

In[101]:=
```
(* Floor is making this visual
  difficult. Make continuous for plot purposes ... *)
```

In[102]:=
```
drawDownMin95WethUsdc90dFiltered1HourCandleContinuous[t_, m_] :=
 1 - (1 - kmin95WethUsdc90dFiltered1HourCandle[m]) ^ (t / m)
```

In[103]:=
```
(* Below is min funding rate required extended to per day rate,
if apply funding payment every m hours  *)
```

In[104]:=
```
Plot[drawDownMin95WethUsdc90dFiltered1HourCandleContinuous[24, m],
 {m, 1, 24}, PlotRange → {0.05, 0.25}]
```

Out[104]=


In[105]:=
```
(* Less we compound, smaller max DAILY funding rate needed to overcome
 price bracket changes. But more short term (<1d) we likely take *)
```

In[106]:=
```
(* Generalize this for any confidence level (not just 95%) *)
```

In[107]:=
```
dminWethUsdc90dFiltered1HourCandle[t_, alpha_] :=
 factorWethUsdc90dFiltered1HourCandle[t, alpha]
```

In[108]:=
```
kminWethUsdc90dFiltered1HourCandle[t_, alpha_] :=
 (1 - 1 / dminWethUsdc90dFiltered1HourCandle[t, alpha]) / 2
```

In[109]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[t_, alpha_, m_] :=
 1 - (1 - kminWethUsdc90dFiltered1HourCandle[m, alpha]) ^ (Floor[t / m])
```

In[110]:=
```
drawDownMinWethUsdc90dFiltered1HourCandleContinuous[t_, alpha_, m_] :=
 1 - (1 - kminWethUsdc90dFiltered1HourCandle[m, alpha]) ^ (t / m)
```

In[111]:=
```
(* If fit to 8h compounded rate but still pay every 10min,
how much is k? (k paid every 10 min but use 8h compounding amount) *)
```

In[112]:=
```
(* Function to rescale k min calibrated using factor's value at
  time m in the future. But then applied over shorter time span < m *)
```

In[113]:=
```
(* d_shorter^(#periods of short in long) = d_longer; m > t here *)
```

In[114]:=
```
rescaledKminWethUsdc90dFiltered1HourCandle[t_, alpha_, m_] :=
 (1 - 1 / (dminWethUsdc90dFiltered1HourCandle[m, alpha]) ^ (t / m)) / 2
```

In[115]:=
```
rescaledKminWethUsdc90dFiltered1HourCandle[1 / 6, 0.05, 8]
```

Out[115]=
```
0.000838735
```

In[116]:=
```
(* Calculate effective funding rate after 8 hours applied every 10 min *)
```

In[117]:=
```
1 - (1 - rescaledKminWethUsdc90dFiltered1HourCandle[1/6, 0.05, 8])^(6*8)
```
Out[117]= 0.0394759

In[118]:=
```
(* Compare with draw down applied only once every 8 hours *)
drawDownMinWethUsdc90dFiltered1HourCandle[8, 0.05, 8]
```
Out[118]= 0.0387123

In[119]:=
```
(* Looks good *)
```
In[120]:=
```
(* Plot price bracket * d^(t/m) over time t *)
```
In[121]:=
```
(* Look at funding rates needed over different confidence levels, to compare *)
```
In[122]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.01, 8]
```
Out[122]= 0.229456

In[123]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.05, 8]
```
Out[123]= 0.111699

In[124]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.10, 8]
```
Out[124]= 0.0800559

In[125]:=
```
(* Last 95 → 99% is what ramps it up significantly *)
```
In[126]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.01, 1]
```
Out[126]= 0.445257

In[127]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.05, 1]
```
Out[127]= 0.231947

In[128]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.10, 1]
```
Out[128]= 0.169511

In[129]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.05, 24]
```
Out[129]= 0.0735077

