



# Migration and Labor Market

## Literature Review

### Introduction to Economics of Immigrations

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- **Theory: How can immigration impact the labour market?**
- **Empirics**
  - **Review of the traditional literature**
    - Spatial correlation approach
    - The endogeneity problem
    - Estimating production functions
  - **Borjas' (2003) national level model**
    - The regression model
    - The structural model
    - The controversy
- **Organizational issues and forming teams**



**H1**

**Increasing labour supply through immigration reduces wages**

**H2**

**Increasing labour supply through immigration increases unemployment if wages are not perfectly flexible**

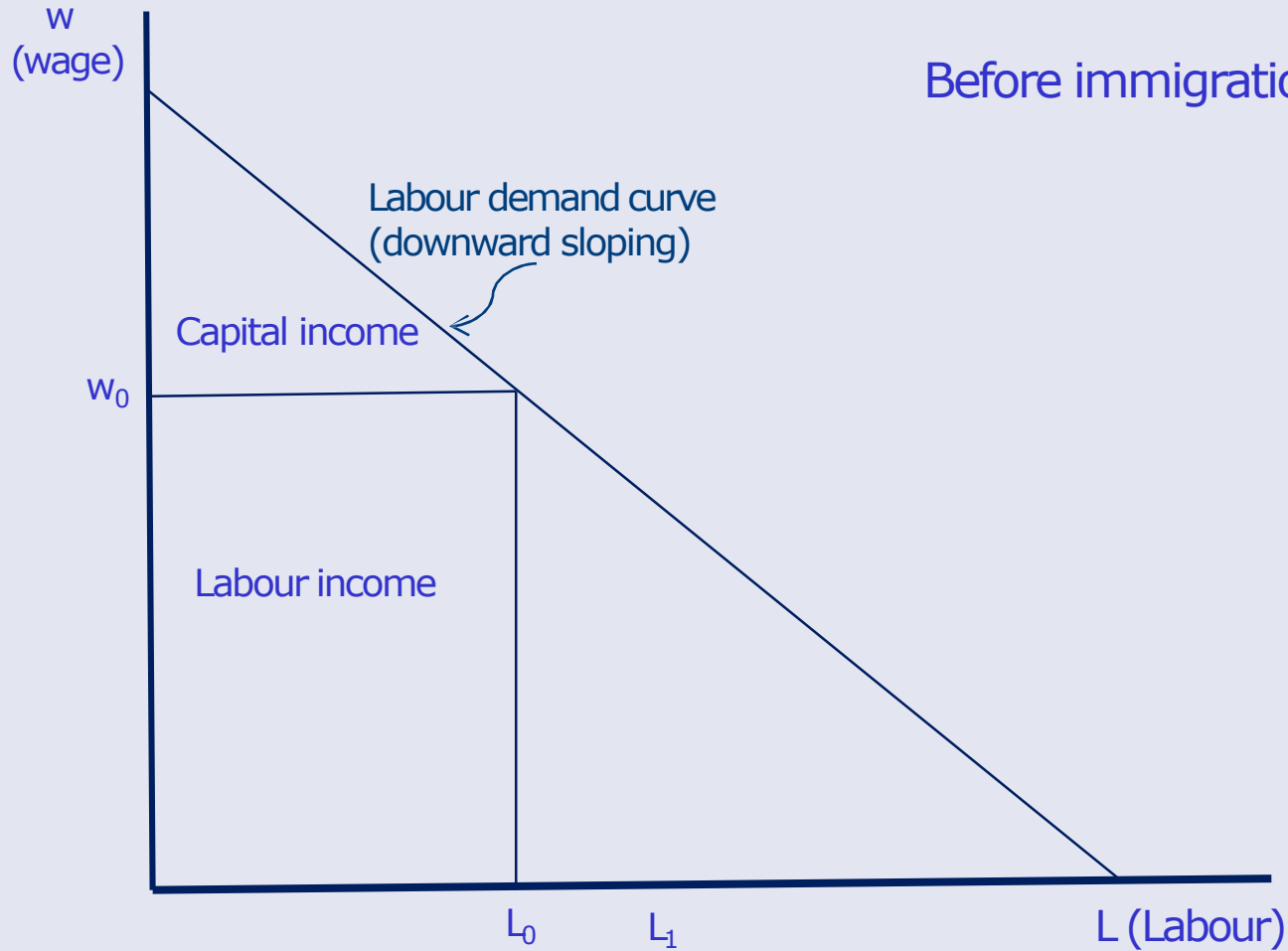


## Assumptions

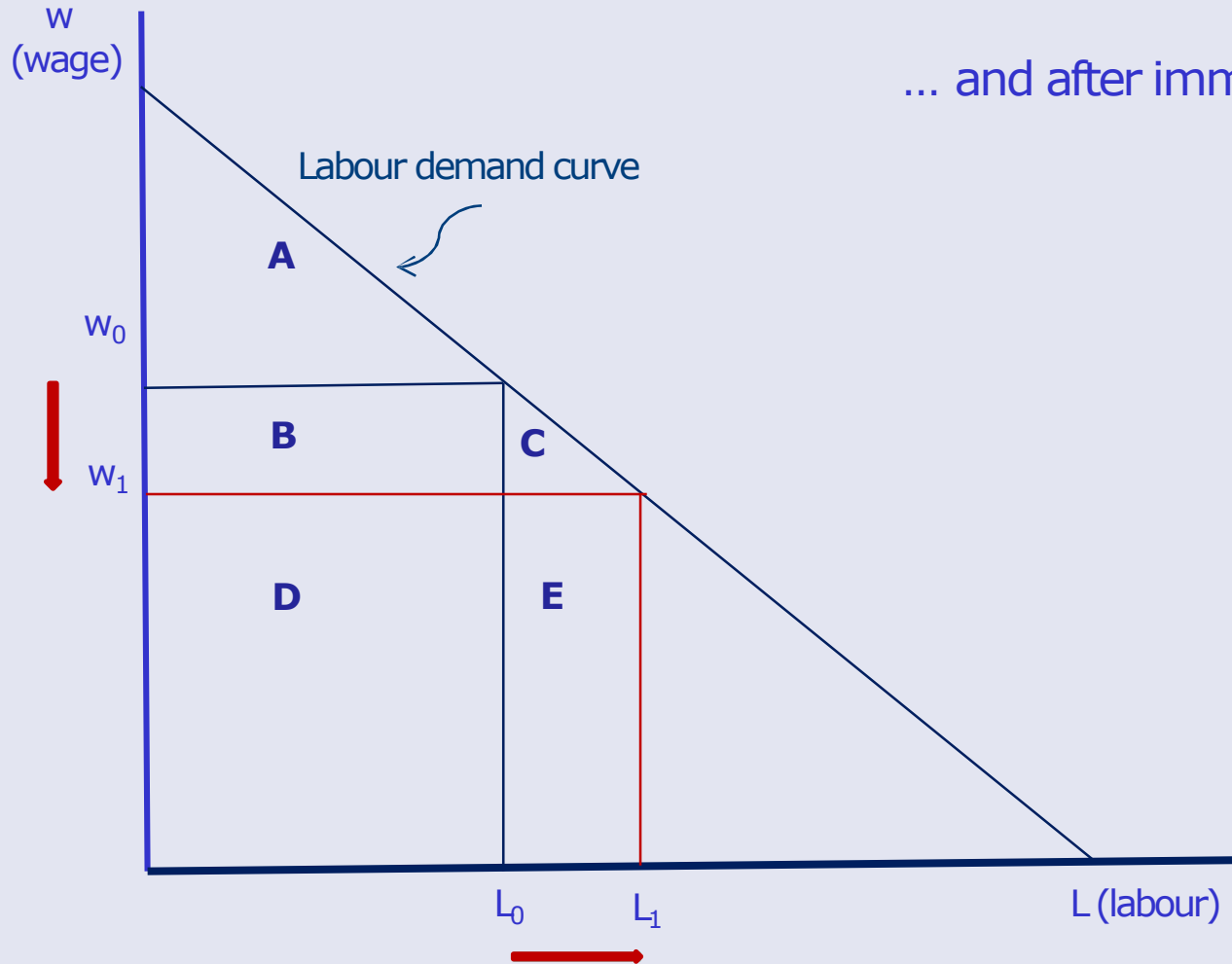
- Fixed capital stock
- No adjustment of goods market via international trade (closed economy)
- Immigrants and natives are perfect substitutes
- Perfect labour markets with flexible wages and no unemployment
- Capital is owned by natives

