Introduction

Migration and the Wage Curve: A New Approach to Measure the Wage and Employment Effects of Migration

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What are the questions?

- Does migration affect wages?
- Do capital stocks adjust in the long- and short run?
- What is the impact on (un-)employment in labour markets with wage rigidities?
- How are the gains and losses distributed across a labour force of heterogeneous workers?
- What are the consequences for migration regulation?
State of the literature

- Substantial empirical literature which tempts to identify wage and employment effects of migration using the variance across regions (Surveys: Borjas, 1995; Friedberg/Hunt, 1995)
  - Natural experiments (e.g. Card, 1990; Hunt, 1992)
  - Other controls for endogeneity (Borjas/Freeman/Katz, 1997; Grossmann, 1982; DeNew/Zimmermann, 1994; 1995; Hatizius, 1994; Pischke/Velling, 1997)
  - Small, insignificant effects on low-skilled wages and unemployment (Card, 1990; Friedberg, 2001; Lewis, 2005; Bauer, 1997; Hatizius, 1995; Venturini/Villosio, 2002)
  - Larger adverse effects (Borjas/Freemann/Katz, 1997; DeNew/Zimmermann, 1994; 1995)
  - Meta-studies: wage elasticity of -0.1 percent, insignificant unemployment effects (Longhi et al., 2006a; 2006b)
State of the literature (cont.)

- National level studies avoid endogeneity of locational choices using the variance across education and experience groups (Borjas, 2003; Bonin, 2005; Ottaviano/Peri, 2006)
- Employing different assumptions
  - Native and foreign workers are perfect vs. imperfect substitutes (Borjas, 2003 and Bonin, 2005 vs. Ottaviano/Peri, 2006 and Card/Lemieux, 2001)
  - Fixed capital stocks vs. capital stock adjustment (Borjas, 2003; Borjas/Freeman/Katz, 1997 vs. Ottaviano/Peri (2006; Brücker, 2007)
- Measuring partial elasticities vs. total effects (Borjas, 2003; Bonin, 2005 vs. Ottaviano/Peri, 2006)
This paper

- Presents a model which considers the employment and wage effects of migration simultaneously
  - Considers wages rigidities employing a 'wage curve' approach (Blanchflower/Oswald, 1994; 1995)
  - Uses a nested CES-production function which considers heterogeneity across education groups, experience groups, natives and migrants
- Simulates short- and long-run impact of migration on the German labor market
- Compares the findings with the US evidence from Ottaviano/Peri (2006)
- Discusses implications for migration regulation
Part I

Outline of the model
Outline of simulation model

Outline of model

- Analysis is based on a structural model in the spirit of Ottaviano/Peri (2006), Boeri/Brucker (2005) and Levine (1999)
- Nested constant-returns to scale production function (CES)
- Heterogeneity of labour market: labour force is distinguished by education, experience, native and foreign workers (Borjas, 2003; Bonin, 2004; Ottaviano/Peri, 2006)
- Models wage rigidities employing a wage curve approach (Blanchflower and Oswald, 1994a; 1994b; Card, 1995)
- Considers capital stock adjustment
Aggregate production function:

$$Y_t = A_t \tilde{L}_t^\alpha K_t^{(1-\alpha)}$$  \hspace{1cm} (1)

First nest: education

$$\tilde{L}_t = \left[ \sum_{q=1}^{4} \theta_{qt} \tilde{L}_{qt}^{(\delta-1)/\delta} \right]^{\delta/(\delta-1)} = \frac{4}{\delta}, \quad \sum_{q=1}^{4} \theta_{qt} = 1, \quad \left(2\right)$$

Second nest: experience

$$\tilde{L}_{qt} = \left[ \sum_{k=1}^{8} \theta_{qkt} \tilde{L}_{qkt}^{(\rho-1)/\rho} \right]^{\rho/(\rho-1)} = \frac{8}{\rho}, \quad \sum_{k=1}^{8} \theta_{qkt} = 1, \quad \left(3\right)$$

