```
In[•]:= (* C3.AI COVID CHALLENGE *)

In[•]:= (* Sweden *)

In[1191]:= Clear["Global`*"]

In[•]:= type = "Deaths_per_Million";
        policy = "C6_Policy";

In[1194]:= pD0 = 0.6649;
        pD1 = 0.1373;
        pD2 = 0.0598;
        pD3 = 0.1188;
        pD4 = 0.0192;

In[•]:= (* COnditional Prob *)

In[1200]:= pD0C6l1 = 0.7830;
        pD1C6l1 = 0.9973;
        pD2C6l1 = 0.9938;
        pD3C6l1 = 0.9969;
        pD4C6l1 = 0.9808;

In[1205]:= pD0C6l0 = 1 - pD0C6l1;
        pD1C6l0 = 1 - pD1C6l1;
        pD2C6l0 = 1 - pD2C6l1;
        pD3C6l0 = 1 - pD3C6l1;
        pD4C6l0 = 1 - pD4C6l1;

In[•]:= (* C6 - 1 *)

In[1211]:= prC6l0 = pD0 pD0C6l0 + pD1 pD1C6l0 + pD2 pD2C6l0 + pD3 pD3C6l0 + pD4 pD4C6l0
Out[•]= 0.145762

In[1212]:= prC6l1 = pD0 pD0C6l1 + pD1 pD1C6l1 + pD2 pD2C6l1 + pD3 pD3C6l1 + pD4 pD4C6l1
Out[•]= 0.854238

In[•]:= (* Quantum Prob *)

In[1214]:= interfC6l0 = Sqrt[pD0 pD0C6l0 pD1 pD1C6l0] Cos[θ00 - θ10] +
          Sqrt[pD0 pD0C6l0 pD2 pD2C6l0] Cos[θ00 - θ20] + Sqrt[pD0 pD0C6l0 pD3 pD3C6l0]
           Cos[θ00 - θ30] + Sqrt[ pD0 pD0C6l0 pD4 pD4C6l0] Cos[θ00 - θ40] +
          Sqrt[pD1 pD1C6l0 pD2 pD2C6l0 ] Cos[θ10 - θ20] + Sqrt[pD1 pD1C6l0 pD3 pD3C6l0]
           Cos[θ10 - θ30] + Sqrt[pD1 pD1C6l0 pD4 pD4C6l0 ] Cos[θ10 - θ40] +
          Sqrt[pD2 pD2C6l0 pD3 pD3C6l0] Cos[θ20 - θ30] + Sqrt[pD2 pD2C6l0 pD4 pD4C6l0 ]
           Cos[θ20 - θ40] + Sqrt[pD3 pD3C6l0 pD4 pD4C6l0 ] Cos[θ30 - θ40];
```

In[1215]:=
```
interfC6l1 = Sqrt[pD0 pD0C6l1 pD1 pD1C6l1] Cos[θ01 - θ11] +
    Sqrt[pD0 pD0C6l1 pD2 pD2C6l1] Cos[θ01 - θ21] + Sqrt[pD0 pD0C6l1 pD3 pD3C6l1]
     Cos[θ01 - θ31] + Sqrt[ pD0 pD0C6l1 pD4 pD4C6l1] Cos[θ01 - θ41] +
    Sqrt[pD1 pD1C6l1 pD2 pD2C6l1 ] Cos[θ11 - θ21] + Sqrt[pD1 pD1C6l1 pD3 pD3C6l1]
     Cos[θ11 - θ31] + Sqrt[pD1 pD1C6l1 pD4 pD4C6l1] Cos[θ11 - θ41] +
    Sqrt[pD2 pD2C6l1 pD3 pD3C6l1 ] Cos[θ21 - θ31] + Sqrt[pD2 pD2C6l1 pD4 pD4C6l1]
     Cos[θ21 - θ41] + Sqrt[pD3 pD3C6l1 pD4 pD4C6l1] Cos[θ30 - θ41];
```

In[1216]:=
```
qprC6l0 = prC6l0 + 2 interfC6l0;
```

In[1217]:=
```
qprC6l1 = prC6l1 + 2 interfC6l1;
```

In[1218]:=

In[1219]:=
```
qprC6l0Norm = FullSimplify[qprC6l0 / (qprC6l0 + qprC6l1)];
```

In[1220]:=
```
qprC6l1Norm = 1 - qprC6l0Norm;
(*FullSimplify[qprC6l1 / (qprC6l0+qprC6l1)]; *)
```