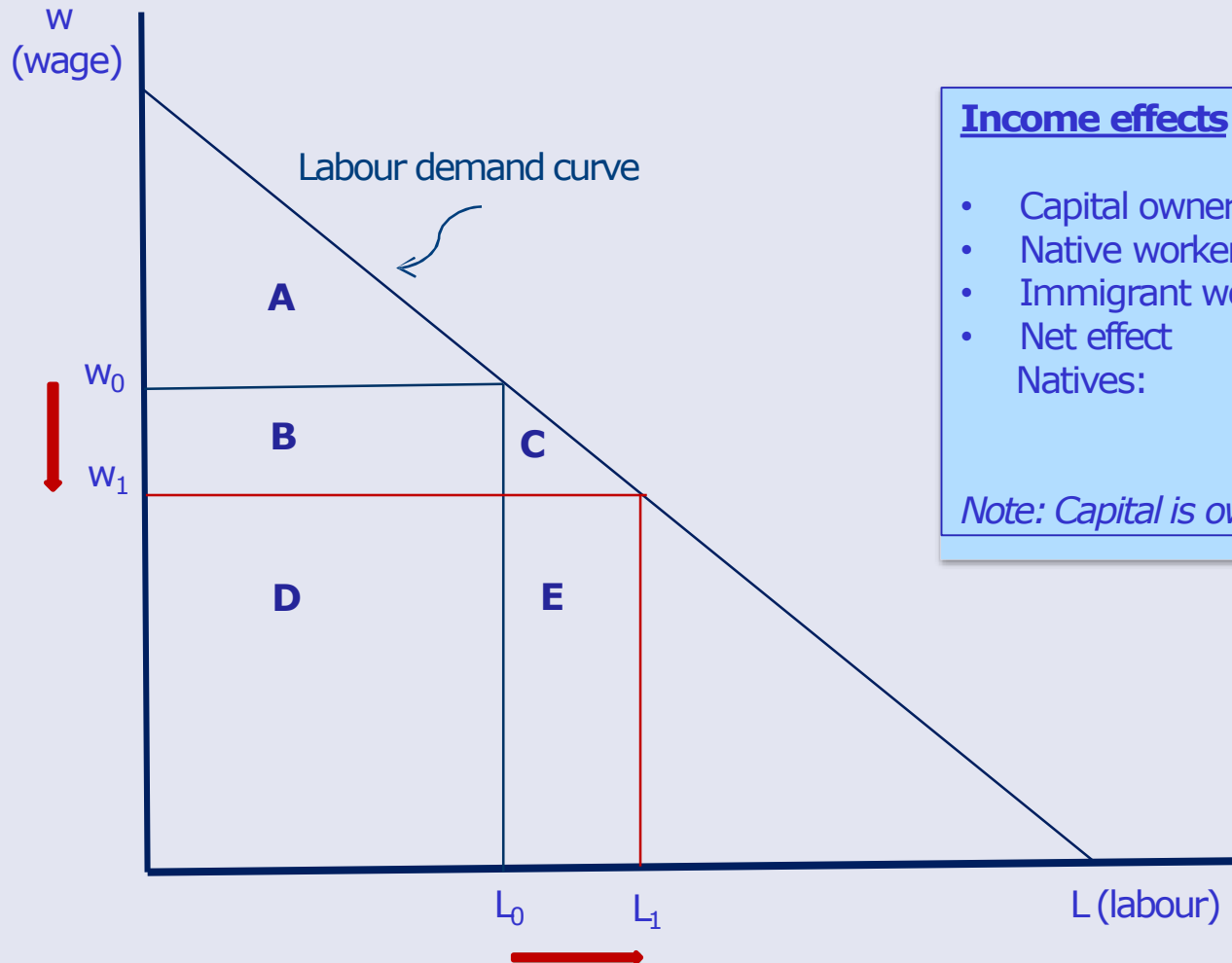
## Employing these assumptions, immigration results in ...

- Increasing labour supply
- Falling capital-labour-ratio
- Falling wages
- Increasing returns to capital (real interest rates)
- Increasing net income levels of total population since capital gains are larger than wage losses. (Converse is true for sending countries.)



# The textbook case





## Income effects

- Capital owners:  $B + C$
- Native workers:  $- B$
- Immigrant workers:  $+ E$
- Net effect  
Natives:  $+ C$

*Note: Capital is owned by natives!*



## Assumptions

- Capital stocks adjust through domestic or international investment to changing real interest rates
- Labour markets are perfect, such that we have no unemployment

