

COVID-19: Travel Ban Effect on Macro Economy

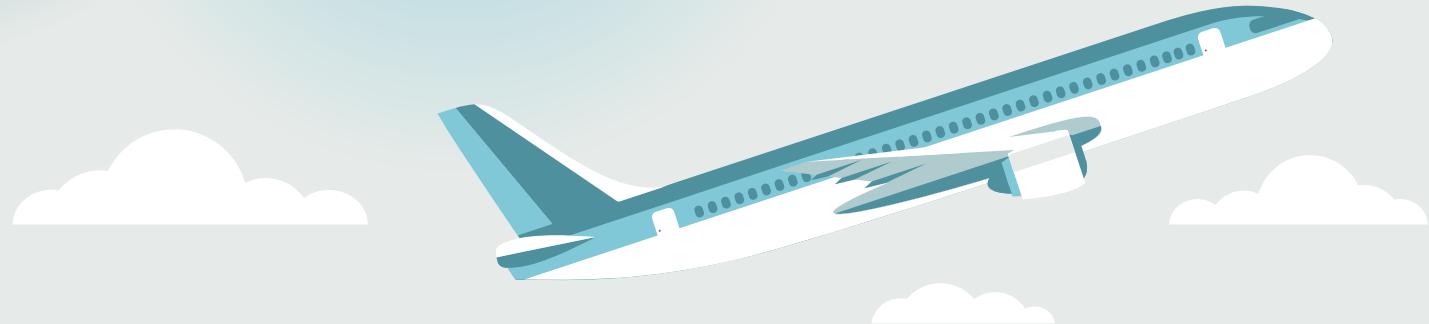
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Macro 200
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About the COVID-19 Travel Ban Policy

- On March 13, 2020 → Pres. Trump issued a national emergency concerning Coronavirus
- The Dept. of Homeland Security (DHS) found it is “acceptable” for flights to be delayed and cancelled that are under the “**security**” category to mitigate spread of COVID-19
- The following principles are acceptable under the “security” category
 - Compliance with Federal directive or notices to mitigate the spread
 - Including mass cancellations
 - Closure of National Airspace System (NAS) facilities
 - Reduced discretionary travel and increased distancing





Setting the Assumptions





Affecting the Consumer

- ❖ The travel ban policy is denoted by theta (θ').
 - θ is 0 → the travel ban is implemented and the consumer is not able to travel
 - θ is 1 → there is no travel ban and the consumer is free to travel
- ❖ Travel is only used for pleasure (ie. consumer is not getting paid to travel)
- ❖ Every consumer travels based on the assumption that every consumer in any industry has 2 week unpaid vacation time that they use to travel away from their home.
- ❖ Each consumer must buy one ticket (when possible - ie. no travel ban)
- ❖ $\pi_{AI} = \pi_G$ and $\pi'_{AI} = \pi'_{G}$ → Since profits are equal for both consumers, the consumer's problem in the two industries are numerically the same

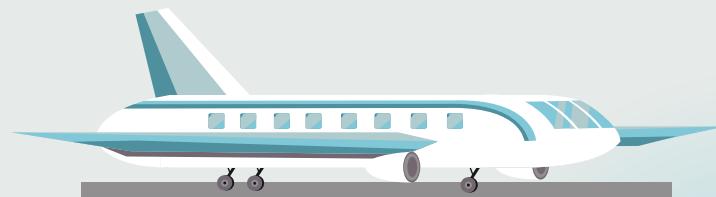


Affecting the Airline

- ❖ The Airline Industry (United Airlines) is a monopoly
- ❖ It takes at least 10 people to enable a plane to fly
- ❖ Every plane is the same size, each plane has exactly 100 seats
 - When plane is booked to capacity (ie. all 100 seats are purchased / 100 plane tickets were sold) an additional plane is used
- ❖ The Airline sells one ticket to each consumer; each consumer must buy one ticket (when possible ie. no travel ban)



Looking at the Models



Consumer in the Goods Industry ↘



Consumer Working in the Goods Industry (π_6)

MAX

$$U(c, l_L, l_A, c', l'_L, l'_A)$$

WHERE

$$c, l_L, l_A, c', l'_L, l'_A, s^P$$

$$c, l_L, c', l_L \geq 0$$

$$l_A, l'_A > 0$$

$$N = (H - l_L - \theta l_A)$$

θ = either 0 or 1

$$c + w l_L + w \theta l_A + p_s \theta + s^P = w H + \pi_6 - T$$

$$c' + w' l'_L + w' \theta' l'_A + p'_s \theta' = w H + \pi'_6 - T' + (1+r) s^P$$



Consumer in the Airline Industry



Consumer Working in Airline Industry (Π_{AI})

MAX

$c, l_L, l_A, c', l_L', l_A', s^P$

WHERE
 $U(c, l_L, l_A, c', l_L', l_A')$

WHERE:

