Request that you should not refuse

- PLEASE SWITCH OFF AND PUT AWAY YOUR CELL PHONES
- LAPTOPS OK IF WORK IS ACADEMIC
- REMOVE BAGS AND OTHER MATERIALS THAT CAN CAUSE DISTRACTION
- STOP HAVING SIDE CONVERSATIONS
- PARTICIPATE IN CLASS

Class 6

Review

Demand for labor with NO Closed Form Solutions

Empirical Issues in Immigration;

Discussion of IV

Automation: Robots and the Labor Market

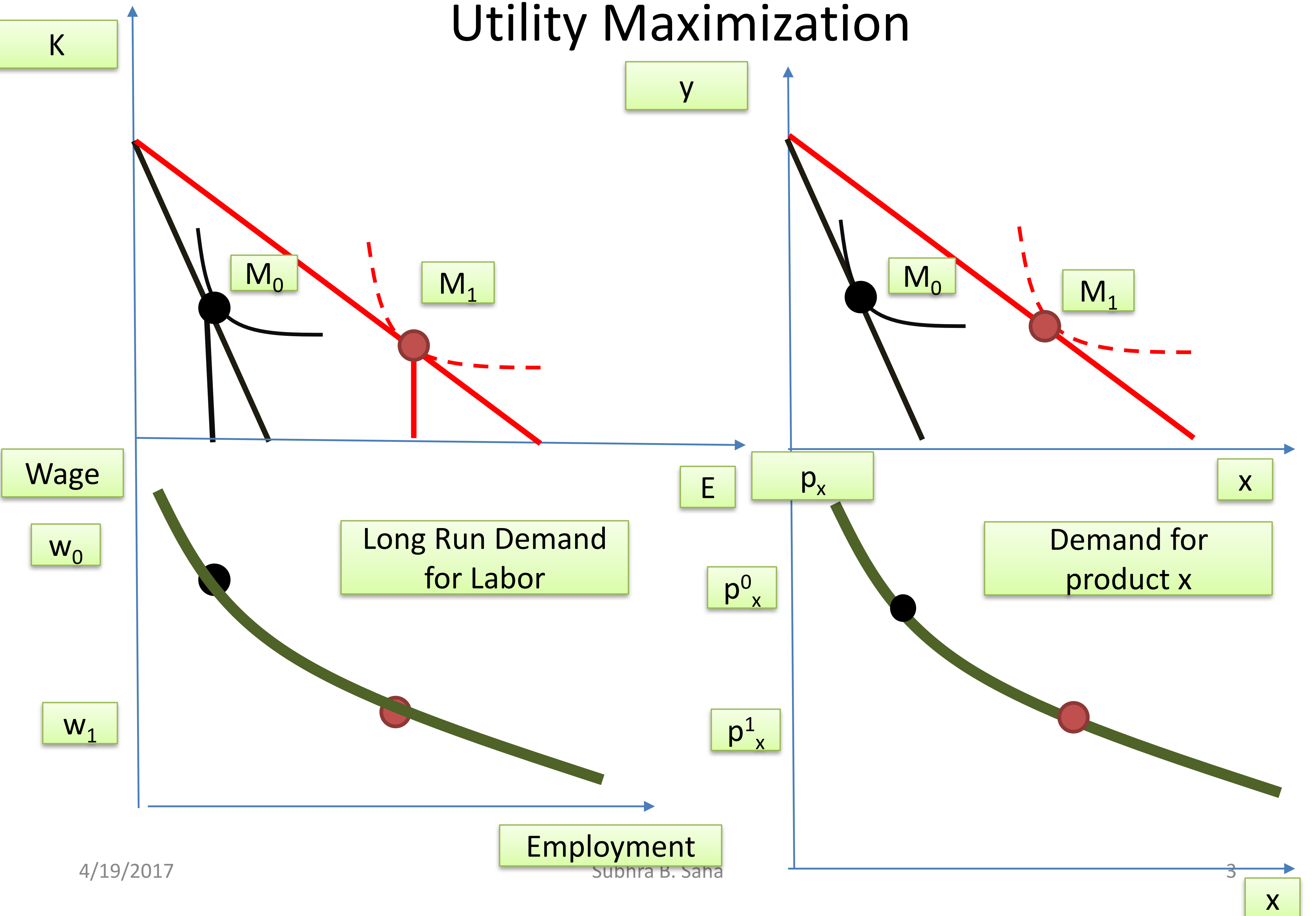
- **Read for Monday's Class (Class 7)**

Read in the upcoming Weekend For Next Monday's Class

- **3.2 – Overrated Minimum wage**
- **3.3 – Women War and Wages**

Work on The Problem Set – Posted (turn it in on Class 8)

Similarities between Profit Maximization and Utility Maximization



Long Run Demand for Labor

$$\underset{\{E,K\}}{Max}\ \ q = f(E,K) = A\log E + K^{\beta}$$

$$s.t\ \ TC = wE + rK$$

$$E > 0; K > 0$$

What do we want to derive? Demand Functions

$$E^{*} = \left(E^{*}(w;.)\right) \qquad K^{*} = \left(K^{*}(r;.)\right)$$

Maximum Value Function

$$q^{*} = A\log\left(E^{*}(w;.)\right) + \left(K^{*}(r;.)\right)^{\beta}$$

$$q = A\log E + K^{\beta} \qquad \frac{\partial f(E,K)}{\partial E} = \frac{A}{E} = MP_E \qquad \frac{\partial f(E,K)}{\partial K} = \beta K^{\beta-1} = MP_K$$