In[130]:=
```
(* Similar with rescale. See if applied every 10 min
 for 8 hour value but after 1 d, 7d, 14d what drawdown is *)
```
In[131]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.05, 8]
```
Out[131]= 0.111699

In[132]:=
```
1 - (1 - rescaledKminWethUsdc90dFiltered1HourCandle[1/6, 0.05, 8])^(6*24)
```
Out[132]= 0.113814

In[133]:=
```
drawDownMinWethUsdc90dFiltered1HourCandle[24*7, 0.05, 8]
```
Out[133]= 0.563564

In[134]:=
```
1 - (1 - rescaledKminWethUsdc90dFiltered1HourCandle[1/6, 0.05, 8])^(6*24*7)
```
Out[134]= 0.570786

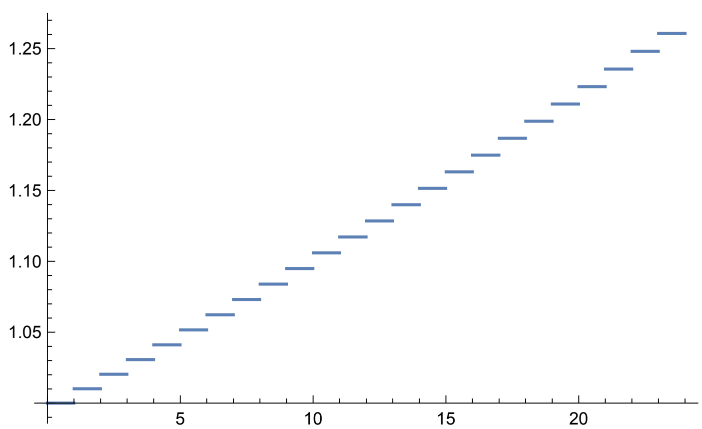
In[135]:=
```
(* Beautiful. Anchoring at factor value at m sets funding rate to
 be min. Does compound surpass price bracket at the 8 hour mark? *)

(* Look at rescaled draw down first to make sure consistent *)
```
In[160]:=
```
rescaledDrawDownMinWethUsdc90dFiltered1HourCandle[t_, alpha_, m_, anchor_] := 1 -
   (1 - rescaledKminWethUsdc90dFiltered1HourCandle[m, alpha, anchor])^(Floor[t/m])
```
In[168]:=
```
rescaledDrawDownMinWethUsdc90dFiltered1HourCandle[24, 0.05, 1, 8]
```
Out[168]= 0.113589

In[161]:=
```
rescaledDrawDownMinWethUsdc90dFiltered1HourCandle[24*7, 0.05, 1, 8]
```
Out[161]= 0.570023

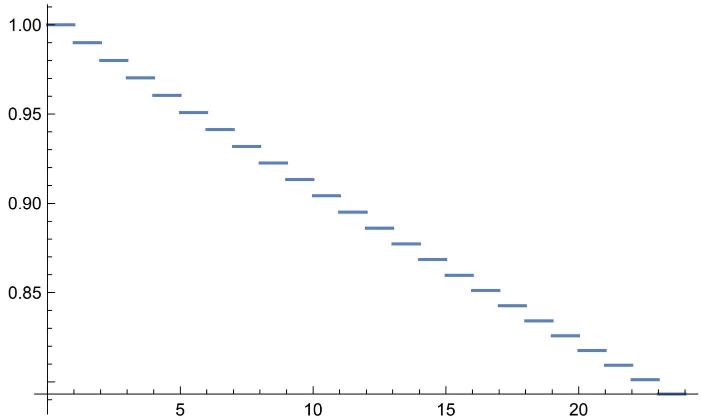
```
(* Great. 1h funding payments on 8h anchor look great *)
```

In[136]:=
```
(* Look at (1 - 2k)^m over time .... Compound
 factor for different compound intervals. Assume funding
 payments applied every 1 h for simplicity with fits. *)
```
In[137]:=
```
compoundFactorMinWethUsdc90dFiltered1HourCandle[t_, alpha_, m_, anchor_] :=
 (1 - 2*rescaledKminWethUsdc90dFiltered1HourCandle[m, alpha, anchor])^
  (Floor[t/m])
```
In[138]:=
```
(* 8h payment at 95% confidence of VaR led to
  drawdown of 11% worst case due to funding. Use alpha=0.05,
m=8. Rescaled funding st paid every 1 h *)
```
In[139]:=
```
Plot[
 {1/compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]}, {t, 0, 24}]
```
Out[139]=



In[140]:= `Plot[{compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]}, {t, 0, 24}]`

Out[140]=



In[141]:= `drawDownMinWethUsdc90dFiltered1HourCandle[24, 0.05, 8]`

Out[141]= 0.111699

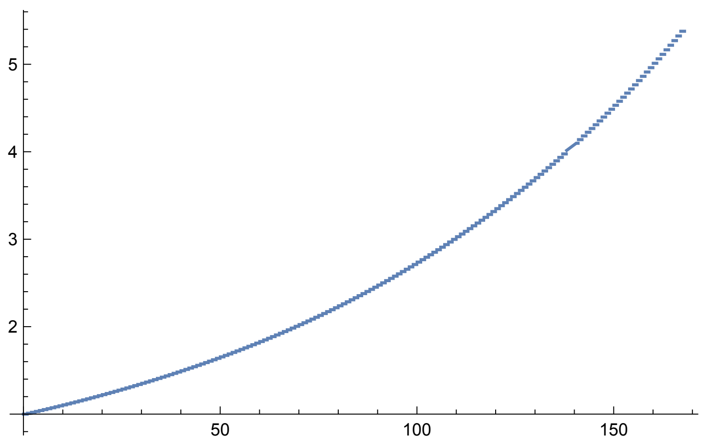
In[142]:= `1 - compoundFactorMinWethUsdc90dFiltered1HourCandle[24, 0.05, 1, 8]`

Out[142]= 0.214754

In[143]:=
```
(* Perfect. Draw down to OI imbalance
 should be about 2 times draw down to OI on a side *)
```

In[144]:=
```
Plot[1 / compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8],
 {t, 0, 24 * 7}]
```

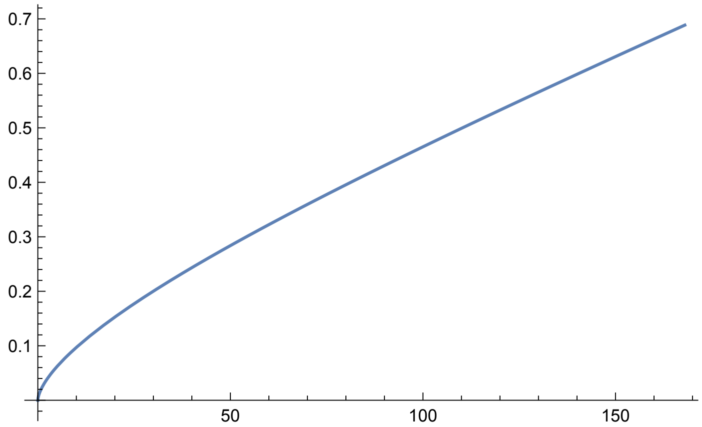
Out[144]=



In[145]:= `(* Plot price bracket ...  *)`