Third nest: native and foreign workers

$$\tilde{L}_{qkt} = \left[ \theta_{qkHt} L_{qkHt}^{(\sigma_q-1)/\sigma_q} + \theta_{qkFt} L_{qkFt}^{(\sigma_q-1)/\sigma_q} \right]^{\sigma_q/(\sigma_q-1)}.$$

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Wage curve: wages adjust to changes of unemployment rate, albeit imperfectly (Blanchflower/Oswald, 1994a; 1994b; Card, 1995)

Different theoretical motivations
- Wage bargain: bilateral bargaining monopoly of trade-unions and employer federations fixes wage
- right-to-manage: profit-maximizing firms hire labour until marginal product of labour equals wage rate
- Alternatively: Efficiency wage considerations
We allow wage curves to differ by labour market segments

- Aggregate wage curve:
  \[ w_t = \phi(u_{qkit}), \quad \phi' < 0, \quad (5) \]

- Wage curve of education groups:
  \[ w_{qt} = \phi_q(u_{qt}), \quad \phi'_q < 0, \quad (6) \]

- Wage curve of natives:
  \[ w_{Hqt} = \phi_{Hq}(u_{Hqt}), \quad \phi'_{Hq} < 0, \quad (7) \]

- Wage curve of foreigners:
  \[ w_{Fqt} = \phi_{Fq}(u_{Fqt}), \quad \phi'_{Fq} < 0, \quad (8) \]
Outline of simulation model

Capital stock adjustment

- Stylized fact on economic growth: capital-output ratio is constant in the long-run (Kaldor, 1961)
- If this holds true, migration does not change labour productivity at the macro level in the long-run
- Empirical evidence
  - constant capital-output ratio in the US
  - small trend-growth in Germany (from 3.0 1960 to 3.15 2006)
- Impact of short-term labour supply shocks
  - small negative impact in the US (Ottaviano/Peri, 2006)
  - insignificant small negative impact in Germany (see below)
\[ \frac{dL_t}{dF_t} = \frac{\eta(1 - u_t)^2}{\eta(1 - u_t)(1 - \alpha)\mu_t} \frac{dN_t}{dF_t} \]

\[ + \frac{(1 - \alpha)(1 - u_t)}{\eta(1 - u_t) + (1 - \alpha)\mu_t} \frac{N_t}{K_t} \frac{dK_t}{dF_t} \]

\[ = (1 - u_t) \frac{dN_t}{dF_t} + \frac{(1 - \alpha)}{\alpha} \frac{1}{\eta} \frac{N_t}{\kappa_t} \frac{d\kappa_t}{dF_t}, \]

- if \( \eta \to \infty \): then \( \frac{dL_t}{dF_t} \to \frac{dN_t}{dF_t} \)
- if \( \eta \to 0 \) and \( \frac{dK_t}{dF_t} \to 0 \): then \( \frac{dL_t}{dF_t} \to 0 \).
Disaggregate employment impact (natives)

\[
\frac{dL_{qkHt}}{dF_t} = - \left( \frac{\mu_{qkt}}{\rho} - \frac{\mu_{qkt}}{\sigma_q} \right) \frac{\eta_k (1 - u_{qkt}) (1 - u_{qkHt})}{\left[ \eta_k (1 - u_{qkt}) + \frac{\mu_{qkt}}{\rho} \right] \left[ \eta_{qkH} (1 - u_{qkHt}) + \frac{1}{\sigma_q} \right]} \frac{H_{qkt}}{N_{qkt}} \frac{dN_{qkt}}{dF_t}
\]

\[
- \left[ \frac{\mu_{qt}}{\delta} - \frac{\mu_{qt}}{\rho} \right] \eta_q (1 - u_{qt}) \left[ (1 - u_{qkt}) + \frac{\mu_{qkt}}{\rho} \right] \left[ \eta_{qkH} (1 - u_{qkHt}) + \frac{1}{\sigma_q} \right] \frac{H_{qkt}}{N_{qkt}} \frac{dN_{qkt}}{dF_t}
\]

\[
+ \frac{\mu_{t}}{\delta} \eta_q (1 - u_{qt}) \left[ (1 - u_{qkt}) + \frac{\mu_{qkt}}{\rho} \right] \left[ \eta_{qkH} (1 - u_{qkHt}) + \frac{1}{\sigma_q} \right] \frac{H_{qkt}}{N_t} \frac{dN_t}{dF_t}
\]