$$\Gamma = p\left(A\log E + K^{\beta}\right) + \lambda[TC - wE - rK]$$

$$\left.\begin{array}{l} \dfrac{\partial \Gamma}{\partial E} = p\dfrac{A}{E} - \lambda w = 0 \ldots(1) \quad \rightarrow p\dfrac{A}{E} = \lambda w \\ \dfrac{\partial \Gamma}{\partial K} = p\beta K^{\beta-1} - \lambda r = 0 \ldots(2) \quad \rightarrow p\beta K^{\beta-1} = \lambda r \end{array}\right\} \rightarrow \frac{A{K^*}^{1-\beta}}{\beta E^*} = \frac{w}{r} \ldots\ldots\ldots\ldots(4)$$

$$\frac{\partial \Gamma}{\partial \lambda} = 0 \Rightarrow TC - wE^* - rK^* = 0 \ldots\ldots\ldots(3)$$

E* will give Demand for Labor Function. Using 3 and 4

$$\left.\begin{array}{l} TC = wE^* + rK^* \\ K^* = \left(\dfrac{\beta w}{Ar}\right)^{\frac{1}{1-\beta}} {E^*}^{\frac{1}{1-\beta}} \end{array}\right\} \begin{array}{l} \rightarrow TC = wE^* + \left(\dfrac{\beta}{Ar}\right)^{\frac{1}{1-\beta}} w^{\frac{1}{1-\beta}} {E^*}^{\frac{1}{1-\beta}} \\ K^* = \left(\dfrac{\beta w}{Ar}\right)^{\frac{1}{1-\beta}} \left(E^*(w;.)\right)^{\frac{1}{1-\beta}} \\ q^* = A\log E^* + {K^*}^{\beta} \end{array}$$

There are no Closed Form Solutions!!!!!