```
In[146]:= Plot[factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1, {t, 0, 24 * 7}]
```

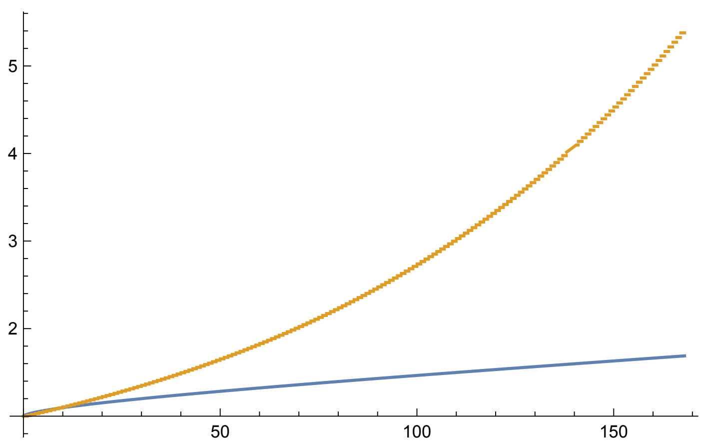
Out[146]=




```
In[147]:= (* Plot 1/compoundFactor vs price bracket *)

In[153]:= Plot[{factorWethUsdc90dFiltered1HourCandle[t, 0.05] , 1/
    compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]}, {t, 0, 24 * 7}]
```

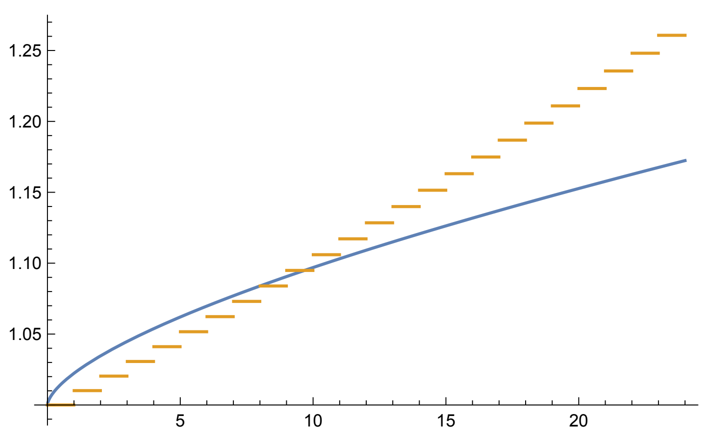
Out[153]=