In[1221]:=
```
res = Minimize[{qprC6l0Norm, qprC6l0Norm + qprC6l1Norm == 1},
  {θ00, θ01, θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41}]
```

Out[•]=
```
{0.0270547, {θ00 → 3.12584, θ01 → -0.0157531, θ10 → -0.0157536,
  θ20 → -0.0157537, θ30 → -0.0157535, θ40 → -0.0157536, θ11 → -0.0157531,
  θ21 → -0.0157531, θ31 → -0.0157531, θ41 → -0.0157532}}
```

In[•]:=
```
(* Params *)
```

In[1223]:=
```
θ10 = res[[2]][[3]][[2]];
θ20 = res[[2]][[4]][[2]];
θ30 = res[[2]][[5]][[2]];
θ40 = res[[2]][[6]][[2]];
θ11 = res[[2]][[7]][[2]];
θ21 = res[[2]][[8]][[2]];
θ31 = res[[2]][[9]][[2]];
θ41 = res[[2]][[10]][[2]];
```

In[•]:=

In[•]:=
```
qprC6l0Norm = FullSimplify[qprC6l0 / (qprC6l0 + qprC6l1)];
```

In[•]:=
```
qprC6l1Norm = 1 - qprC6l0Norm;
```

In[•]:=
```
(* Updated probabilities *)
```

In[•]:=
```
{qprC6l0Norm, qprC6l1Norm}
```

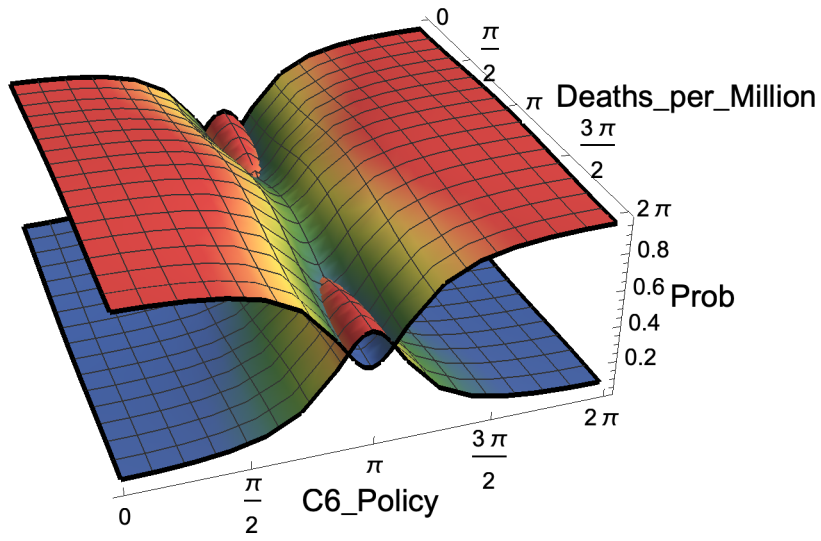
Out[•]=
```
{(10.3023 + 4.00665 Cos[θ00] - 0.0631243 Sin[θ00]) / (128.284 +
    4.00665 Cos[θ00] + 108.392 Cos[θ01] - 0.0631243 Sin[θ00] - 1.70765 Sin[θ01]),
 1 - (10.3023 + 4.00665 Cos[θ00] - 0.0631243 Sin[θ00]) / (128.284 +
    4.00665 Cos[θ00] + 108.392 Cos[θ01] - 0.0631243 Sin[θ00] - 1.70765 Sin[θ01])}
```

In[1236]:=
```
p0 = Plot3D[qprC6l0Norm, {θ00, 0, 2 π},
    {θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),
    AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},
    BoundaryStyle → Thick, Boxed → False,
    Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},
    TicksStyle → Directive[Black, 12]];
```