## Hence, immigration results in...

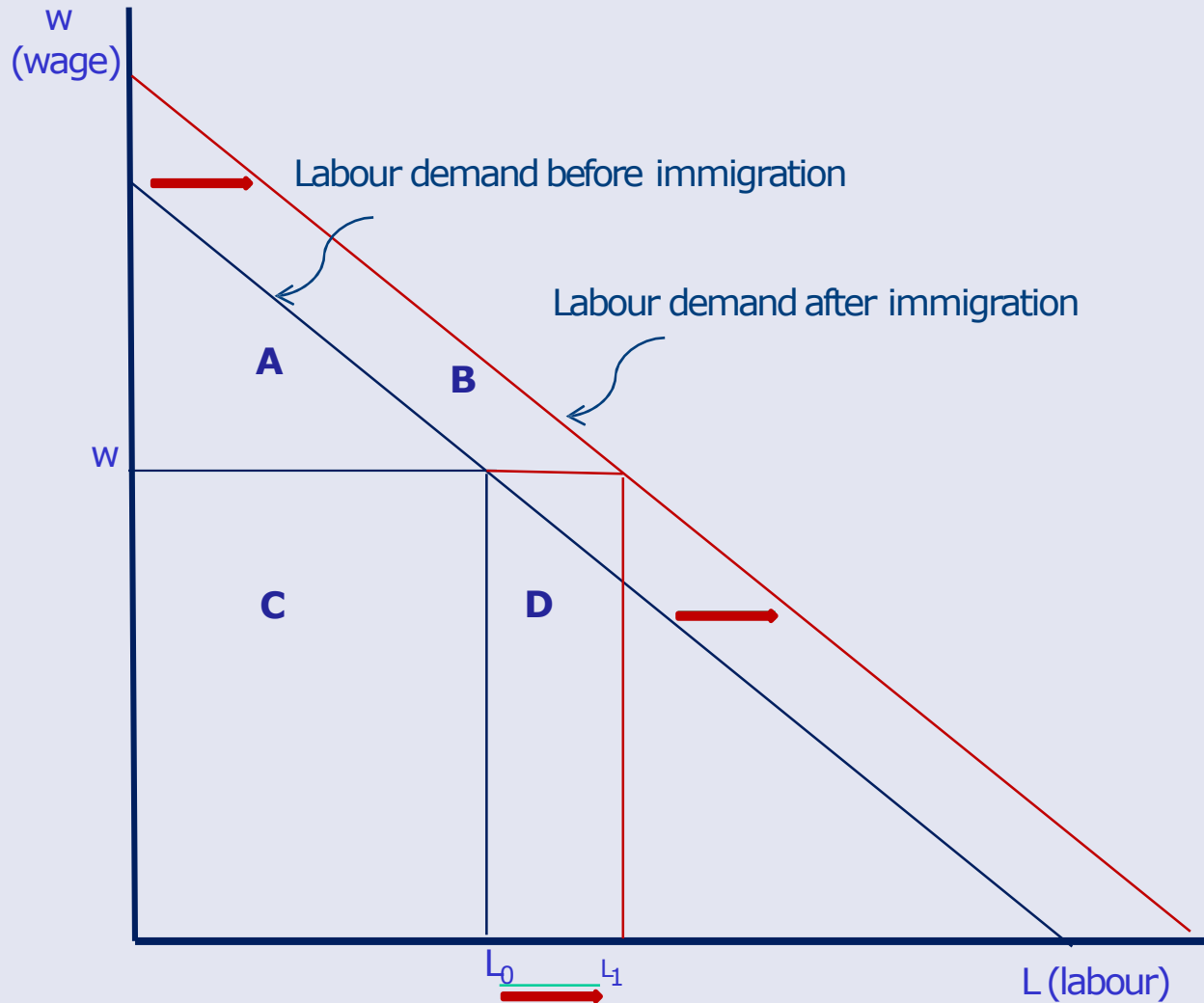
- increasing returns to capital in the first place
- Increasing domestic or international investment
- Eventually, capital-labour-ratio remains unchanged
- Consequently, labour demand curve adjusts
- Wages and capital returns remain constant at least in the long-run