$$\rightarrow TC = wE^{*} + \left(\frac{\beta}{Ar}\right)^{\frac{1}{1-\beta}} w^{\frac{1}{1-\beta}} E^{*\frac{1}{1-\beta}}$$

$$Baseline: w = 20$$

$$1000 = 20E^{*} + 100E^{*2} \rightarrow E^{*} = 3.06$$

$$Scenario\ \ 1: w = 40$$

$$1000 = 40E^{*} + 400E^{*2} \rightarrow E^{*} = 1.53$$

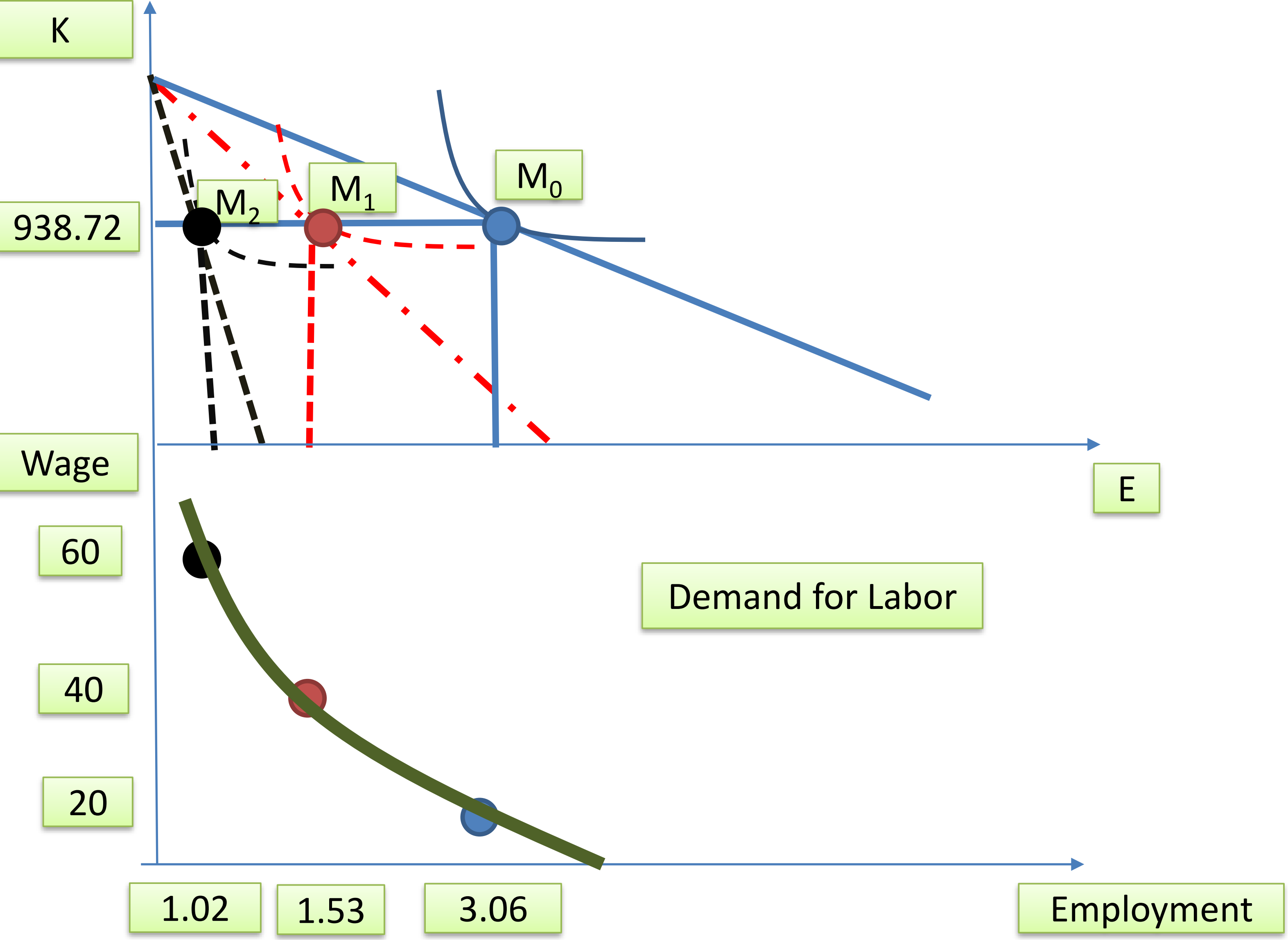
$$Scenario\ \ 2: w = 60$$

$$1000 = 60E^{*} + 900E^{*2} \rightarrow E^{*} = 1.02$$

https://www.wolframalpha.com/input/?i=solve+100x%5E2+%2B20x+-1000+%3D+0

$$TC = wE^{*} + \left(\frac{\beta}{Ar}\right)^{\frac{1}{1-\beta}} w^{\frac{1}{1-\beta}} E^{*\frac{1}{1-\beta}} \qquad K^{*} = \left(\frac{\beta w}{Ar}\right)^{\frac{1}{1-\beta}} \left(E^{*}(w;.)\right)^{\frac{1}{1-\beta}} \qquad q^{*} = A \log E^{*} + K^{*\beta}$$

Parameters	**Baseline**	**Scenario 1**	**Scenario 2**
A	1	1	1
beta	0.5	0.5	0.5
TC	1000	1000	1000
w	**20**	**40**	**60**
r	1	1	1
1- beta	0.5	0.5	0.5
1/1-beta	2	2	2
Ar	1	1	1
beta/Ar	0.5	0.5	0.5
(beta/Ar)^1/1-beta	0.25	0.25	0.25
w^(1/1-beta)	400	1600	3600
[(beta/Ar)^1/1-beta]*w^(1/1-beta)	100	400	900
E*	**3.06**	**1.53**	**1.02**
beta*w/A*r	10	20	30
(beta*w/A*r)^(1/1-beta)	100	400	900
E*^(1/1-beta)	9.39	2.35	1.04
K*	**938.72**	**938.72**	**938.72**
A*logE*	0.49	0.19	0.01
K*^beta	30.64	30.64	30.64
q*	**31.12**	**30.82**	**30.65**



Demand For Labor: Collection of (Pareto) Efficient Points: Collection of Marginal Product of Labor which decreases as employment increases

Practice Problems: Find E*, K*, q*, Elasticity of Labor Demand for the following production functions

1] $\underset{\{E,K\}}{Max} \;\; q = f(E,K) = E^{\alpha} + K$

2] $\underset{\{E,K\}}{Max} \;\; q = f(E,K) = \alpha E + \beta K$

3] $\underset{\{E,K\}}{Max} \;\; q = f(E,K) = Min\{\alpha E, \beta K\}$

The constraints are the same in each case of production function

$$s.t \;\; TC = wE + rK$$

$$E \geq 0; K \geq 0$$

Relationship Between Immigration and Wages