```
(* Look at the earlier times ... *)

In[154]:= Plot[{factorWethUsdc90dFiltered1HourCandle[t, 0.05] ,
   1/compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]}, {t, 0, 24}]
```

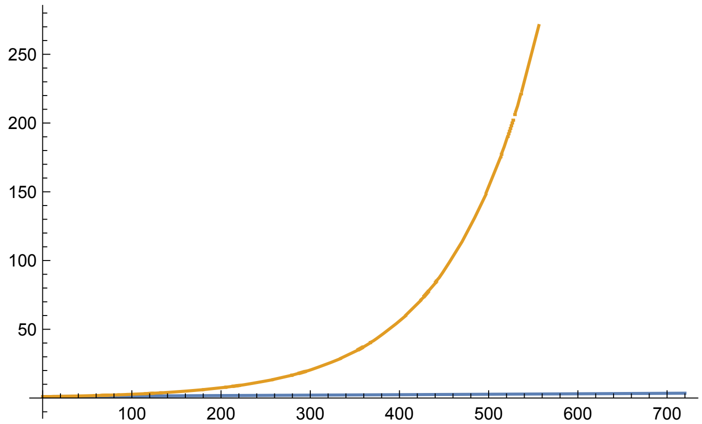
Out[154]=



```
(* Look at later times ... *)
```

In[159]:=
```
Plot[{factorWethUsdc90dFiltered1HourCandle[t, 0.05] ,
  1/compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]}, {t,
  0, 24*30}]
```

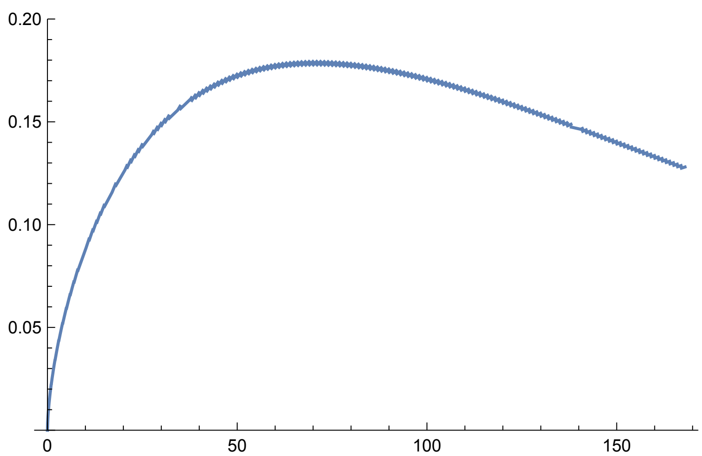
Out[159]=



In[149]:=
```
(* and the product of the two to make sure decreasing over time ... *)
```

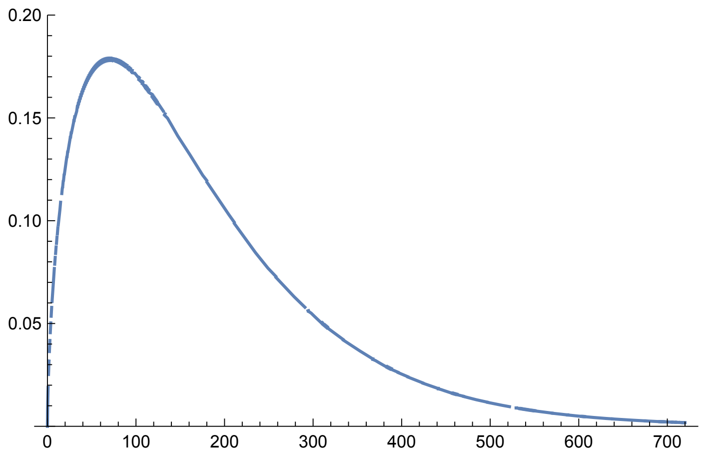
In[156]:=
```
Plot[(factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1) *
  compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8],
 {t, 0, 24*7}, PlotRange → {0, 0.2}]
```

Out[156]=



In[158]:=
```
Plot[(factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1) *
   compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8],
  {t, 0, 24 * 30}, PlotRange → {0, 0.2}]
```

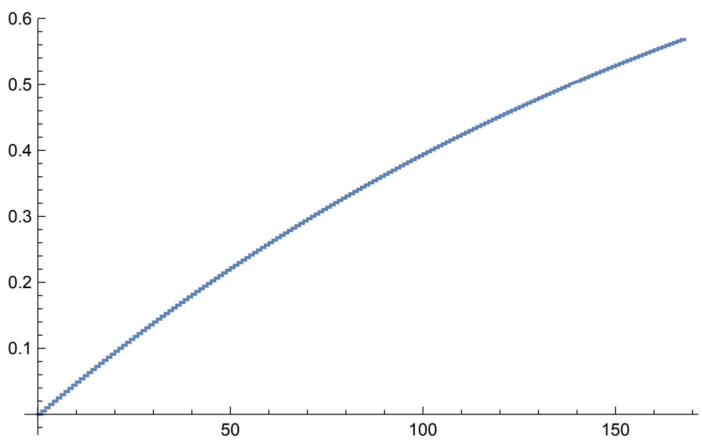
Out[158]=