## Empirically, capital stocks indeed adjust

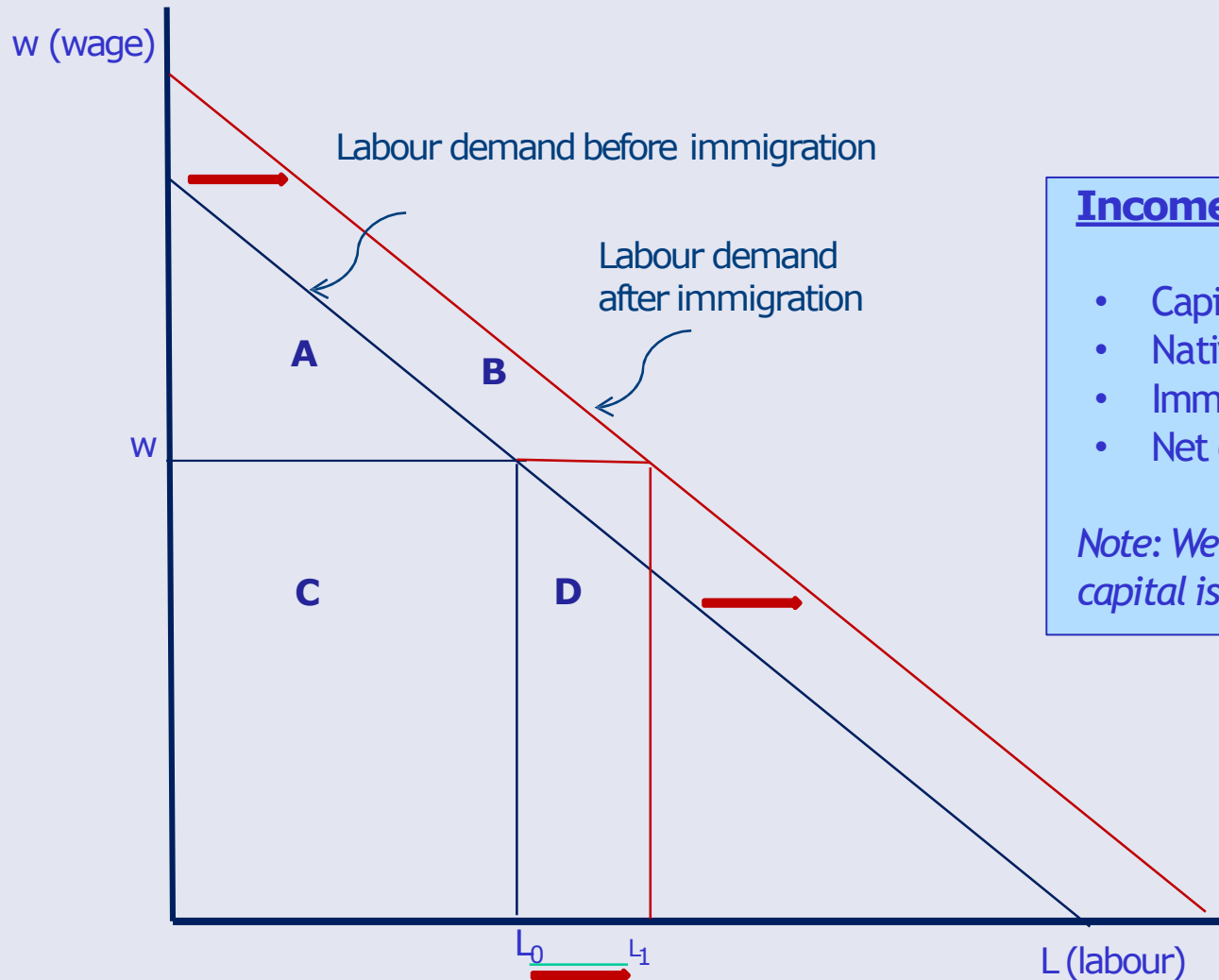
- Capital-output-ratio and, hence, the productivity adjusted capital labour ratio remain constant in real economies since WW II (Kaldor, 1962; Ottaviano/Peri, 2006; Brücker/Jahn 2009)



# Immigration with capital stock adjustment



# Immigration with capital stock adjustment



## Income effects:

- Capital owners: B
- Native workers: No
- Immigrants: D
- Net effect natives: B

*Note: We have assumed that capital is owned by natives.*



## Assumptions

- Consider an economy which is open to trade
- Output is produced with capital and (homogeneous) labour
- There is a labour-intensive sector (e.g. textiles) and a capital-intensive sector (e.g. automobile) producing a labour-intensive (shirts) and a capital-intensive goods (cars)
- Both goods are traded internationally
- Labour is mobile, capital is not (for illustrative purposes)
- The country does not affect prices on world markets (small-country- assumption)



## Consequences ....

- Immigration increases labour supply in the destination country
- The labour-intensity of production increases in both sectors
- But the labour-intensive sectors expands disproportionately, i.e. the share of the capital-intensive sector falls (Rybczynski-effect)
- The economy imports less labour-intensive goods and exports less capital-intensive goods
- The prices in the goods markets remain the same
- The prices in the factor markets – i.e. capital rents and wages – remain unchanged as well
- Thus, immigration simply substitutes trade and does not affect labour markets

## Labour is not homogenous

- Workers are different with respect to skills, work experience, language proficiency, gender, age, and many other abilities and motivation
- They are therefore employed in different occupations, industries, firms, etc.,  
i.e. different segments of the labour market
- Therefore they have different relationships in the production process, e.g. engineers and manual workers

## Net substitutes in the labour market

- Workers, where the competition (substitution) effect is larger than the complementarity in the production process

## Net complements

- Workers, where the complementarity dominates the competition (substitution) effect in the labour market



## Effects

- An increasing labour supply through immigration generates both a scale effect, i.e. it increases production, and a substitution effects, i.e. increases competition for workers which are relatively similar
- Workers who are (net) complements benefit from an increasing labour demand which is triggered by the scale effect, i.e. increasing production
- Hence, in perfect labour markets workers who are net substitutes suffer from falling wages while workers who are net complements benefit from increasing wages



