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High growth firms, firm dynamics and industrial variety - Regional evidence from Austria

Seminar IEB

Barcelona, November 2015

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- 1. Motivation**
- 2. High growth firms: measurement, importance and stylised facts**
- 3. The non-persistence of high firm growth**
- 4. Persistence of the share of high growth firms at the regional level**
- 5. Is industrial structure a determinant of the number of high growth firms: Evidence for Austrian regions**
- 6. Concluding remarks**

- **Surprisingly little is known about firm growth patterns on a regional level.**

Except recent work by Duschl (2014) on growth rate distributions in Germany, finding that turbulences are more pronounced in regions with a higher aggregate growth performance, with a highly qualified workforce and with more unrelated variety in the industrial portfolio.

- **We study the share of high growth firms and its determinants for Austrian NUTS-3 regions.**
 - **Are there important differences in the number of HGFs across regions & if so what are determinants?**
 - **Non-persistence of HGF at the firm level but persistence at the regional level?**
 - **Does sector composition matter?**

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- **Industrial dynamics is relevant for economic change**

 - **Economic policy is interested in firm growth**
 - **success stories**
 - **employment generation**
 - **Are HGFs expression of growth or of volatility?**
 - **policy fad (?)**

 - **Availability of representative and comprehensive firm level datasets**
 - **Interpretation of aggregate stylized facts on the basis of microeconomic distributions/populations instead of behavior of “representative agents”**

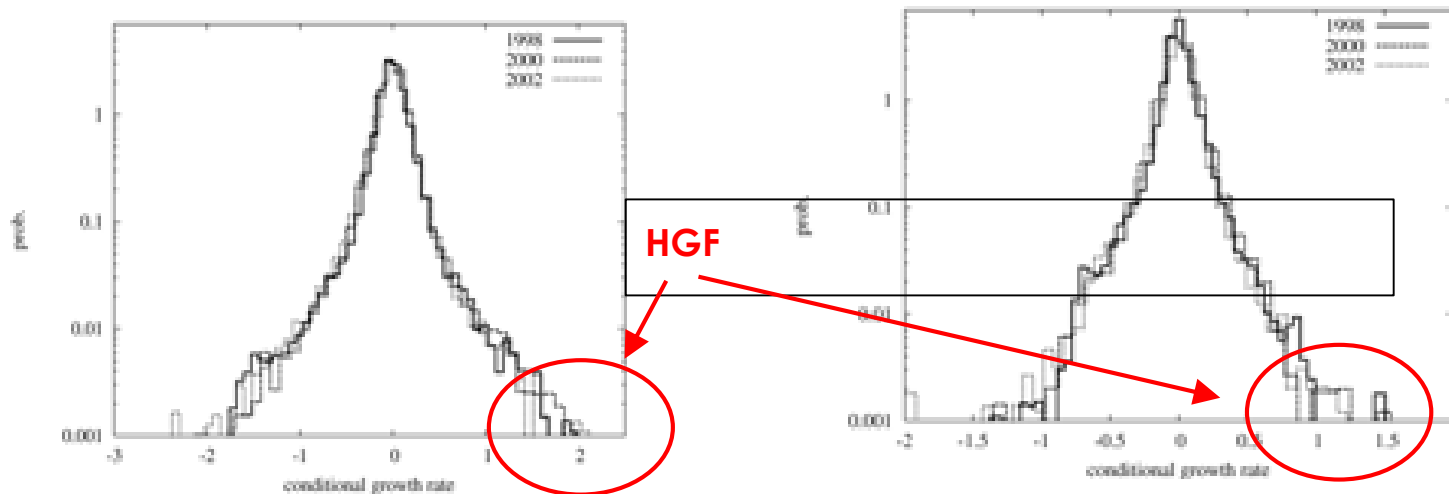
Definition of high growth firms (OECD-Eurostat):

Fast growing firms are firms with at least 10 employees in the start-year and annualized employment growth exceeding 20% during a 3-year period.

Controversies:

- relative vs. absolute growth: relative growth measure favours small firms (deviation from Gibrat's law)
- cut off ignores large number of small firms
- organic growth vs. growth by acquisitions

The distribution of (log) firm growth rates



Left: distribution of sales growth (log growth) of French manufacturing firms (*Bottazzi et al., 2010*). Right: distribution of employment growth (log growth) of French manufacturing firms (*Coad, 2007a*). Note the log scale on the y-axis.

- SF 1: growth rates distributions are heavy-tailed**
- SF 2: a small number of HGFs create a large share of new jobs**
- SF 3: HGFs tend to be young but are not necessarily small**
- SF 4: HGFs are not more common in high-tech industries**
- SF 5: high growth is not to be persistent over time**
- SF 6: difficult to predict which firms are going to grow**
- SF 7: the use of different growth indicators selects a different set of firms**

SF 4: HGFs are not more common in high-tech industries

SF 5: high growth is not to be persistent over time

Industry distribution of HGFs and persistence at the firm level and at the regional level.