$c, l_L, c', l_L' \geq 0$

$l_A, l_A' > 0$

$N = (H - l_L - \theta l_A)$

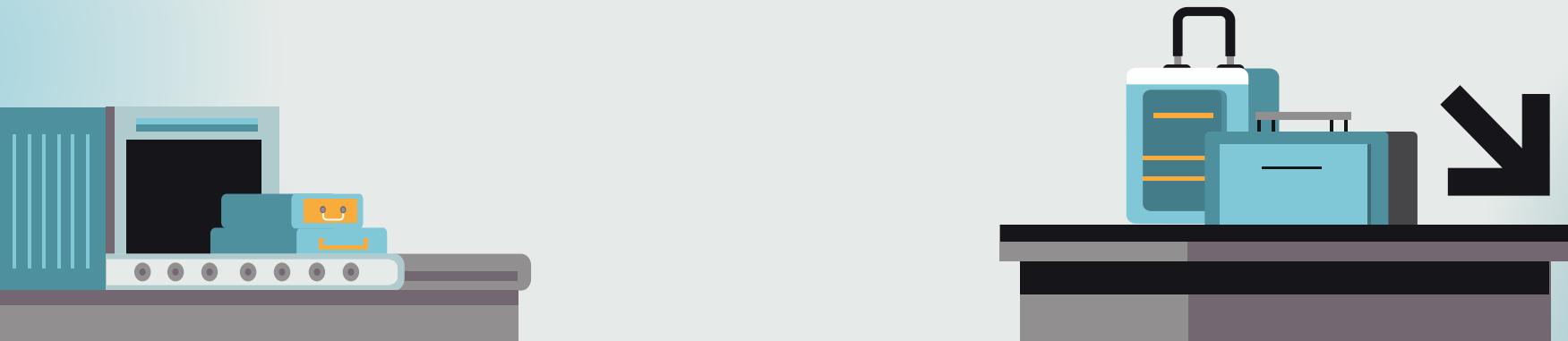
$\theta = \text{either } 0 \text{ or } 1$

$$c + w l_L + w\theta l_A + p_s \theta + s^P = wH + \Pi_{AI} - T$$

$$c' + w'l_L' + w'\theta'l_A' + p'_s\theta' = wH + \Pi_{AI}' - T' + (1+r)s^P$$



Firm in the Goods Industry



Representative Goods Firm

$$\underset{I, N, N'}{\text{MAX}} \quad \left[z_c F_c(\bar{K}_c, N_c) - (w \cdot N_c) - I \right] + \frac{1}{1+r} \left[z'_c F_c(K'_c, N'_c) + (1-d)K' - (w'_c \cdot N'_c) \right]$$

WHERE

$$K' = (1-d)\bar{K} + I$$





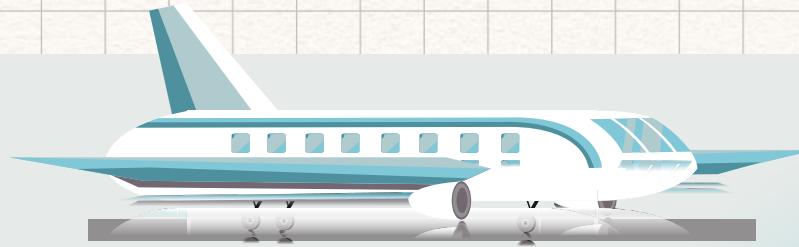
K Firm in the Airline Industry

UNITED AIRLINE FIRM'S PROBLEM

$$\underset{P_s, I_s, N_s}{\text{MAX}} \left[\frac{P_s Y_s}{P} - \frac{W_s}{P} \left(\frac{Y_s}{Z_s \bar{K}^\alpha} \right)^{\frac{1}{1-\alpha}} - I_s - C_{P_s} \right] + \frac{1}{1+r} \left[\left(\frac{Y'_s}{Y_s} \right)^{\frac{1}{\epsilon}} Y'_s - \frac{W'_s N'_s}{P} + (1+\delta) K'_s \right]$$

WHERE

- $Y_s = \left(\frac{P_s}{P} \right)^{-\epsilon} Y$
- $Y'_s = Z'_s \bar{K}^\alpha N'_s^{1-\alpha}$
- $K'_s = (1-\delta) \bar{K}_s + I_s$
- $C_{P_s} = \frac{\Psi}{2} (P_s - 1)^2 Y$
- $P_s, K'_s, N'_s \geq 0$





The Government



The Government

$$\bar{G} + S^G = T$$

$$\bar{G}' = T' + (1+r)S^G$$

T, T' are lump-sum taxes charged to all consumers today and tomorrow respectively





Looking at the Effects of the Travel Ban on the Economy

Effect of θ' Moving from 1 → 0

AIRLINE INDUSTRY

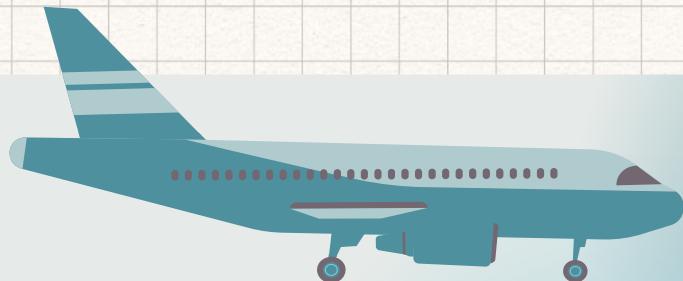
CURRENT LABOR DEMANDED : United will continue hiring until the marginal benefit of the next hire is < the marginal cost of that hire :

→ given the optimal price (P_s^*), this occurs when the $MPL \left(1 + \left(\frac{(P - \bar{A}P^Y)}{\epsilon - 1}\right)\right) \left(\frac{\epsilon - 1}{\epsilon}\right) = w$

INVESTMENT DEMANDED : United stops investing more when the marginal benefit of the next unit = the marginal cost of said unit :

→ This occurs when the $\frac{MPK'_s + (1 - \delta) \left(\frac{\epsilon - 1}{\epsilon}\right)}{1 + r} = 1$

* the AIRLINE INDUSTRY'S LABOR and INVESTMENT DEMAND ARE UNAFFECTED BY $\Delta\theta'$ *



Effect of θ' Moving from 1 → 0

GOODS INDUSTRY

- With the same process as above, we can see the firm's demands are:

$$\text{CURRENT LABOR DEMANDED : } MPL_c = w_c$$

$$\text{CURRENT INVESTMENT DEMAND : } \frac{MPK'_c (1-\delta)}{1+r} = 1$$

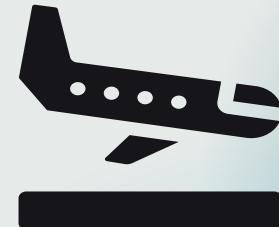
* the goods industry's labor and investment demand are unaffected by $\Delta\theta'$ *

GOVERNMENT

$$G + S^6 = T$$

$$G' = T + (1+r)S^6$$

the travel ban doesn't affect our government model. They still charge the same taxes to consumers, save the same amount, and G is G' remain the same.