## Imperfect labour markets

- Labour markets, where the wage-price-mechanisms is not perfectly working, such that sticky wages may result in unemployment

## Immigration and unemployment

- Immigration may have no impact at the macro level if capital or goods markets adjust smoothly
- But it may affect employment prospects of different groups in the labour market differently depending on whether they are net complements or substitutes
- The unemployment rate of net complements falls since they benefit from increasing labour supply, while it increases for net substitutes due to higher competition
- The total unemployment may increase if immigration disproportionately increases labour supply in inflexible segments of the labour market and vice versa



- There are competing theories on the labour market impact of immigration
  - Fixed capital stocks vs. capital stock adjustment
  - Open versus closed economies
  - Homogeneous vs. heterogeneous labour
  - Perfect vs. imperfect labour markets
- These theories have different implications on the wage and employment impacts of immigration, but may capture a part of the real world under certain conditions
- Thus, it remains basically an empirical question whether immigration reduces wages and increases unemployment





- **The spatial correlation approach:**
  - Card (1990) on the Mariel Boatlift
  - Altonji and Card (1991) for the US
  - Hunt (1992) on Algerian expatriates in France
  - Dustmann, Fabbri and Preston (2005) for the UK
  - Many more...
  
- **The structural approach:**
  - Borjas (2003)
  - Ottaviano and Peri (2012)
  - Brücker and Jahn (2011)
  - Brücker, Jahn, Hauptmann, Upward (2014)
  - Many more...



- “(...) *the effect of immigration on labour market outcomes of natives is relatively small.*”  
Rahel Friedberg and Jennifer Hunt, *Journal of Economic Perspectives*, Vol. 9, 1995
- A large econometric literature uses the regional (or: spatial) variance of the foreigner share for identification of wage and employment effects
- Meta-studies of this literature suggest that an immigration of 1% of the labour force
  - reduces wages by less than 0,1% (Longhi et al., 2005)
  - increases the unemployment rate by less than 0,1%-point (Longhi et al., 2006)



- Simple regression models, which explain wages or employment rates by the foreigner share controlling for regional covariates (output shocks etc.)
- Estimation of parameters of structural economic models, which are derived from aggregate production functions. Using these parameters the effects of immigration can be simulated (production function- or factor proportion approach)
  - CES- and Translog-production functions form theoretical framework



- **Using the regional variance of the foreigner share for the identification of the wage and/or employment effects of immigration**
- **Essential assumption:**  
*“Given an exogenous flow of immigrants to areas that is uncorrelated with levels/changes of native labour supply or demand across areas, and given sufficient time for the wages of native workers to adjust to changes in supply, comparisons of wages between immigrant-intensive areas should yield valid estimates of the effect of immigration on wages.”*

*Borjas/Freeman/Katz, AER 1997, p. 246*



- **Estimation in levels:**

$$\ln w_{ijkt} = a * m_{ijkt} + \mathbf{b}' \mathbf{x}_{ijt} + \mathbf{d}' \mathbf{z}_{kt} + e_{ijkt}$$

- **Estimation in differences:**

$$\Delta \ln w_{ijkt} = a * \Delta m_{ijkt} + \beta' \Delta \mathbf{x}_{ijt} + \gamma' \Delta \mathbf{z}_{kt} + \varepsilon_{ijkt}$$

where

$\mathbf{w}$  is the wage,  $\mathbf{m} \equiv M/(N+M)$  the migration share,  $\mathbf{x}$  a vector of individual human capital characteristics (age, education, gender etc.),  $\mathbf{z}$  a vector of regional characteristics (GDP etc.),  $e$  and  $\varepsilon$  the error terms.

$i$  denotes the individual (person) index,  $j$  an education index,  $k$  the regional index and  $t$  the time index.  $\ln$  is the log operator, and  $\Delta$  the first difference operator.



- An unbiased estimate requires that the error term is white noise, i.e. that

$$E(e_{ijkt}) \sim N(0, \sigma^2)$$

- This requires that migration share is exogenous, i.e. that it determines the wage rate, but that the wage rate does not determine the migration share:

$$w_{ijkt} = f(m_{ijkt}) \quad \text{but} \quad m_{ijkt} \neq f(w_{ijkt}).$$

If otherwise,  $E(e_{ijkt}) \neq N(0)$ !

Intuitively: If the migration share in a region is somehow affected by the wage level or the growth of wages, we can't receive an unbiased estimate.