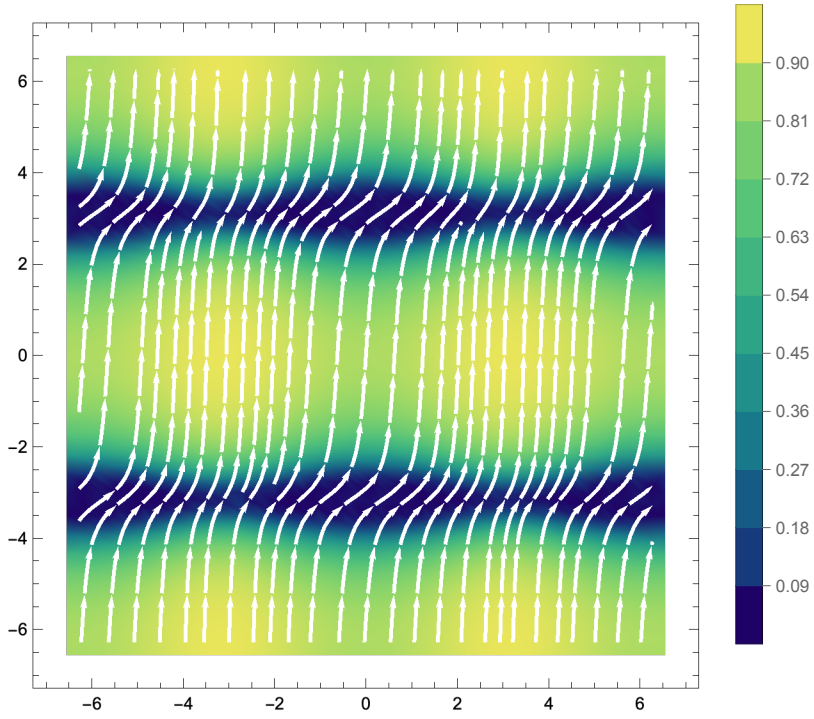
In[1237]:=
```
p1 = Plot3D[qprC6l1Norm, {θ00, 0, 2 π},
    {θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),
    AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},
    BoundaryStyle → Thick, Boxed → False,
    Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},
    TicksStyle → Directive[Black, 12]];
```

In[1238]:=
```
Show[p0, p1]
```

Out[•]=



In[•]:=
```
fig = StreamDensityPlot[{qprC6l0Norm, qprC6l1Norm},
  {θ00, -2 π, 2 π}, {θ01, -2 π, 2 π}, ColorFunction → "BlueGreenYellow",
  PlotLegends → BarLegend[{"BlueGreenYellow", {0, 1}}, 10],
  AxesLabel → Automatic, StreamStyle → {White, Thick}]
```




```
In[•]:= Clear[θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41]

In[•]:= res = Maximize[{qprC6l0Norm, qprC6l0Norm + qprC6l1Norm == 1},
          {θ00, θ01, θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41}]

Out[•]= {0.599076,
         {θ00 → -0.0157536, θ01 → -3.15735, θ10 → -1.04233, θ20 → -1.18342, θ30 → -1.33467,
          θ40 → -1.14213, θ11 → -1.55531, θ21 → 0.112742, θ31 → -1.76147, θ41 → 0.183178}}

In[•]:= (* Params *)

In[•]:= θ10 = res[[2]][[3]][[2]];
        θ20 = res[[2]][[4]][[2]];
        θ30 = res[[2]][[5]][[2]];
        θ40 = res[[2]][[6]][[2]];
        θ11 = res[[2]][[7]][[2]];
        θ21 = res[[2]][[8]][[2]];
        θ31 = res[[2]][[9]][[2]];
        θ41 = res[[2]][[10]][[2]];

In[•]:=

In[•]:= qprC6l0Norm = FullSimplify[qprC6l0 / (qprC6l0 + qprC6l1)];

In[•]:= qprC6l1Norm = 1 - qprC6l0Norm;

In[•]:= (* Updated probabilities *)
```