CONSUMER

MB	MC
<u>TRADEOFFS</u>	
$c \text{ vs } l'_A$	MU_c
$c' \text{ vs } l'_A$	$MU_{c'}$
$l_L \text{ vs } l'_A$	MU_{l_L}
$l'_L \text{ vs } l'_A$	$MU_{l'_L}$
$l_A \text{ vs } l'_A$	MU_{l_A}

HERE ARE ALL TRADEOFFS WHEN $\theta' = 1$ (before travel ban)



WHEN $\theta' = 0$, $l'_A = 0$, SO THERE IS NO TRADEOFF THAT CAN POSSIBLY INCLUDE l'_A .

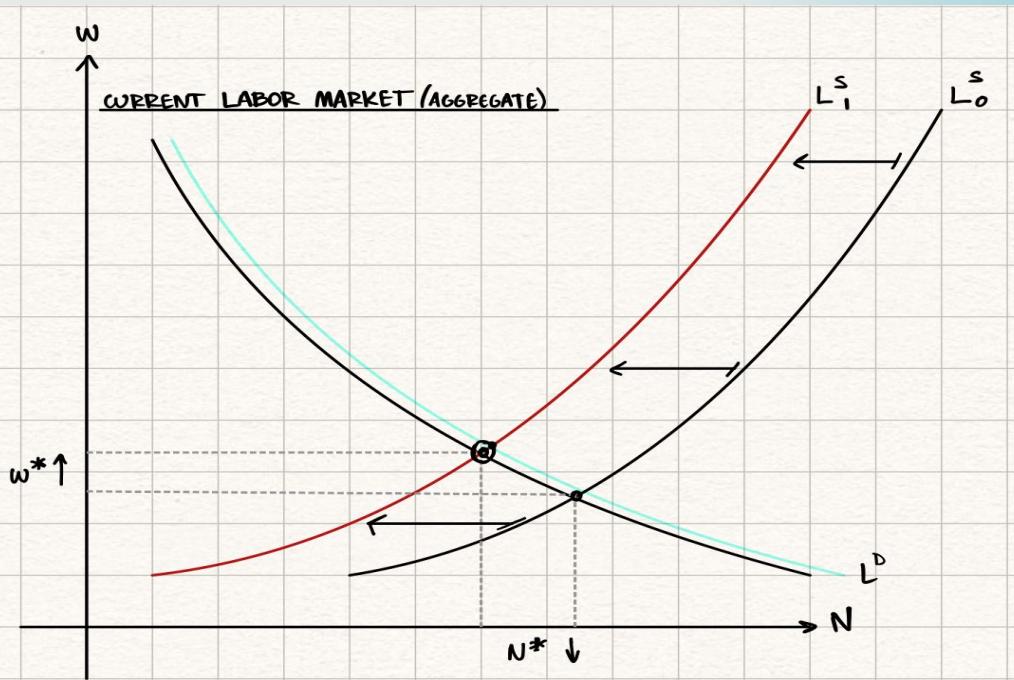
* THEREFORE TRADEOFFS ARE NOT Affected BY THE TRAVEL BAN *

FEASIBILITY

$$\begin{aligned} C + w'l_L + w\theta l_A + p_s \theta + s^p &= wH + \pi_s - T \\ C' + w'l'_L + w'\theta' l'_A + p'_s \theta' &= wH + \pi'_s - T' + (1+r)s^p \end{aligned}$$

↓ ↓

$\theta' \downarrow$, so $y' \uparrow \& l'_A = 0$, so $c, c', l_L, l'_L, l_A \uparrow$ [NORMAL GOODS ASSUMPTION]