- Natural experiments
  - Allocate, e.g. by helicopter, 100,000 immigrants in one region but no ones in other regions and forbid them to move
  - Examples:
    - The Mariel Boatlift (Card 1990),
    - the end of colonisation of Algeria (Hunt, 1992),
    - the influx of ethnic Germans or asylum seekers and their administrative distribution across German regions (Glitz, 2012)
- Instrumental variable estimation
  - Find an instrumental variable which is (i) correlated with the migrant share but (ii) uncorrelated with the wage rate
  - Use this to predict the exogenous part of the migration share
  - Use the predicted migration share for identification of the wage effect



- Assumption:
  - The IV determines the migration share, but the wage rate does not determine the IV:

$$m_{ijkt} = f(\mathbf{z}_{ijkt}) \text{ but } \mathbf{z}_{ijkt} \neq f(w_{ijkt}) ,$$

where  $\mathbf{z}$  is a (vector of) instruments.

- Two-step estimation:
  - First, estimate the migration share:

$$m_{ijkt} = \mathbf{a}'\mathbf{z}_{ijkt} + \mathbf{b}'\mathbf{x}_{ijkt} + e_{ijkt}$$

- Second, estimate the wage rate using the predicted migration share:

$$w_{ijkt} = \mathbf{a}^* m_{ijkt}^{\text{predict}} + \mathbf{B}'\mathbf{x}_{ijkt} + \varepsilon_{ijkt}$$





- The challenge is to find good instruments
- Usually the past migration share is used to predict the current one
- However, this might be problematic if the past migration share is correlated with the current wage rate or current wage growth
- Sometimes geographical variables are used as well
- Altogether, it is controversial whether the IVs we have are sufficiently uncorrelated



- Principal criticism of the spatial correlation approach
  - Endogeneity of migration share
  - Labour market adjustment by influx or outflow of natives
  - Local labour markets are not closed, i.e. migration effects spill over to other areas via trade and capital movements
- The alternative
  - Using the variance of the foreigner share across education and work experience cells of the labour market at national level for identification of migration effects
  - Crucial assumption: the foreigner share across education-experience cells is exogenous, i.e. not affected by differences in wage/employment rates across cells i.e. compared to other countries
  - Problem of proper definition of labour market cells



- Definition of migration share:

$$m_{ijt} = M_{ijt} / (M_{ijt} + N_{ijt})$$

- Estimation equation:

$$\ln y_{ijt} = \Theta m_{ijkt} + s_i + x_j + \pi_t + (s_i \times x_j) + (s_i \times \pi_t) + (x_j \times \pi_t) + \varphi_{ijt}$$

where

$y$  is the outcome variable (wage or employment rate),  $m$  the migration rate,  $s$  a vector of skill groups,  $x$  a vector of work experience groups,  $\pi$  a vector of time fixed effects,  $\varphi$  the error term.  $i$  denotes the skill index,  $j$  the work-experience index, and  $t$  the time index.  $\ln$  is the log operator.



- Thus, the labour market outcome is explained by the migration share and a bunch of dummy variables.
- The dummy variables control for
  - education levels
  - work experience levels
  - time effects: e.g. macro-economic shocks or technological progress
- The interaction dummy variables control for
  - the interaction between education and work experience
  - the interaction between education and time, e.g. due to skill-biased technological progress
  - the interaction between work experience and time



- A dummy variable has a value of 1, i.e. if somebody has a certain education level, and of 0 if otherwise
- Dummy variables are a save way to control for influences which result from differences in levels or over time.



- The definition of labour market cells might be arbitrary and yield therefore biased results
- In particular, it is questionable whether immigrants and natives of the same education and work experience level are indeed similar, e.g. language differences might affect productivity. Borjas tries to make adjustments for this, but it is controversial whether this is sufficient
- There might be still endogeneity resulting from the endogenous selection of immigrants in certain labour market cells
- The approach measures only the partial effects, but no cross-effects which result from spillovers to other labour market cells, e.g. by increasing labour demand there



- Structural models can address the cross-effects in other labour market cells
- These models rest on production functions, from which we can derive the wage effects
- Usually the elasticities of a CES-production function is estimated and the wage effects of a labour supply shock are then simulated
- Borjas uses a so-called nested CES-production function:
  - First level: Output is produced with capital and labour aggregate
  - Second level: the labour aggregate contains 4 education groups
  - Third level: each education groups contains 8 experience groups



- Aggregate production:

$$Y = (\theta_{L_t} L^\alpha + \theta_{K_t} K^\alpha)^{1/\alpha}$$

- Labour aggregate:

$$L_t = \left[ \sum_{i=1}^4 L_{it}^\delta \right]^{1/\delta}$$

- Each education group:

$$L_{it} = \left[ \sum_{j=1}^8 L_{ij t}^\rho \right]^{1/\rho}$$

- Differentiating the production function for each type of labour yields the respective wage rate.