```
(* Compare with draw down over time *)
```

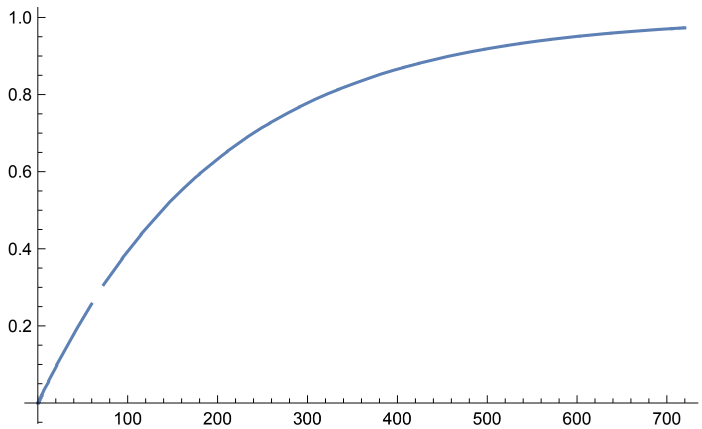
In[165]:=
```
Plot[{rescaledDrawDownMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]},
  {t, 0, 24 * 7}]
```

Out[165]=



In[166]:=
```
Plot[{rescaledDrawDownMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]},
 {t, 0, 24 * 30}]
```

Out[166]=

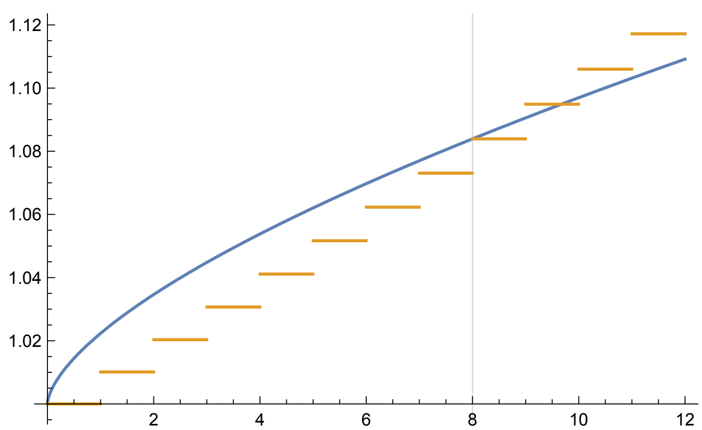


In[151]:=
```
(* Anchor used in k is everything. What is the
  interpretation? Time when d^m is exactly equal to first term in
  price bracket[m]. Then d^m surpasses greatly in size as m → infty *)

