7: Appendix

Figure 1: Example of a simple random network

```
ER[n_, p_] :=
  Table[If[j == k, 0, RandomChoice[{p, 1 - p} → {1, 0}]], {j, 1, n}, {k, 1, n}];
A0 = ER[20, 0.1];
GraphPlot[A0, DirectedEdges → True]
```

Figure 3: Plot showing the gradient-learning model and the scenarios

$$U[J\_] := m\, J - \frac{c}{2} J^2;$$

```
D[U[J], J];
Solve[-c J + m == 0, J];
```

$$\mathrm{DSolve}[\{\partial_t J[t] == \alpha\, U[J[t]] - \beta\, J[t],\ J[0] == J0\},\ J[t],\ t];$$

```
Plot[
```

$$\left\{\frac{2\, e^{m t \alpha + \frac{i\, m \alpha\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} (m \alpha - \beta)}{-e^{t \beta + \frac{i\, \beta\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} + c\, e^{m t \alpha + \frac{i\, m \alpha\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} \alpha}\ /.\ m \to 5\ /.\ c \to 0.1\ /.\ \alpha \to 0.9\ /.\ \beta \to 0.9\ /.\ J0 \to 0.001,\right.$$

$$\frac{2\, e^{m t \alpha + \frac{i\, m \alpha\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} (m \alpha - \beta)}{-e^{t \beta + \frac{i\, \beta\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} + c\, e^{m t \alpha + \frac{i\, m \alpha\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} \alpha}\ /.\ m \to 5\ /.\ c \to 0.1\ /.\ \alpha \to 0.2\ /.\ \beta \to 0.2\ /.\ J0 \to 0.001,$$

$$\frac{2\, e^{m t \alpha + \frac{i\, m \alpha\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} (m \alpha - \beta)}{-e^{t \beta + \frac{i\, \beta\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} + c\, e^{m t \alpha + \frac{i\, m \alpha\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} \alpha}\ /.\ m \to 5\ /.\ c \to 0.1\ /.\ \alpha \to 0.9\ /.\ \beta \to 0.2\ /.\ J0 \to 0.001,$$

$$\left.\frac{2\, e^{m t \alpha + \frac{i\, m \alpha\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} (m \alpha - \beta)}{-e^{t \beta + \frac{i\, \beta\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} + c\, e^{m t \alpha + \frac{i\, m \alpha\, (\pi - i\, \mathrm{Log}[J0] + i\, \mathrm{Log}[-c\, J0\, \alpha + 2 m \alpha - 2 \beta])}{m \alpha - \beta}} \alpha}\ /.\ m \to 5\ /.\ c \to 0.1\ /.\ \alpha \to 0.2\ /.\ \beta \to 0.9\ /.\ J0 \to 0.001\right\},\ \{t, 0, 100\},$$

```
 FrameLabel → {"t  (Time)", "J[t]  (Number of job applications over time)"},
 PlotLabel →
  Style["Gradient-learning model showing AI impact on job applications",
   18, Bold, Black],
 PlotTheme → "Scientific",
 ImageSize → Large,
 LabelStyle → Directive[Black, Bold],
 PlotLegends → {"Scenario 1", "Scenario 2", "Scenario 3", "Scenario 4"}]
```

··· Solve : Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information.

Figure 4: TFP over time for a developed and developing country

```
U[x_] := α (A x + B x^2);
∂_t x[t] == L ∂_x[t] U[x[t]];
Plot[Floor[t], {t, 2023, 2100}, Frame → True]
F[λ_] := RandomVariate[PoissonDistribution[λ]];
InnovationList0 = Table[F[1], {j, 1, 1000}];
AISchum[t_, InnovationList_] := AI0 γ^(Σ_{k=1}^{Floor[t]} InnovationList[[k]]);
SolSchum1[Lα_, AI1_, γ1_, x0_, T_, InnovationList_] := x[t] /.
   NDSolve[{x′[t] == Lα ((AISchum[t, InnovationList] /. AI0 → AI1 /. γ → γ1) - x[t]),
      x[0] == x0}, x[t], {t, 0, T}][[1]];
Solx1 = SolSchum1[0.8, 100, 0.9, 1, 100, InnovationList0];
Solx2 = SolSchum1[0.2, 100, 0.9, 1, 100, InnovationList0];
Plot[{Solx1, Solx2}, {t, 0, 100},
 Frame → True,
 FrameLabel → {"Time (years from now)", "Total Factor Productivity"},
 PlotRange → Full,
 PlotLabel → Style["Total Factor Productivity over time", 20, Bold, Black],
 PlotTheme → "Scientific",
 PlotLegends → {"Developed country", "Developing country"},
 LabelStyle → Directive[Black, Bold],
 ImageSize → Large]
```

Figure 5: Development gap in technological progress over time for a developed and developing country

```
Plot[{Solx1 - (AISchum[t, InnovationList0] /. AI0 → 100 /. γ → 0.9),
  Solx2 - (AISchum[t, InnovationList0] /. AI0 → 100 /. γ → 0.9)}, {t, 0, 100},
 Frame → True,
 FrameLabel → {"Time (years from now)", "Development-gap"},
 PlotRange → Full,
 PlotLabel → Style["Development gap over time", 20, Bold, Black],
 PlotTheme → "Scientific",
 PlotLegends → {"Developed country", "Developing country"},
 LabelStyle → Directive[Black, Bold],
 ImageSize → Large]
```