\[
+ \frac{(1 - \alpha)}{\alpha} \eta (1 - u_t) \left[ (1 - u_{qt}) + \frac{\mu_{qt}}{\delta} \right] \left[ (1 - u_{qkt}) + \frac{\mu_{qkt}}{\rho} \right] \left[ \eta_{qkH} (1 - u_{qkHt}) + \frac{1}{\sigma_q} \right] \frac{H_{qkt}}{\kappa_t} \frac{d\kappa_t}{dF_t}
\],
Outline of simulation model

Disaggregate employment impact (foreigners)

\[
\frac{dL_{qkFt}}{dF_t} = \frac{\eta_{qkF}(1 - u_{qkFt})^2}{\eta_{qkF}(1 - u_{qkFt}) + \frac{1}{\sigma_q}} \frac{dF_{qkt}}{dF_t} 
\]

\[
- \left( \frac{\mu_{qkt}}{\rho} - \frac{\mu_{qkt}}{\sigma_q} \right) \frac{\eta_q(1 - u_{qkt})}{\eta_q(1 - u_{qkt}) + \frac{\mu_{qkt}}{\sigma_q}} \frac{\eta_{qkF}(1 - u_{qkFt})}{\eta_{qkF}(1 - u_{qkFt}) + \frac{1}{\sigma_q}} F_{qkt} \frac{dN_{qkt}}{dF_t} 
\]

\[
- \left( \frac{\mu_{qkt}}{\delta} - \frac{\mu_{qkt}}{\rho} \right) \frac{\eta_q(1 - u_{qkt})}{\eta_q(1 - u_{qkt}) + \frac{\mu_{qkt}}{\delta}} \frac{\eta_{qkF}(1 - u_{qkFt})}{\eta_{qkF}(1 - u_{qkFt}) + \frac{1}{\sigma_q}} F_{qkt} \frac{dN_{qkt}}{N_{qkt} dF_t} 
\]

\[
+ \frac{\mu_{t}}{\delta} \frac{\eta_q(1 - u_{qkt}) + \frac{\mu_{qkt}}{\delta}}{\eta_q(1 - u_{qkt}) + \frac{\mu_{qkt}}{\rho}} \frac{\eta_{qkF}(1 - u_{qkFt})}{\eta_{qkF}(1 - u_{qkFt}) + \frac{1}{\sigma_q}} F_{qkt} \frac{dN_{t}}{N_t dF_t} 
\]

\[
+ \frac{(1 - \alpha)}{\alpha} \frac{\eta_q(1 - u_{qkt}) + \frac{\mu_{qkt}}{\delta}}{\eta_q(1 - u_{qkt}) + \frac{\mu_{qkt}}{\rho}} \frac{\eta_{qkF}(1 - u_{qkFt})}{\eta_{qkF}(1 - u_{qkFt}) + \frac{1}{\sigma_q}} F_{qkt} \frac{d\kappa_t}{\kappa_t dF_t} 
\]

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\[
\frac{dw_{qkHt}}{w_{qkHt}} = \frac{1}{\delta} \sum_{n} \sum_{m} \sum_{j} \left( s_{nmjt} \frac{dL_{nmjt}}{L_{nmjt}} \right)_{\text{immigration}} \\
- \left( \frac{1}{\delta} - \frac{1}{\rho} \right) \frac{1}{s_{qt}} \left( \sum_{m} \sum_{j} s_{qmjt} \frac{dL_{qmjt}}{L_{qmjt}} \right)_{\text{immigration}} \\
- \left( \frac{1}{\rho} - \frac{1}{\sigma_q} \right) \frac{1}{s_{qkt}} \sum_{j} \left( s_{qkjt} \frac{dL_{qkjt}}{L_{qkjt}} \right)_{\text{immigration}} \\
- \frac{1}{\sigma_q} \left( \frac{dL_{qkHt}}{L_{qkHt}} \right)_{\text{immigration}} + \frac{1 - \alpha}{\alpha} \left( \frac{d\kappa_t}{\kappa_t} \right)_{\text{immigration}}.
\]
Part II