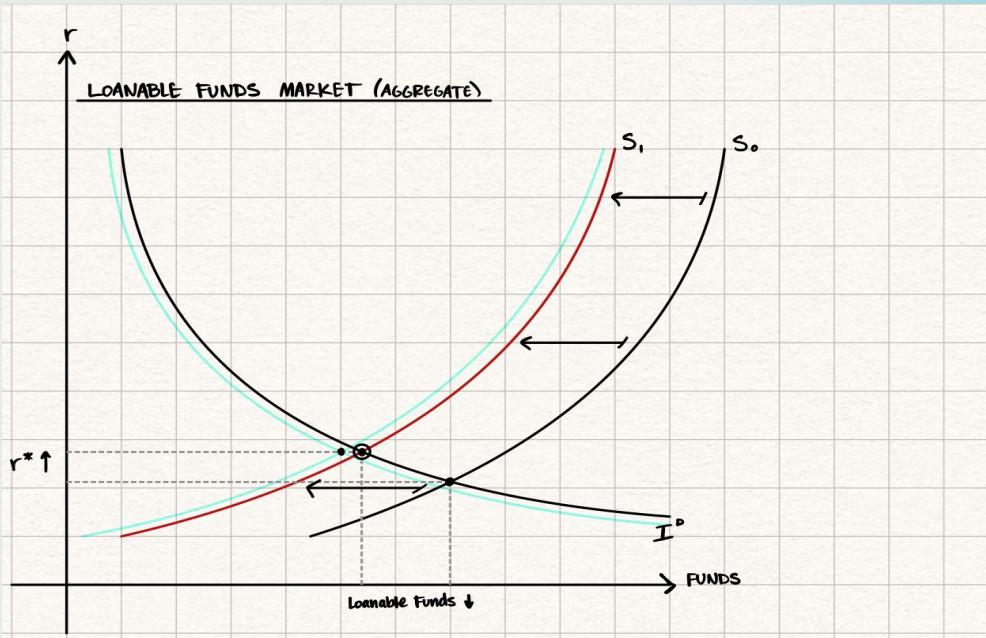


L_d^o : unaffected

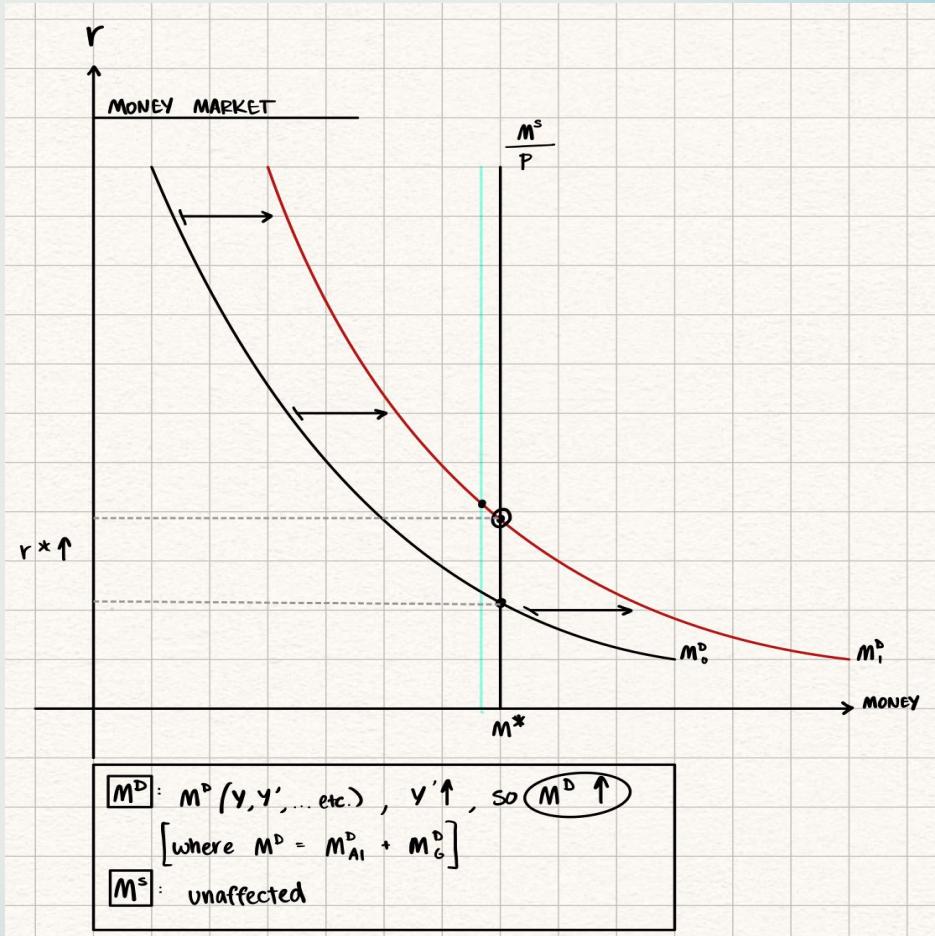
$$[L_d^o = L_{AI}^o(w, w', r, y, y', \tau, \tau', \underline{P}) + L_{G}^o(w, w', r, y, y', \tau, \tau')]$$