- They find much larger effects: increasing the foreigner share by 1 per cent of the labour force
  - reduces wages of natives by 0.3 to 0.4 per cent
  - increases unemployment by 0.3 and 0.4 percentage points
  - Borjas (QJE 2003) finds that both for the regression and the structural estimation model
  - Aydemir/Borjas (JEEA, 2006) find remarkably similar results for the US, Canada, Mexico



Ottaviano-Peri (2006/2012) estimate a structural model similar to Borjas (2003), but with two important differences:

- They consider the adjustment of capital stock, which reduces the migration impact substantially
- Ottaviano/Peri treat native and immigrant labour in each education-experience cell as imperfect substitutes, i.e. they add a third nest for native and migrant labour to the CES production function. Consequently, immigrants suffer from migration, while natives tend to benefit
- A large controversy on the appropriate classification of the labour market cells follows, see the 2012 volume of the Journal of the Economic Association on this issue



- Delivered completely different findings:
  - wages of natives increased by 0.06 percent, while those of foreigners fell by 0.6 percent at an immigration of 1 percent of the labour force (Ottaviano/Peri, NBER DP 2006, JEEA 2012)
- The exact measurement is subject of a large and controversial literature since then
  - E.g. Borjas/Grogger/Hanson, JEEA 2012; Ottaviano/Peri JEEA 2012, Manning et al., JEEA 2012; Dustmann JEEA 2012



- There are several studies based on data from Germany, UK, DK and some other countries
- They all find that immigrants and natives are imperfect substitutes and that the overall effects are relatively small
  - Germany: D'Amuri/Ottaviano/Peri, EEA, 2010; Brücker/Jahn, ScJE 2012; Brücker/Hauptmann/Jahn/Upward, EEA, 2014; Felbermayr et al., WA 2013
  - UK: Manning et al., JEEA, 2012; Brücker/Hauptmann/Jahn/Upward, EEA, 2014
  - Denmark: Brücker/Hauptmann/Jahn/Upward, EEA, 2014



- The methods to measure the migration impact on labour markets are not uncontroversial
- Addressing endogeneity is a key issue
- In structural models it matters (i) whether natives and immigrants are perfect or imperfect substitutes in the labour market, and (ii) whether capital stock adjustment is considered
- The majority of the evidence suggests that (i) the overall impact is rather small and (ii) that natives and immigrants are imperfect substitutes. Nevertheless, the evidence is quite heterogeneous.

# What we want to do in this seminar

University of Bamberg



# Replicating the Borjas (QJE 2003) regression model



- The general idea is to bring the Borjas' model to new data
- We have collected data for Germany, Denmark and the UK (Brücker/Hauptmann/Jahn/Upward, EER 2014)
- These data can be used for the rather simple Borjas' regression model
- We can compare the outcomes and learn one or two things about cross-country differences



- Definition of migration share:

$$m_{ijt} = M_{ijt} / (M_{ijt} + N_{ijt})$$

- Estimation equation:

$$\ln y_{ijt} = \Theta m_{ijkt} + \mathbf{s}_i + \mathbf{x}_j + \mathbf{n}_t + (\mathbf{s}_i \times \mathbf{x}_j) + (\mathbf{s}_i \times \mathbf{n}_t) + (\mathbf{x}_j \times \mathbf{n}_t) + \varphi_{ijt}$$

where

$y$  is the outcome variable (wage or employment rate),  $m$  the migration rate,  $s$  a vector of skill group-fixed effects,  $x$  a vector of work experience group fixed effects,  $n$  a vector of time fixed effects,  $\varphi$  the error term.  $i$  denotes the skill index,  $j$  the work-experience index, and  $t$  the time index.  $\ln$  is the log operator.





- A detailed break-down of the labour force by education-, work-experience groups and national origin
- Detailed wage information for these education-, work-experience and nationality groups
- The unemployment rates by education-, work-experience and nationality groups for the calculation of employment rates
- Then we have to create a large set of dummy variables and interaction dummy variables for these groups and the time fixed effects
- But in the first place we will look into the data



- I order the STATA Software Packages
- Then we make us familiar with STATA
- We learn elementary aspects of descriptive data analysis, graphs and Ordinary Least Squares (OLS) estimation
- Then we conduct the graphical analysis and the regression analysis
- But until then, you need to have a look into the literature!

# Next Meeting: May 25



- Begin: 12:00 – 14:00
- Topic: Intro to STATA
- **All meetings are compulsory.**

THANKS FOR YOUR ATTENTION!