Data
The data set

- IAB Employment Sample (IABS)
  - 2% sample of all employees and unemployed derived from social security records
  - censored: 5,800 Euro income ceiling
  - no self-employed
- identification of foreigners by citizenship
  - we treat individuals as foreigners if they are once reported as foreign nationals
- we restrict sample to Western Germany (without Berlin)
- we exclude part-time workers since no information on working hours available
- we use the 1980-2004 period (25 time series observations)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>no vocational degree</td>
<td>0.313</td>
<td>0.336</td>
<td>0.480</td>
<td>0.477</td>
</tr>
<tr>
<td>vocational degree</td>
<td>0.051</td>
<td>0.053</td>
<td>0.082</td>
<td>0.087</td>
</tr>
<tr>
<td>high school + vocational degree</td>
<td>0.063</td>
<td>0.045</td>
<td>0.066</td>
<td>0.070</td>
</tr>
<tr>
<td>college or university degree</td>
<td>0.075</td>
<td>0.054</td>
<td>0.055</td>
<td>0.063</td>
</tr>
</tbody>
</table>
Part III

Estimation
Estimation strategy

Three steps:

- Impact of labour supply shocks on capital-output ratio
- Elasticities of production function
  - Elasticity of substitution between native and foreign workers
  - Elasticity of substitution between experience groups
  - Elasticity of substitution between education groups
- Wage curves
Capital stock adjustment

- **Long-run impulse**

\[
\ln(\kappa_t) = \beta_0 + \beta_1 \ln(\kappa_{t-1}) + \beta_2 \ln(N_t) + \beta_3 Trend_t + \epsilon_t, \quad (13)
\]

- **Short-run impulse**

\[
\ln(\kappa_t) = \gamma_0 + \gamma_1 \ln(\kappa_{t-1}) + \gamma_2 \Delta \ln(N_t) + \gamma_3 Trend_t + \epsilon_t, \quad (14)
\]

- Ottaviano/Peri (2006) estimated second regression and obtained similar results
Estimation of long- and short-term adjustment

<table>
<thead>
<tr>
<th></th>
<th>long-run</th>
<th>short-run</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ln(k_{t-1})$</td>
<td>0.85 ***</td>
<td>0.74 ***</td>
</tr>
<tr>
<td>(0.13)</td>
<td>(0.09)</td>
<td></td>
</tr>
<tr>
<td>$\ln(N_t)$</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>(0.04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta \ln(N_t)$</td>
<td>-0.08</td>
<td></td>
</tr>
<tr>
<td>(0.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>adjusted $R^2$</td>
<td>0.61</td>
<td>0.61</td>
</tr>
<tr>
<td>Durbin-Watson statistics</td>
<td>1.47</td>
<td>1.39</td>
</tr>
</tbody>
</table>

The dependent variable is $\ln(k_{t-1})$. Each regression includes a constant and a deterministic time trend.
Elasticities of substitution

- Between natives and foreign workers:

\[
\ln \left( \frac{w_{qkHt}}{w_{qkFt}} \right) = D_{kj} - \frac{1}{\sigma_{qk}} + \nu_{qkt},
\]  

(15)

- Between experience groups:

\[
\ln w_{qkt} = D_t + D_{qt} + D_{qk} - \frac{1}{\rho} \ln(\tilde{L}_{qkt}) + \nu_{qkt},
\]

(16)

- Between education groups:

\[
\ln w_{qt} = D_t + D_{q} + \lambda_q \text{Trend}_q - \frac{1}{\delta} \ln(\hat{L}_{qkt}) + \vartheta_{qt}.
\]

(17)
Elasticities of substitution: results

- Between natives and foreign workers: $\sigma_q$
  - all: 55***
  - ed1: 37***
  - ed2: 83***
  - ed3: 30***
  - ed4: 111

- Between experience groups: $\rho$
  - 200*

- Between education groups: $\delta$
  - 4***
Estimation of wage curves

- total labour force:

  \[ \ln(w_{qkt}) = \beta_q \ln(w_{qk,t-1}) - \eta_q u_{qkt} + \gamma_q' \tau_q + e_{qkt}, \]  
  \( (18) \)