L_s^o : $\ell_A, \ell_G \uparrow$, so $(N \downarrow)$

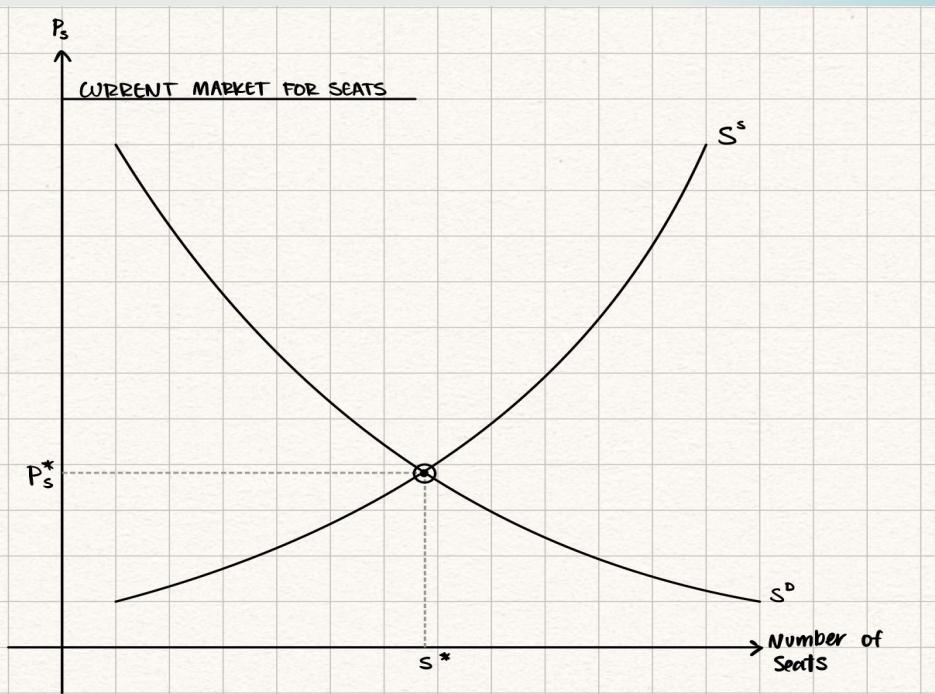
$$[L_s^o = L_{AI}^o + L_{G}^o]$$



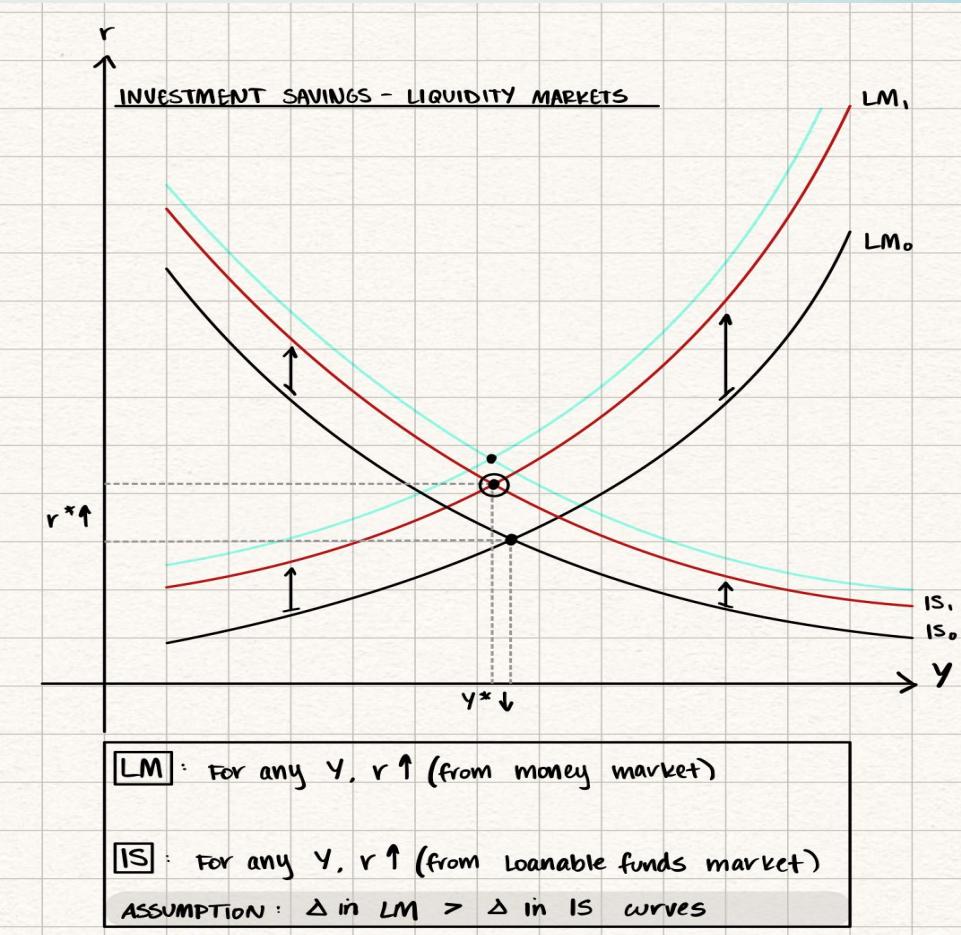
- $\boxed{S^P}$: $S^P = \underline{WH + \pi - T - C - wL_L - wL_A - p_s}$ (TAKEN FROM A REPRESENTATIVE CONSUMER)
[where $S^P = S_{H1}^P + S_G^P$] $\rightarrow c, L_L, L_A \uparrow$, so $(S^P \downarrow)$
- $\boxed{I^D}$: unaffected
[where $I^D = I_{H1}^D + I_G^D$]