Dustmas, Schonberg and Sthuler
JEP 2016

Card (2009) minor effect on native wages

Borjas (2003) wages of natives being harmed

Ottaviani and Peri (2012) report positive wage effects on natives

Why such mixed Results?

Immigration changes which wage for who?

- immigration harmful (beneficial) for individuals whose skills are most similar (dissimilar) to those of immigrants
- Decrease in wage **in absolute terms** and **relative to other types of labor**
- **Walmart Example:**
- **Pre Immigration**: 80%:Retail ($20); 20% Managers ($60)
- **Post Immigration**:80%:Retail ($10); 20% Managers ($80)
- Calculate **relative wage** and **absolute (average) wage** in the economy

Restrictive Assumptions in the canonical model : relaxed by others to explain the contradictory results : authors think these are unnecessary

- Multiple output nature of an economy, thus adding possibilities of adjustment to immigration along the product mix and technology margins (Card and Lewis 2007; Lewis 2011; Dustmann and Glitz 2015)
- The price of the output good to vary, rather than being fixed (Özden and Wagner 2015)

The Main Reasons are

A] Despite being derived as a ***variant*** of the same canonical model, **different empirical specifications measure different structural parameters**.

B] two assumptions that are ***commonly*** and ***tacitly*** made when bringing this framework to the data may be **invalid**:

Which assumptions are invalid & Why?

1) The labor supply elasticity is **homogenous** across different groups (young/old; skilled/unskilled) of natives (ignores employment responses: Labor Supply is assumed to be **inelastic: this is not true when using regional variations**)

2) We can place immigrants and natives into education-experience cells within which they compete in the labor market, based on their **reported** education and age. In reality, immigrant skills/education are **downgraded**.