- natives

  \[ \ln(w_{Hqkt}) = \beta_{Hq} \ln(w_{Hqk,t-1}) - \eta_{Hq} u_{Hqkt} + \gamma_{Hq}' \tau_q + e_{Hqkt}, \]  
  \( (19) \)

- foreigners

  \[ \ln(w_{Fqkt}) = \beta_{Fq} \ln(w_{Fqk,t-1}) - \eta_{Fq} u_{Fqkt} + \gamma_{Fq}' \tau_q + e_{Fqkt}, \]  
  \( (20) \)
<table>
<thead>
<tr>
<th>dependent variable</th>
<th>$\ln \text{wage}</th>
<th>\ln \text{wage}(t - 1)$</th>
<th>unemployment rate</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ln \text{wage}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>all</td>
<td>0.82 ***</td>
<td>-0.17 ***</td>
<td>-0.96</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.03)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no vocational</td>
<td>0.70 ***</td>
<td>-0.23 ***</td>
<td>-0.79</td>
<td>0.93</td>
</tr>
<tr>
<td>degree</td>
<td>(0.06)</td>
<td>(0.03)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vocational</td>
<td>0.69 ***</td>
<td>-0.34 ***</td>
<td>-1.08</td>
<td>0.94</td>
</tr>
<tr>
<td>degree</td>
<td>(0.07)</td>
<td>(0.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>high school with</td>
<td>0.57 ***</td>
<td>-0.16 ***</td>
<td>-0.37</td>
<td>0.88</td>
</tr>
<tr>
<td>vocational degree</td>
<td>(0.07)</td>
<td>(0.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>university or</td>
<td>0.31 ***</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.93</td>
</tr>
<tr>
<td>college degree</td>
<td>(0.11)</td>
<td>(0.05)</td>
<td></td>
<td></td>
</tr>
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</table>
### Wage curve: Results for native labour force

<table>
<thead>
<tr>
<th>dependent variable</th>
<th>In $wage(t - 1)$</th>
<th>unemployment rate</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>In $wage$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no vocational degree</td>
<td>0.75 ***</td>
<td>-0.21 ***</td>
<td>-0.86</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.04)</td>
<td></td>
</tr>
<tr>
<td>vocational degree</td>
<td>0.70 ***</td>
<td>-0.34 ***</td>
<td>-1.13</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.06)</td>
<td></td>
</tr>
<tr>
<td>high school with</td>
<td>0.56 ***</td>
<td>-0.17 ***</td>
<td>-0.39</td>
</tr>
<tr>
<td>vocational degree</td>
<td>(0.07)</td>
<td>(0.06)</td>
<td></td>
</tr>
<tr>
<td>university</td>
<td>0.30 ***</td>
<td>-0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>or college degree</td>
<td>(0.11)</td>
<td>(0.05)</td>
<td></td>
</tr>
</tbody>
</table>

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Migration and the Wage Curve: A New Approach to Measure the
### Wage curve: Results for foreign labour force

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>ln (wage(t - 1))</th>
<th>Unemployment rate</th>
<th>R(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In wage</td>
<td></td>
<td>Short-run</td>
<td>Long-run</td>
</tr>
<tr>
<td>no vocational</td>
<td>0.45 ***</td>
<td>-0.25 ***</td>
<td>-0.49</td>
</tr>
<tr>
<td>degree</td>
<td>(0.06)</td>
<td>(0.03)</td>
<td>0.89</td>
</tr>
<tr>
<td>vocational degree</td>
<td>0.52 ***</td>
<td>-0.25 ***</td>
<td>-0.52</td>
</tr>
<tr>
<td>degree</td>
<td>(0.07)</td>
<td>(0.03)</td>
<td>0.89</td>
</tr>
<tr>
<td>high school degree</td>
<td>0.38 ***</td>
<td>-0.02 ***</td>
<td>-0.04</td>
</tr>
<tr>
<td>degree</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>0.38</td>
</tr>
<tr>
<td>university or college degree</td>
<td>0.40 ***</td>
<td>0.04</td>
<td>0.07</td>
</tr>
</tbody>
</table>

