Scary Bad News

Scary bad news reduces the world’s collective mean expected outcome. It also greatly increases the range of possible outcomes. Finally, it dramatically increases the divergence in views, between those with bullish and bearish outcomes. How might we Apply this view to today’s circumstances? Think Trump, trade, and our bicameral legislature.

Trump proposes a 45% tax on Chinese imports, and needs both the Senate and the House for this to become law. Everyone agrees that this would provoke an all-out trade War with China, and share prices would implode. Optimists think the Senate and House will almost certainly reject this proposal. They view each House as, independently, 90% likely to reject the proposal. Pessimists worry that each house, independently, are 20% likely to approve of this legislation.

Optimists Notions:

Senate rejects Trump proposed 45% tax on Chinese imports: 90% likely
Senate approves Trump proposed 45% tax on Chinese imports: 10% likely

Pessimists Notions:

House rejects Trump proposed 45% tax on Chinese imports: 80% likely
House approves Trump proposed 45% tax on Chinese imports: 20% likely

Asset prices equal 1, unless both the House and the Senate approve the legislation. If both approve, asset prices fall to 0.2%

Optimists Output expectations:

<table>
<thead>
<tr>
<th>Senate</th>
<th>House</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>.9 × .9 = .81</td>
</tr>
<tr>
<td>R</td>
<td>A</td>
<td>.9 × .1 = .09</td>
</tr>
<tr>
<td>A</td>
<td>R</td>
<td>.1 × .9 = .09</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>.1 × .1 = .01</td>
</tr>
</tbody>
</table>

MEAN EXPECTED OUTCOME:

(0.99 × 1) + (0.01 × 0.2) = .992

VARIANCE OF OUTPUT EXPECTATIONS:

\[ V = \sum X^2 \cdot P_x - \bar{X}^2 \]

\[ = [(1^2 \cdot .99) + (.2^2 \cdot .01)] - .992^2 \]

\[ = .0063 \]

Pessimists Output expectations:

<table>
<thead>
<tr>
<th>Senate</th>
<th>House</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>.8 × .8 = .64</td>
</tr>
<tr>
<td>R</td>
<td>A</td>
<td>.8 × .1 = .08</td>
</tr>
<tr>
<td>R</td>
<td>A</td>
<td>.1 × .8 = .08</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>.2 × .2 = .04</td>
</tr>
</tbody>
</table>

MEAN EXPECTED OUTCOME:

(0.96 × 1) + (0.04 × 0.2) = .968

VARIANCE OF OUTPUT EXPECTATIONS:

\[ V = \sum X^2 \cdot P_x - \bar{X}^2 \]

\[ = [(1^2 \cdot .96) + (.2^2 \cdot .04)] - .968^2 \]

\[ = .025 \]
SCARY BAD NEWS: THE SENATE APPROVES THE TARIFF

Optimists Output expectations:  

<table>
<thead>
<tr>
<th>Senate</th>
<th>House</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>R</td>
<td>1 x .9 = .9</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>1 x .1 = .1</td>
</tr>
</tbody>
</table>

Mean expected outcome: 

\[(.9 \times 1) + (.1 \times .2) = .92\]

Variance of output expectations: 

\[V = \sum X^2 \cdot P_x - \mu^2\]

\[= [(1^2 \cdot .9) + (.2^2 \cdot 1)] - .92^2\]

\[= .058\]

Optimist mean: .992  
Optimist variance: .0063

Pessimists Output expectations:  

<table>
<thead>
<tr>
<th>Senate</th>
<th>House</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>R</td>
<td>1 x .8 = .80</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>1 x .2 = .2</td>
</tr>
</tbody>
</table>

Mean expected outcome: 

\[(.8 \times 1) + (.2 \times .2) = .84\]

Variance of output expectations: 

\[V = \sum X^2 \cdot P_x - \mu^2\]

\[= [(1^2 \cdot .8) + (.2^2 \cdot .2)] - .84^2\]

\[= .102\]

Pessimist mean: .968  
Pessimist variance: .025

Optimists variance goes up nearly 10 fold!  
Optimist/pessimist mean outcome spread MORE THAN TRIPLES!  
Pessimists now see a 20% chance of Armageddon—those are worse odds than Russian Roulette!  
(And no Sane person plays Russian Roulette)

The point? Negative resolution of one of the two conditional events has powerful effects. 
The asset market, pre-Senate vote, assigned somewhere between a 1 in 100 and a 4 in 100 chance of Armageddon. After the vote? Somewhere between 1 in 10 and 1 in 5.