Borjas (2003): “national skill cell approach”

- Exploits exogenous variation in immigrant inflows across education-experience cells on a national level – these are subject to law changes
- identify a relative wage effect of immigration of one experience group versus another within education groups and of one education group versus another
- Heterogenity in group-specific labor supply elasticities, this approach may produce estimates that are **hard to interpret**
- **Subject to measurement error: Downgrading**

$$\Delta \log w_{gat} = \theta^{skill} \Delta p_{gat} + \Delta \pi_t + (s_g \times \Delta \pi_t) + (x_a \times \Delta \pi_t) + \Delta \varphi_{gat}$$

Altonji and Card (1991) "pure spatial approach"

- Exploits variation in the total immigrant flow across regions
- recovers the total wage effect of immigration on a particular native skill group that takes into account complementarities across skill cells and across labor and capital
- That estimate total effects still produce estimates that have a clear interpretation when using variation across local labor markets
- Robust to downgrading

$$\Delta \log w_{gart} = \theta_{ga}^{spatial} \Delta p_{rt} + s_{ga} \times \Delta \pi_t + \Delta \varphi_{gart} .$$

Card (2001) "mixture approach"

- uses variation in immigrant inflows both across education groups and across regions
- identify a relative wage effect of immigration of one experience group versus another within education groups and of one education group versus another
- Robust to both labor supply elasticity heterogeneities between groups & downgrading

$$\Delta \log w_{grt} = \theta^{spatial,skill} \Delta p_{grt} + (s_r \times \Delta \pi_t) + (s_g \times \Delta \pi_t) + \Delta \varphi_{grt} .$$

Downgrading (measurement error) may seriously impair the estimation of a key parameter : **the elasticity of substitution between immigrants and natives**, which may help to explain why studies using this approach find often positive wage effects of immigration for natives.

Relationship Between Immigration and Wages

Is this relationship causal?

Studies that slice the labor market into spatial units (state, city, county) use past settlement of immigrants as an instrumental variable for current immigration [Altonji and Card (1991)]

Studies that slice the labor market into skill groups instead typically assume that immigrant inflows are exogenous (generally uses **fixed effects**) [Borjas [2003]]

Natural Experiments – have a problem with parallel assumption or choice of the correct set of control cities

Do we still have enough information to answer if we need to have immigrants?

How many generations does it take for an immigrant to be a native? – can the share of immigrants in population miscalculated?

Immigration Surplus to natives – Cost of having immigrants

Instrumental Variables/Natural Experiments/RD

Visual Demonstration of the Problem

Randomized Control Trial: $X \longrightarrow Y$

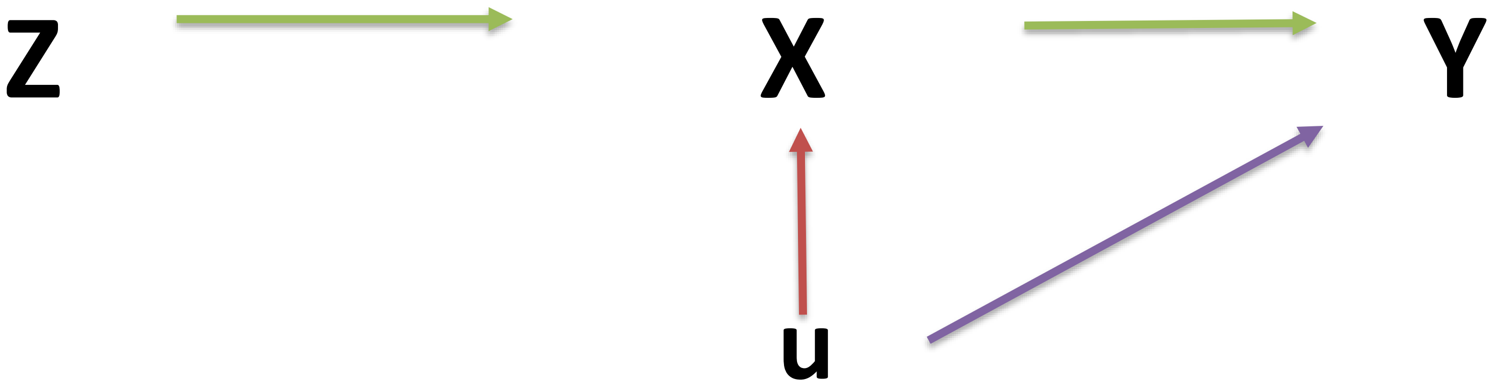
Good Regressions:

$$\begin{tikzcd} X \arrow[r] & Y \\ u \arrow[ur] & \end{tikzcd}$$

Bad Regressions:

$$\begin{tikzcd} X \arrow[r] & Y \\ u \arrow[u] \arrow[ur] & \end{tikzcd}$$

Visual Demonstration of the Solution: IV/Natural Experiment (DiD)/RD/:



$$IV : Strong / Weak$$

$$\text{cov}(z_i, x_i) \neq 0$$

$$IV : Valid / Invalid$$

$$\text{cov}(z_i, u_i) = 0$$

$$y_i = \alpha + \beta x_i + \delta_1 Control^1{}_i + ... + \delta_k Control^k{}_i + u_i ....(1)$$

$$First \ \ Stage$$

$$x_i = \omega_0 + \theta_1 z^1{}_i + ... + \theta_k z^k{}_i + \eta_1 Control^1{}_i + ... + \eta_k Control^k{}_i + \upsilon_i ....(2)$$

$$Use \ First \ Stage \ Estimates \ to \ \ find : \hat{x}_i$$

$$Second \ \ Stage$$

$$y_i = \pi_0 + \lambda \hat{x}_i + \gamma_1 Control^1{}_i + ... + \gamma_k Control^k{}_i + \xi_i ....(1)$$

Want you to understand that the IV variables go in the first stage of the regression but **NOT** in the second stage

This is called **exclusion restriction**

Possible IVs for immigration and wages

- Settling decisions of early immigrants

IV=Z	cov(Z,X)	Cov (Z,U)
Early Immigrants	Strong	Possibly Invalid

Why are there so many jobs?

Labor Markets and Automation

Suppose the manufacturing industry in a US city has labor demand and supply curves estimated as

$$w = A - Bh^{d} \ldots(1)$$

$$w = C + Dh^{s} \ldots(2)$$

In the baseline the industry does not use any machines. Suppose the firms in the industry start employing **R** robots to substitute humans. Which equation will you modify (equation 1 or equation 2) and how? You might want to draw a graph to know. Find the equilibrium wage and employment in baseline and in the case of new equilibrium.

Short Run Demand for Labor

$$q = A\log E + \overline{K}^{\beta}$$

$$\frac{\partial f(E,K)}{\partial E} = \frac{A}{E} = MP_E$$

$$\Gamma = p\left(A\log E + \overline{K}^{\beta}\right) - wE - r\overline{K}$$

$$\frac{\partial \Gamma}{\partial E} = p\frac{A}{E} - w = 0....(1)$$

$$\rightarrow E^* = \frac{A}{pw}.....(2)$$

$$q = E^{\alpha}\overline{K}^{\beta}$$

$$\frac{\partial f(E,K)}{\partial E} = \alpha E^{\alpha-1}\overline{K}^{\beta} = MP_E$$

$$\Gamma = p\left(E^{\alpha}\overline{K}^{\beta}\right) - wE - r\overline{K}$$

$$\frac{\partial \Gamma}{\partial E} = p\alpha E^{\alpha-1}\overline{K}^{\beta} - w = 0....(1.1)$$

$$\rightarrow E^* = \left(\frac{w}{p\alpha\overline{K}^{\beta}}\right)^{\frac{1}{\alpha-1}}.....(2.1)$$