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Estimation: Summarizing

- Capital stock adjustment
  - No long-run impact of labour supply on capital-output ratio
  - No significant or small impact of short-term labour supply shocks

- Elasticities of production function
  - Native and foreign workers imperfect substitutes
  - Experience groups almost perfect substitutes
  - Education groups imperfect substitutes
Wage curve
- Total elasticity very similar to findings in international literature (-1.1)
- High elasticity of no vocational training group
- Average elasticity of vocational training group
- Low elasticity of high school degree group
- Zero elasticity of university and college degree group!

The flexibility of labour markets is thus declining with education!

Do efficiency wages matter?
Part IV

Simulation of results
Simulation assumptions

- Marginal impact: simulation of a 1% increase of labour force through migration
- Using the sample average of the foreigner share for assessment of labour shock by skill and experience groups
- Short-run scenario: considering short-run semi-elasticity of wage curve and (small) negative impact on capital-output ratio
- Long-run scenario: considering long-term elasticity of wage curve and complete capital stock adjustment
- Comparing with the US: Wage results from Ottaviano/Peri (2006) calculated at 1% of workforce (1/11)
## Simulation results: total labour force

<table>
<thead>
<tr>
<th></th>
<th>Short-run results</th>
<th>Long-run results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>wages rate</td>
<td>wages rate</td>
</tr>
<tr>
<td>all</td>
<td>0.07 -0.20</td>
<td>0.10 -0.17</td>
</tr>
<tr>
<td>no vocational degree</td>
<td>-0.04 1.60</td>
<td>-0.20 0.99</td>
</tr>
<tr>
<td>vocational degree</td>
<td>0.08 -0.27</td>
<td>0.14 -0.10</td>
</tr>
<tr>
<td>high school degree</td>
<td>0.12 -0.14</td>
<td>0.18 -0.01</td>
</tr>
<tr>
<td>college or university degree</td>
<td>0.20 -3.31</td>
<td>0.23 -3.28</td>
</tr>
</tbody>
</table>

wages: change in % at an immigration of 1%
unemployment rate: change in %-points
## Simulation results: native labour force

<table>
<thead>
<tr>
<th></th>
<th>short-run results</th>
<th></th>
<th>long-run results</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>wages</td>
<td>unemployment rate</td>
<td>wages</td>
<td>unemployment rate</td>
</tr>
<tr>
<td>all</td>
<td>0.08</td>
<td>-0.46</td>
<td>0.12</td>
<td>-0.38</td>
</tr>
<tr>
<td>no vocational degree</td>
<td>-0.01</td>
<td>0.20</td>
<td>-0.16</td>
<td>0.59</td>
</tr>
<tr>
<td>vocational degree</td>
<td>0.08</td>
<td>-0.36</td>
<td>0.15</td>
<td>-0.17</td>
</tr>
<tr>
<td>high school degree</td>
<td>0.13</td>
<td>-0.56</td>
<td>0.19</td>
<td>-0.36</td>
</tr>
<tr>
<td>college or university degree</td>
<td>0.20</td>
<td>-3.68</td>
<td>0.22</td>
<td>-3.60</td>
</tr>
</tbody>
</table>

Wages: change in % at an immigration of 1%

Unemployment rate: change in %-points
### Simulation results: foreign labour force

<table>
<thead>
<tr>
<th></th>
<th>short-run results</th>
<th>long-run results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>wages</td>
<td>unemployment</td>
</tr>
<tr>
<td>all</td>
<td>-0.06</td>
<td>2.25</td>
</tr>
<tr>
<td>no vocational degree</td>
<td>-0.14</td>
<td>2.92</td>
</tr>
<tr>
<td>vocational degree</td>
<td>-0.02</td>
<td>1.16</td>
</tr>
<tr>
<td>high school degree</td>
<td>-0.01</td>
<td>7.06</td>
</tr>
<tr>
<td>college or university degree</td>
<td>0.28</td>
<td>3.05</td>
</tr>
</tbody>
</table>