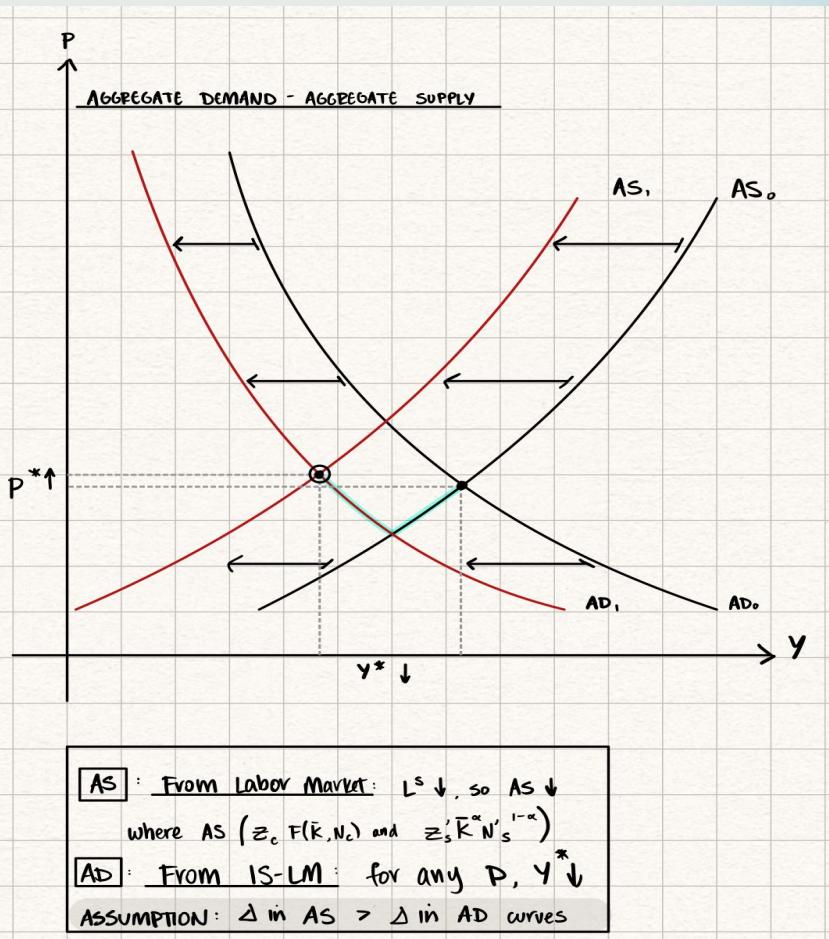


lo
lo
I



- According to our model : when travel is a viable option, the consumer MUST purchase a seat. $I_A \uparrow$, but demand for seats is unaffected.
- Seat supply is also unaffected (from the firm)





Hypothesis Based on the Model



Based on our resulting effects from the model & markets, here are our conclusions



- c, l_a, l_L, c', l'_L increased →
 - Total resources increased when the travel ban was issued as consumers could not put resources towards travel away in the second period, meaning more resources could be put towards goods other than l'_a
- Firm revenue decreases →
 - Firm revenue is derived from ticket sales, which will decrease when travel ban is implemented
- Investment (I) stays the same →
 - Travel ban only affected consumers, not firms; investment would not change
- Labor (N) decreased →
 - Because people have more resources, they will leisure more to maximize utility, meaning they work less.



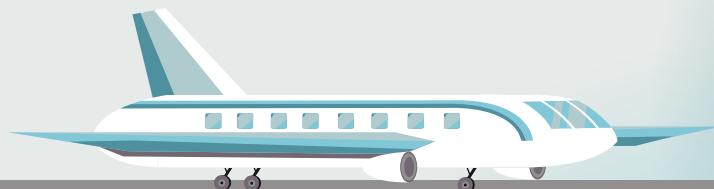
- Wage (W) increased →
 - People work less because without time spent away, they have more time for leisure.
- Interest rate (r) increased →
 - Increase in consumption today and tomorrow means people will demand more money, therefore increasing the interest rate.
- Output (Y) decreased →
 - Seats are included in output, so when people are not able to buy tickets anymore, output decreases
- Price in the economy (P) increased →
 - Since Y is decreasing in the IS-LM and the labor supply and there is leftward shifts of both AD and AS in the AD-AS market, P would increase.