(* So look at 1/compoundFactor vs price factor BEFORE hit the anchor to
  make sure 1/compoundFactor is less but we cross at anchor time ... *)
```

In[157]:=
```
Plot[{factorWethUsdc90dFiltered1HourCandle[t, 0.05],
  1 / compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]},
 {t, 0, 12}, GridLines → {{8}}]
```

Out[157]=



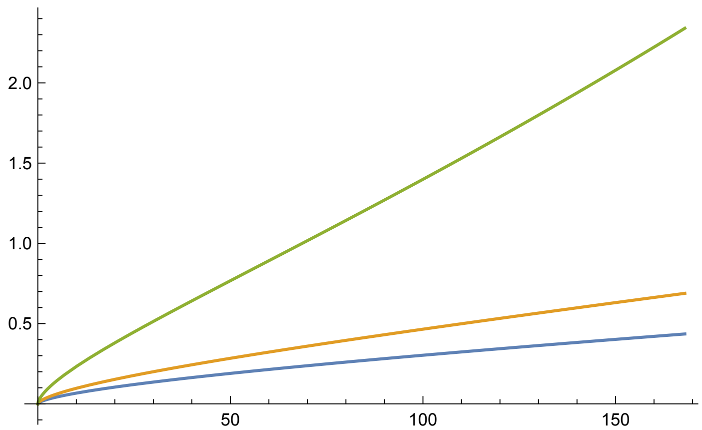

```
(* Perfect. Interpretation is correct. *)

(* Then product of price bracket and compound factor is playing catch up for
 the first 8 hours in order to get to point where decreasing over time? *)

(* Look at different price bracket
 VaR growth over time without compound factor *)
```

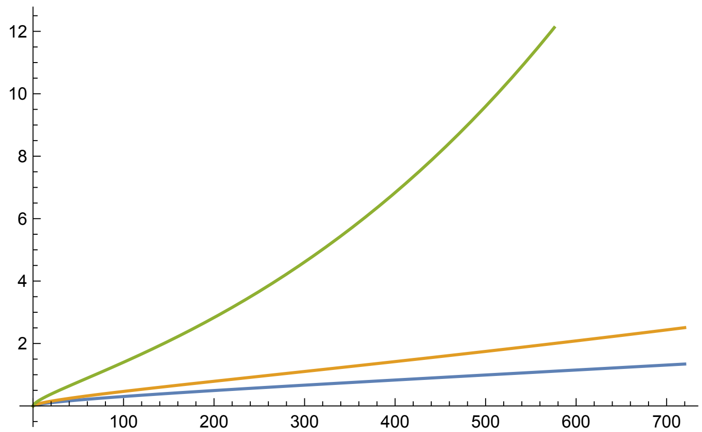
In[170]:=
```
Plot[{(factorWethUsdc90dFiltered1HourCandle[t, 0.10] - 1),
  (factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1),
  (factorWethUsdc90dFiltered1HourCandle[t, 0.01] - 1)}, {t, 0, 24 * 7}]
```

Out[170]=



In[176]:=
```
Plot[{(factorWethUsdc90dFiltered1HourCandle[t, 0.10] - 1),
  (factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1),
  (factorWethUsdc90dFiltered1HourCandle[t, 0.01] - 1)}, {t, 0, 24 * 30}]
```

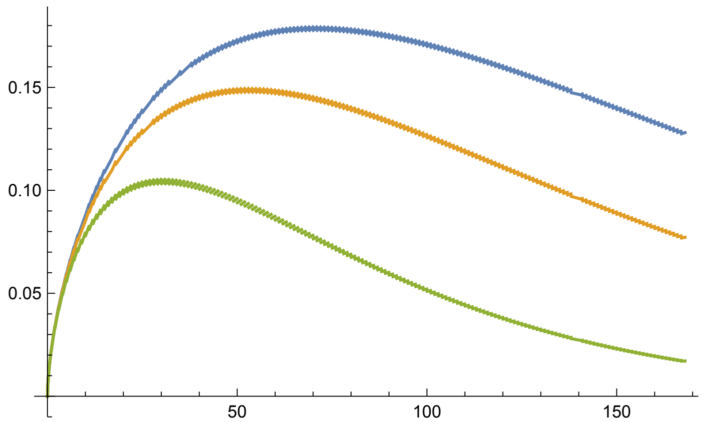
Out[176]=