The VIX: An estimate of market participants’ expectation for future volatility, based upon weighted averages of equity market futures prices. Note that it slowly falls then violently jumps. 
We slowly convince ourselves of shrinking risks. Then we get scary news. 
Note also that scary news, half the time, is not followed by horrible reality.
Leverage and the Law of One Price

A workhorse of modern macroeconomic theory is the representative agent. This entity is assumed to be rational, forward looking, intergenerational, and an approximation to how, in aggregate, all of us would respond to differing economic developments. We all know, however, that people have very different notions about how the world works, and we witness a wide variety of reactions to emerging developments. The Geanakoplos paper explicitly rejects this framework, to great effect. He assumes people hold a continuum of beliefs about the future. And he uses elegant math to show that these people will trade and produce one market price in a world that does not allow borrowing, and a higher price, once we introduce the right to borrow.

What does this world look like?

There are two time periods: t₀ and t₁.
Individuals, in t₀, are given one unit of a Consumption good, c, and one unit of an investment good, Y. Y pays either 1 unit of c, in an UP world, or 0.2 units of c, in a DOWN world.
The individuals want to maximize their utility. Utility is derived from consuming, in t₀ or t₁.
Individuals don’t care about when they consume (No discount rate, they are not ‘impatient’)
Individuals may costlessly warehouse consumer goods, w. (these are canned peas not fresh bananas)
(We make the result easy to see by assuming all agents warehouse all c in t₀, and consume all c in t₁)
Most importantly, there is a perfect spread of opinion about Y’s payoff:
Some are sure it will pay 1 unit of c. Some are sure it will pay 0.2 units of c.
And a spectrum of others populates the gaps.
Agents can trade c in period 0 for Y.
We arrive at an equilibrium price for P, how much c one must pay to get a unit of Y, in t₀.
Each agent will have values for c, y, and w in t₀.
Each agent, in period t₁, will get utility from the amount of c they have.
Utility, in t₁, is a function of whether the world is UP or DOWN.
Each agent h, is configured as follows:

\[(c₀, y₀, w₀, c_U, c_D)\]

Suppose there are 100 agents. They are all rational. They can all do some simple math. They simply have a wide range of opinions about what the future will look like. Given their range of opinions about how much c Y will deliver in period 1, we can derive P, the equilibrium price.
We can use a spreadsheet to see that agents 60 to 100 are buyers and agents 1 to 59 are sellers:

<table>
<thead>
<tr>
<th>agent h</th>
<th>UP PROBABILITY</th>
<th>MEAN Y value</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100%</td>
<td>1</td>
</tr>
<tr>
<td>90</td>
<td>90%</td>
<td>0.92</td>
</tr>
<tr>
<td>80</td>
<td>80%</td>
<td>0.84</td>
</tr>
<tr>
<td>70</td>
<td>70%</td>
<td>0.76</td>
</tr>
<tr>
<td>60</td>
<td>60%</td>
<td>0.68</td>
</tr>
<tr>
<td>59</td>
<td>59%</td>
<td>0.672</td>
</tr>
<tr>
<td>50</td>
<td>50%</td>
<td>0.6</td>
</tr>
<tr>
<td>40</td>
<td>40%</td>
<td>0.52</td>
</tr>
<tr>
<td>30</td>
<td>30%</td>
<td>0.44</td>
</tr>
<tr>
<td>20</td>
<td>20%</td>
<td>0.36</td>
</tr>
<tr>
<td>10</td>
<td>10%</td>
<td>0.28</td>
</tr>
<tr>
<td>1</td>
<td>1%</td>
<td>0.208</td>
</tr>
</tbody>
</table>

Agent 60’s mean expected outcome? \( Y = (0.6 \times 1) + (0.4 \times .2) = 0.68 \)
All agents above agent 60 have higher expectations. They will buy \( Y \), if \( P = 0.68 \)
All agents below agent 60 have lower expectations. They will sell \( Y \), if \( P = 0.68 \)

So 41 buyers trade 1 unit of \( c \) for \( 1/.68 \), or roughly 1.47 units of \( Y \). They buy 59 units.
Sellers, \( h \) 1 to \( h \) 59, sell 59 units.

The market cleared. At \( P = .68 \), the following is true:

\[
(c_0, y_0, w_0, c_U, c_D) = (0, 2.5, 0, 2.5, 0.5) \text{ for } h \geq 60
\]

\[
(c_0, y_0, w_0, c_U, c_D) = (0, 0, 1.68, 1.68, 1.68) \text{ for } h \leq 60
\]

**WHAT Happens when we allow for borrowing?**

Let us think about that qualitatively today. We will move look at it formally, in the second half of this course. It is easy to see that if I am very optimistic, and I can find a willing lender, offering a low interest rate, I will accumulate more. And this drives the equilibrium price higher! Why? Because we end up with the assets held by the most optimistic agents.