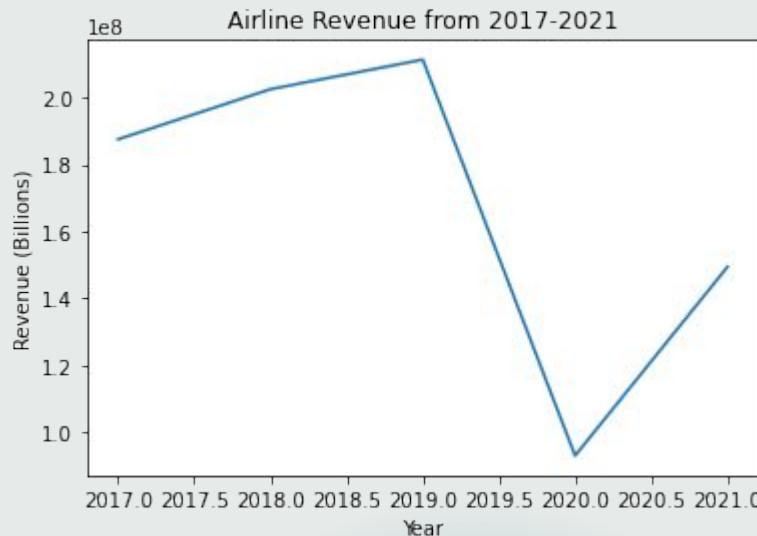
Real-World Graphs



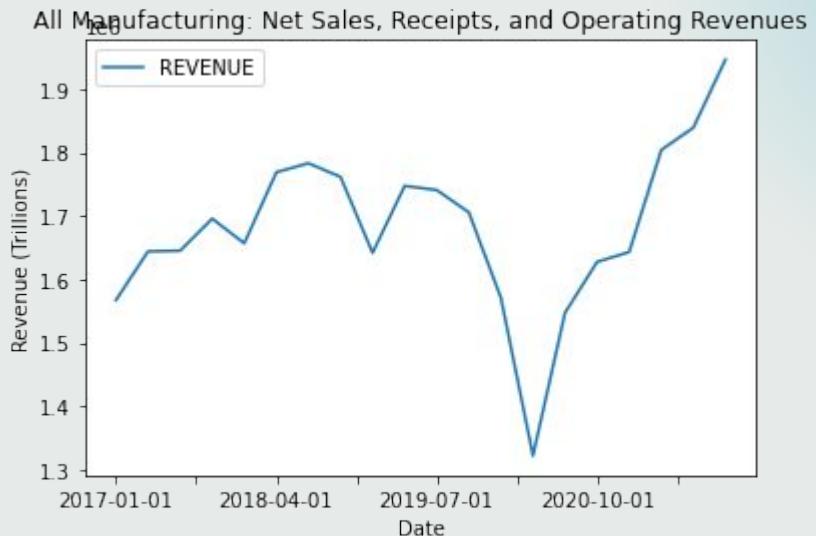
**On the
firm side
of
things...**



Revenue for Airlines and Manufacturers

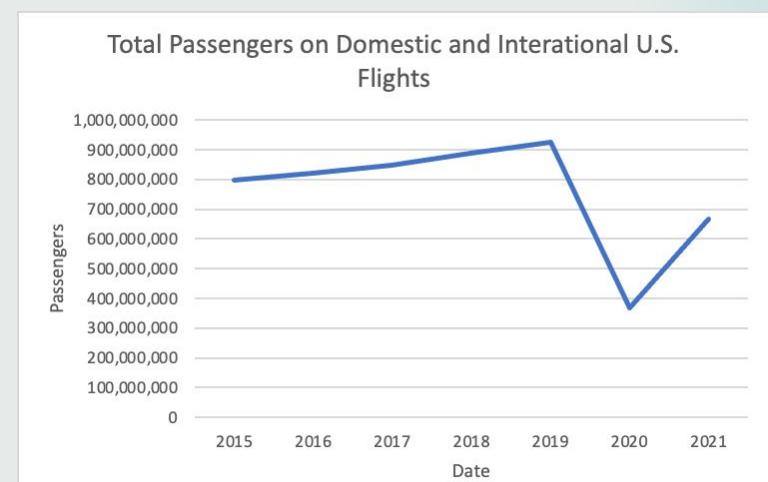
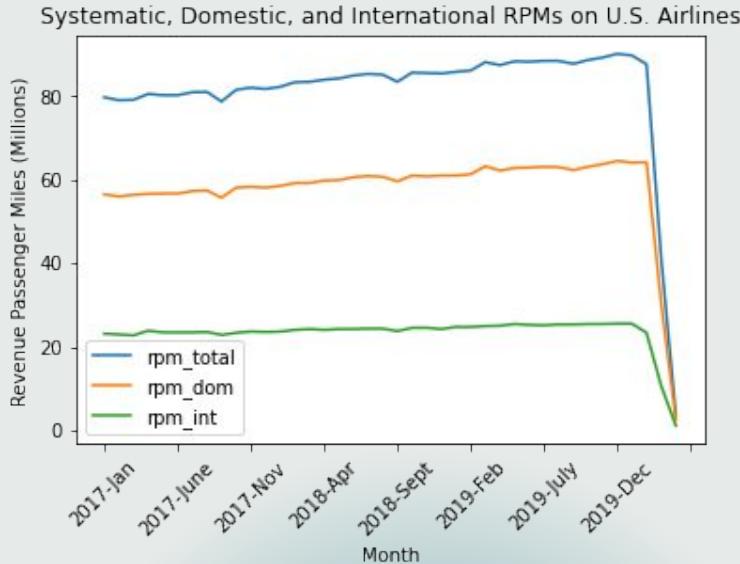


Source: BTS



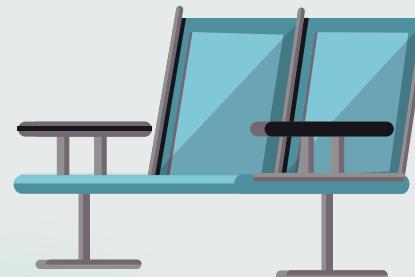
Source: FRED

Revenue Passenger Miles

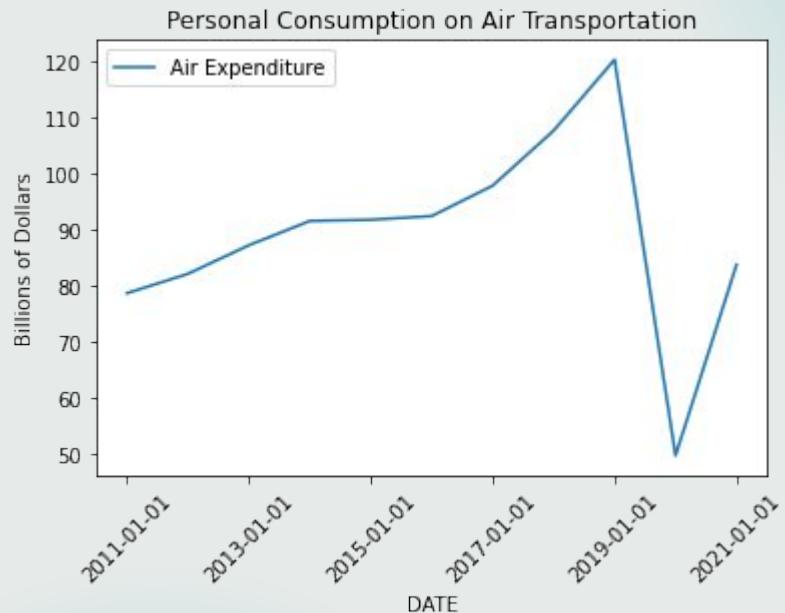
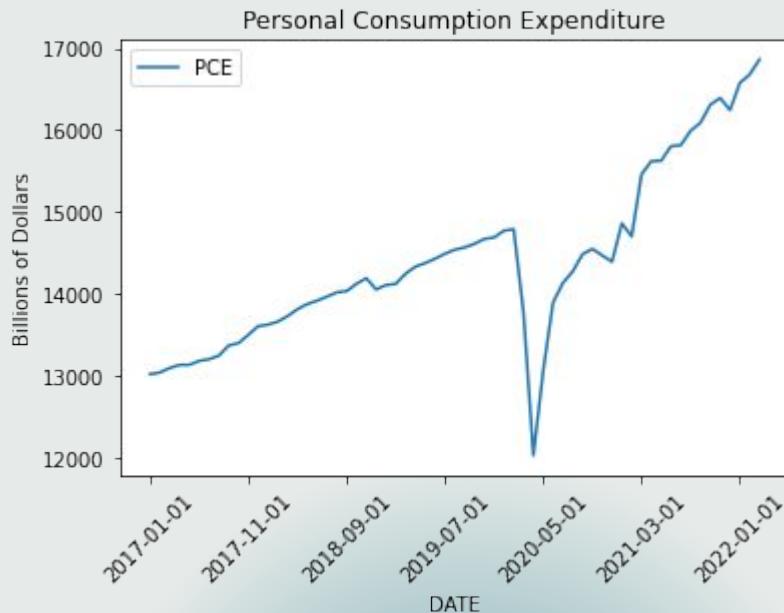