```
(* Try product of price bracket and compound
  factor for different anchor times in k calibration ... *)
```

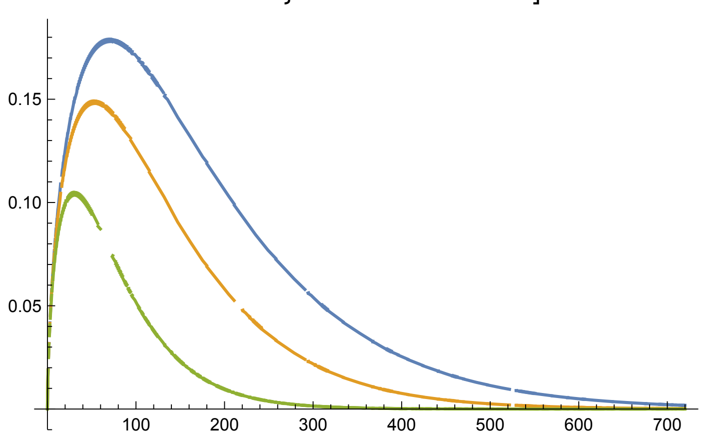
In[167]:=
```
Plot[{(factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1) *
   compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8],
  (factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1) *
   compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 4],
  (factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1) *
   compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 1]}, {t, 0, 24 * 7}]
```

Out[167]=



In[175]:=
```
Plot[{(factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1) *
   compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8],
  (factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1) *
   compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 4],
  (factorWethUsdc90dFiltered1HourCandle[t, 0.05] - 1) *
   compoundFactorMinWethUsdc90dFiltered1HourCandle[
    t, 0.05, 1, 1]}, {t, 0, 24 * 30}]
```

Out[175]=

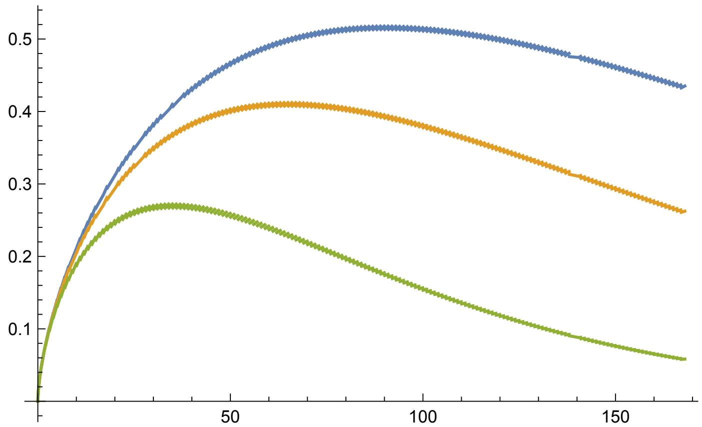



```
(* So most VaR to passive holders happens over
 shorter term when imbalance first created. Longer users hold
 positions and imbalance gets drawn down through funding,
the more VaR gets curbed and eventually brought to zero *)
```

```
(* What if we underestimate funding rate needed? As in should have used alpha=
 0.01 instead of alpha=0.05? what does this do to VaR over time? *)
```

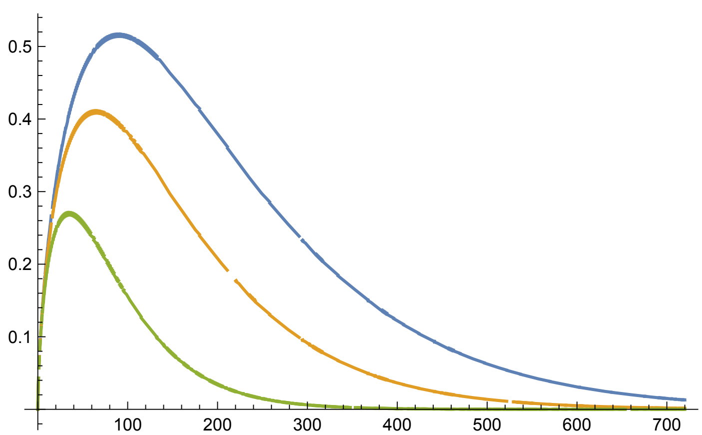
```
In[171]:= Plot[{(factorWethUsdc90dFiltered1HourCandle[t, 0.01] - 1) *
     compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8],
   (factorWethUsdc90dFiltered1HourCandle[t, 0.01] - 1) *
     compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 4],
   (factorWethUsdc90dFiltered1HourCandle[t, 0.01] - 1) *
     compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 1]}, {t, 0, 24 * 7}]
```

Out[171]=