**wages:** change in % at an immigration of 1%

**unemployment rate:** change in %-points
### US simulation results (Ottaviano/Peri, 2006): wage effects

<table>
<thead>
<tr>
<th></th>
<th>native wages</th>
<th></th>
<th>foreign wages</th>
<th></th>
<th>all</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>short-run</td>
<td>long-run</td>
<td>short-run</td>
<td>long-run</td>
<td>short-run</td>
<td>long-run</td>
</tr>
<tr>
<td>average</td>
<td>0.06</td>
<td>0.16</td>
<td>-1.90</td>
<td>-1.80</td>
<td>-0.10</td>
<td>0.00</td>
</tr>
<tr>
<td>high-school dropouts</td>
<td>-0.20</td>
<td>-0.10</td>
<td>-1.58</td>
<td>-1.48</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>high school graduates</td>
<td>0.12</td>
<td>0.21</td>
<td>-2.24</td>
<td>-2.14</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>college dropouts</td>
<td>0.21</td>
<td>0.31</td>
<td>-1.22</td>
<td>-1.12</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>college graduates</td>
<td>-0.03</td>
<td>0.06</td>
<td>-2.30</td>
<td>-2.20</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

*change in % at an immigration of 1%*
German simulation results: perfect labour markets

<table>
<thead>
<tr>
<th></th>
<th>native wages</th>
<th>foreign wages</th>
<th>all</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>short-run</td>
<td>long-run</td>
<td>short-run</td>
</tr>
<tr>
<td>average</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.32</td>
</tr>
<tr>
<td>no vocational training</td>
<td>-0.50</td>
<td>-0.46</td>
<td>-0.64</td>
</tr>
<tr>
<td>vocational training</td>
<td>0.05</td>
<td>0.08</td>
<td>-0.06</td>
</tr>
<tr>
<td>high school graduates</td>
<td>0.08</td>
<td>0.10</td>
<td>0.31</td>
</tr>
<tr>
<td>university graduates</td>
<td>0.15</td>
<td>0.18</td>
<td>0.36</td>
</tr>
</tbody>
</table>

change in % at an immigration of 1%
Part V

Summary and conclusions
Summary of estimation results

- We find strong evidence for capital stock adjustment
- We find relatively high elasticities of substitution between native and foreign workers, experience and education groups – at least compared to the US evidence
- We find evidence for existence of a wage curve in Germany
- Elasticity between wages and unemployment declines with education levels
- Elasticity between wages and unemployment is smaller for foreign workers
- This has important implications for migration effects
We find that immigration *reduces* aggregate unemployment by 0.2%-points and *increases* aggregate wages by 0.1%.

Migration into the low-skilled sector involves higher employment of skilled workers.

Only moderate wage effects due to wage rigidities.

The native labour force gains from less-skilled immigration:
- unemployment rate: -0.46 %-points (short-), -0.38%-points (long-run)
- wages: +0.08% (short-), +0.12% (long-run)

The foreign labour force suffers from less-skilled immigration:
- unemployment rate: +2.25 %-points (short-), +1.77%-points (long-run)
- wages: -0.06% (short-), -0.11% (long-run)
Ottaviano/Peri (2006) find larger wage effects for the US:
- native wages: +0.06% (short-), +0.16% (long-run)
- foreign wages: -1.90% (short-), -1.80% (long-run)
- total wages: -0.10% (short-), 0.00% (long-run)

Comparing the results with perfect labour market scenario for Germany yields comparable results in the aggregate, but smaller differences between education groups and natives and foreigners:
- native wages: -0.01% (short-), +0.02% (long-run)
- foreign wages: -0.32% (short-), -0.29% (long-run)
- total wages: -0.04% (short-), 0.00% (long-run)

Future research: estimating wage curve model for the US
Conclusions

- Consideration of labour market rigidities can change our views on migration impacts
- Countries can benefit from immigration, if migrants move into labour market segments with higher wage flexibility
- Interestingly enough, this is the low-skilled segment in Germany
- If the estimates of the wage curve are correct, high-skilled immigration would increase unemployment in Germany
- Regulation of migrant influx by skill levels has to consider therefore labour market conditions carefully
- Evidence from other countries needed