In[•]:=
```
{qprC6l0Norm, qprC6l1Norm}
```

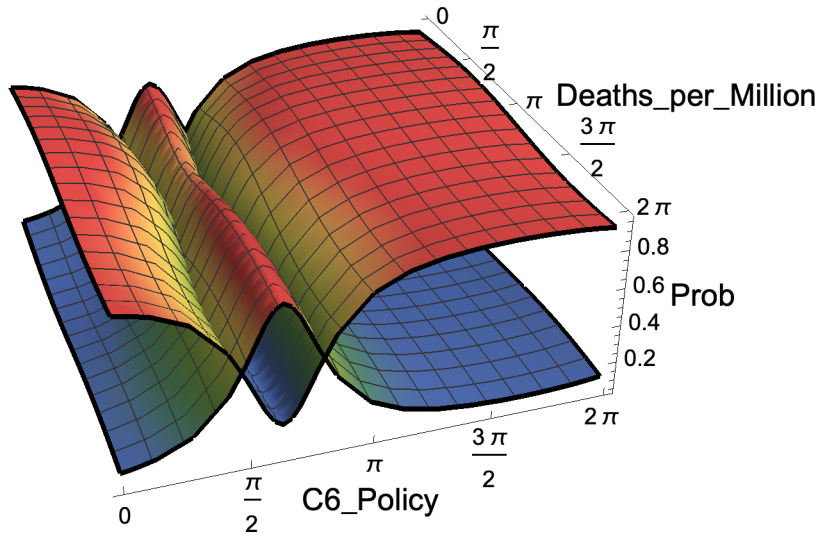
Out[•]=
$$\left\{\frac{10.264 + 1.52967\,\text{Cos}[\theta 00] - 3.66558\,\text{Sin}[\theta 00]}{84.8298 + 1.52967\,\text{Cos}[\theta 00] + 31.3413\,\text{Cos}[\theta 01] - 3.66558\,\text{Sin}[\theta 00] - 64.6681\,\text{Sin}[\theta 01]},\right.$$
$$\left.1 - \frac{10.264 + 1.52967\,\text{Cos}[\theta 00] - 3.66558\,\text{Sin}[\theta 00]}{84.8298 + 1.52967\,\text{Cos}[\theta 00] + 31.3413\,\text{Cos}[\theta 01] - 3.66558\,\text{Sin}[\theta 00] - 64.6681\,\text{Sin}[\theta 01]}\right\}$$

In[•]:=
```
p0 = Plot3D[qprC6l0Norm, {θ00, 0, 2 π},
    {θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),
    AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},
    BoundaryStyle → Thick, Boxed → False,
    Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},
    TicksStyle → Directive[Black, 12]];
```

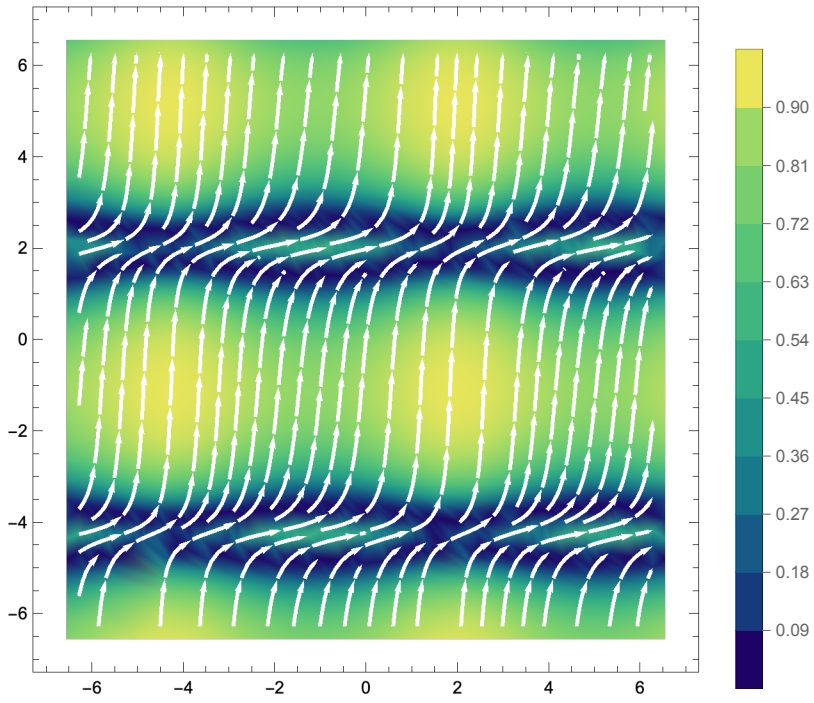
In[•]:=
```
p1 = Plot3D[qprC6l1Norm, {θ00, 0, 2 π},
    {θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),
    AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},
    BoundaryStyle → Thick, Boxed → False,
    Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},
    TicksStyle → Directive[Black, 12]];
```

In[•]:=
```
Show[p0, p1]
```

Out[•]=



In[•]:=
```
fig = StreamDensityPlot[{qprC6l0Norm, qprC6l1Norm},
  {θ00, -2 π, 2 π}, {θ01, -2 π, 2 π}, ColorFunction → "BlueGreenYellow",
  PlotLegends → BarLegend[{"BlueGreenYellow", {0, 1}}, 10],
  AxesLabel → Automatic, StreamStyle → {White, Thick}]
```


6
4
2
0
−2
−4
−6
−6
−4
−2
0
2
4
6
0.90
0.81
0.72
0.63
0.54
0.45
0.36
0.27
0.18
0.09