```
In[173]:= Plot[{(factorWethUsdc90dFiltered1HourCandle[t, 0.01] - 1) *
     compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8],
   (factorWethUsdc90dFiltered1HourCandle[t, 0.01] - 1) *
     compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 4],
   (factorWethUsdc90dFiltered1HourCandle[t, 0.01] - 1) *
     compoundFactorMinWethUsdc90dFiltered1HourCandle[
      t, 0.05, 1, 1]}, {t, 0, 24 * 30}]
```

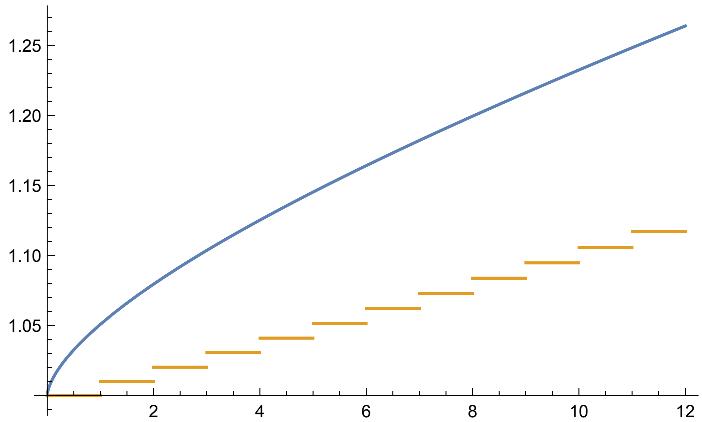
Out[173]=




```
(* Look at 1/compoundFactor (larger alpha than required) vs price
  factor BEFORE hit the anchor to see what new anchor time is ... *)
```

In[172]:=
```
Plot[{factorWethUsdc90dFiltered1HourCandle[t, 0.01],
  1/compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]}, {t, 0, 12}]
```

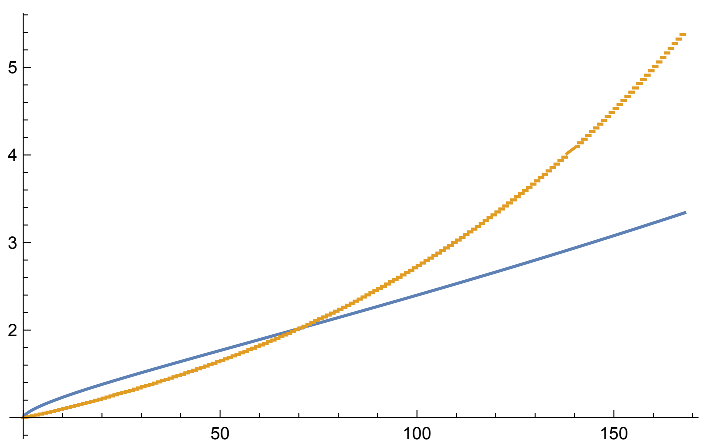
Out[172]=




```
(* Interesting, anchor time comes much later. Not great,
but still exists ... However, VaR still seems to decrease tho, just more drawn
 out AND significantly higher max value/peak (about 2x for alpha=0.05). *)
```

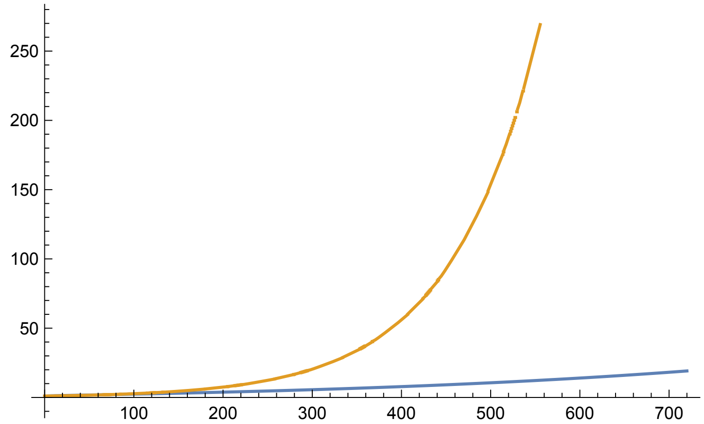
In[174]:=
```
Plot[{factorWethUsdc90dFiltered1HourCandle[t, 0.01], 1/
   compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]}, {t, 0, 24*7}]
```

Out[174]=



In[177]:=
```
Plot[{factorWethUsdc90dFiltered1HourCandle[t, 0.01],
  1/compoundFactorMinWethUsdc90dFiltered1HourCandle[t, 0.05, 1, 8]}, {t,
  0, 24*30}]
```

Out[177]=




```
(* Instead of anticipated anchor of 8h, get anchor around 72h (3d). *)
```

```
(* What about set funding factor to not exp^{(m*t)^{1/a}}
 but exp^{m*(t)^(1/a)}? What's difference in interest rate? *)
```

```
(* What about underestimating the stable distribution fit params? *)
```