Source: BTS

**Looking at the
consumers...**



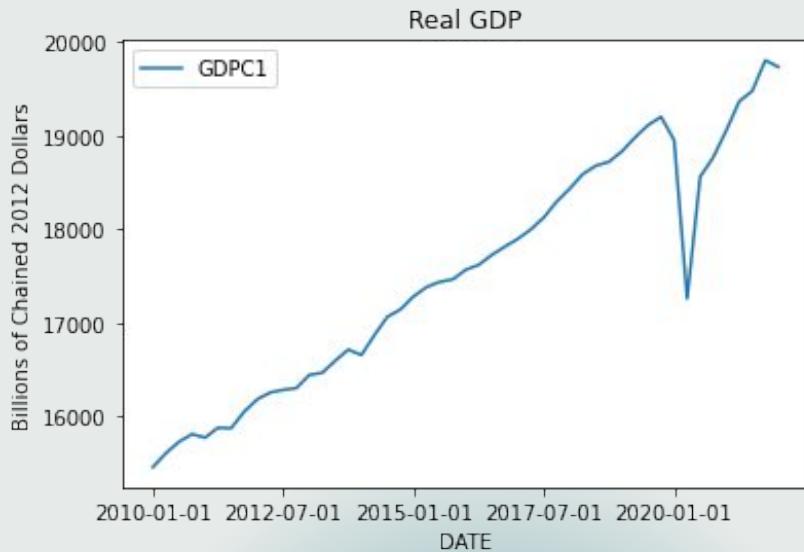
Consumption



Source: FRED

Overall Economic Impact

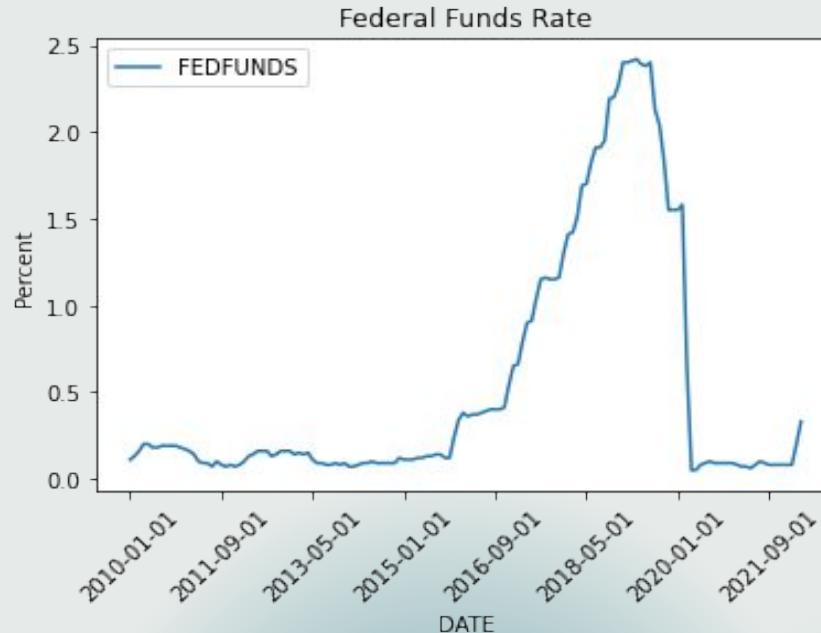
GDP



- Y decreased by 1944.105 billion dollars from Oct 2019 to April 2020
- Supported by our model

Source: FRED

Federal Funds Rate



- Chosen because it affects many other interest rates and most accurately reflects changes in the whole economy
- Decreased from 2.25% in April 2019 to 0.05% in April 2020
- Not supported by our model

List of Data Sources



<https://www.transportation.gov/sites/dot.gov/files/2020-04/Reporting%20of%20Causes%20for%20Flight%20Delays%20and%20Cancellations.pdf>

- policy

<https://fred.stlouisfed.org/series/QFR101MFGUSNO>

- Manufacturing

<https://fred.stlouisfed.org/series/FEDFUNDS>

- Federal funds rate

<https://fred.stlouisfed.org/series/W790RC1Q027SBEA>

- Private investment

<https://fred.stlouisfed.org/series/UNEMPLOY>

- Unemployment level

<https://fred.stlouisfed.org/series/PCE>

- Personal consumption expenditure

<https://fred.stlouisfed.org/series/DAITRC1A027NBEA>

- Consumption on air transportation

https://www.transtats.bts.gov/DL_SelectFields.aspx?gnoyr_VO=GEH&OO_f_u146_anrz=Nv4%20Pn44vr4%20Sv0n0pvny

- Airline Revenue, RPM

https://www.transtats.bts.gov/Data_Elements.aspx?Data=4

- Total passengers

Thanks!

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