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- **The available HGF literature (e.g. Henrekson and Johansson 2010) suggests that we should not observe systematic differences as:**
 - **The likelihood of observing HGFs should be independent of patterns of industrial specialization.**
 - **The likelihood of observing HGFs should be correlated with growth rates at the industry level.**
 - **Cross-country comparisons (e.g. Bravo-Biosca 2010) show considerable differences in HGF shares and growth rate distributions across countries.**
 - **Institutional and regulatory differences are minor, even if Austria is a federal country.**

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- **HGF shares are computed using the Austrian Social Security files**
 - **Annual employment stocks for all private sector firms with at least one employee**
 - **Time 1994 to 2009: five 3-year periods: 1995/1997, 1998/2000, 2001/2003, 2003/2006, 2007/2009**
 - **NACE Rev. 1.1**
 - **35 NUTS3 districts**

 - **Additional Data: Statistics Austria**

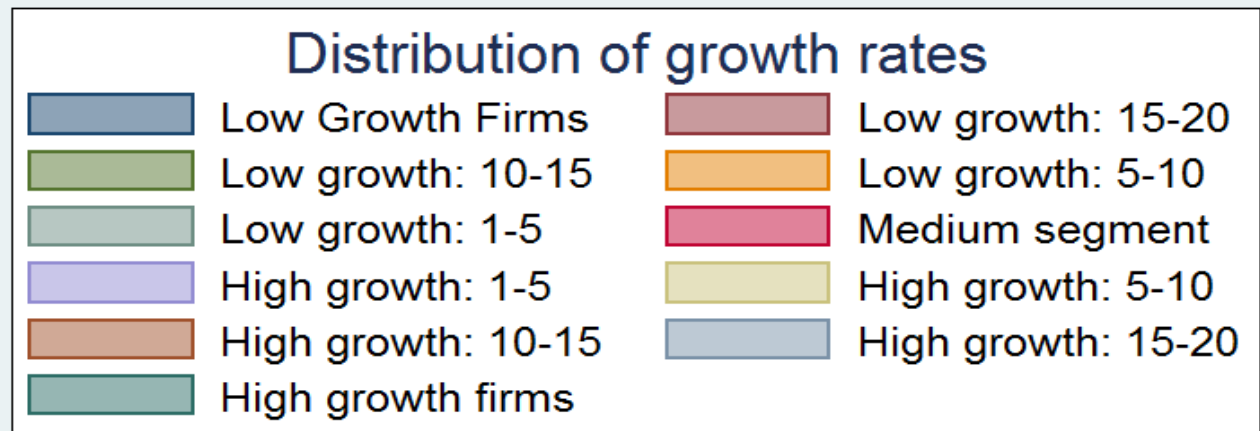
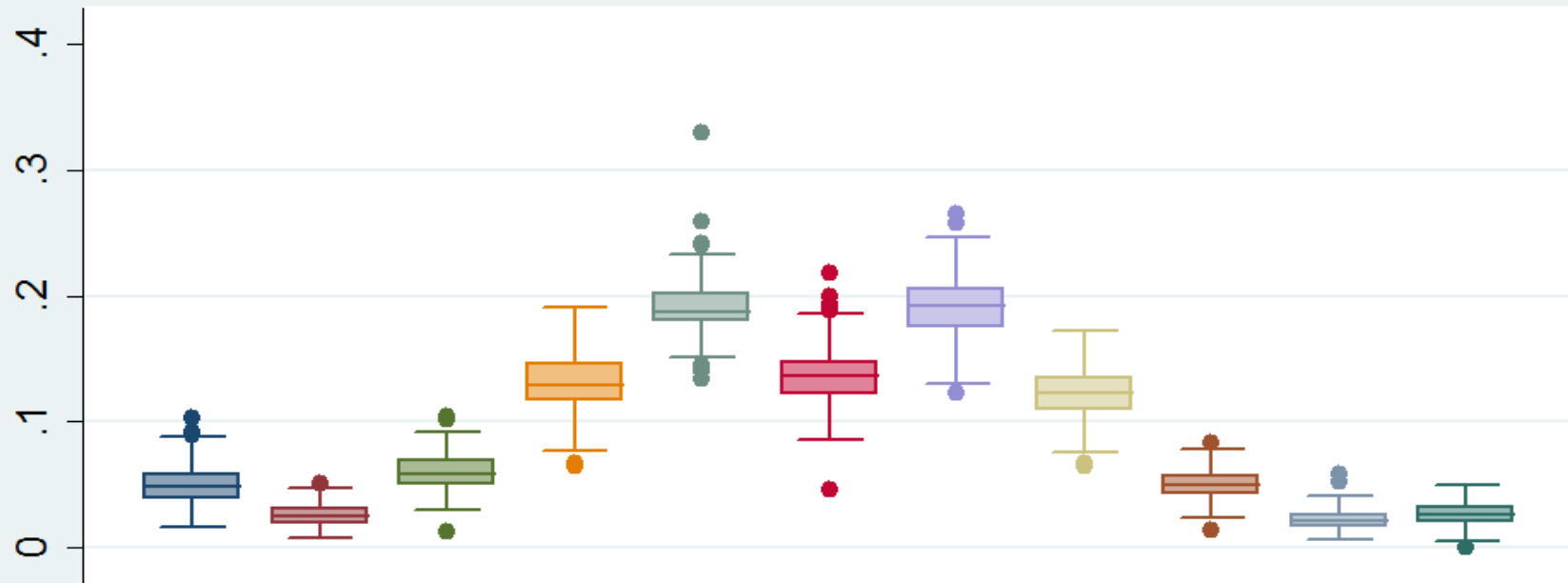
- **Growth rate distribution in Austria has the same shape as the growth rate distribution for other countries (e.g., Bravo-Biosca, 2013)**
 - **Most firms have marginal growth rates, and**
 - **a few firm display very high rates of growth (decline)**
- **However, Austria has a**
 - **comparatively low number of high growth firms (HGFs) and high decline firms (LGFs), and**
 - **a rather large fraction of stable firms**

- We use the Eurostat/OECD definition:
 - More than 20% p.a. relative growth in three years
 - Larger than 10 employees at the beginning

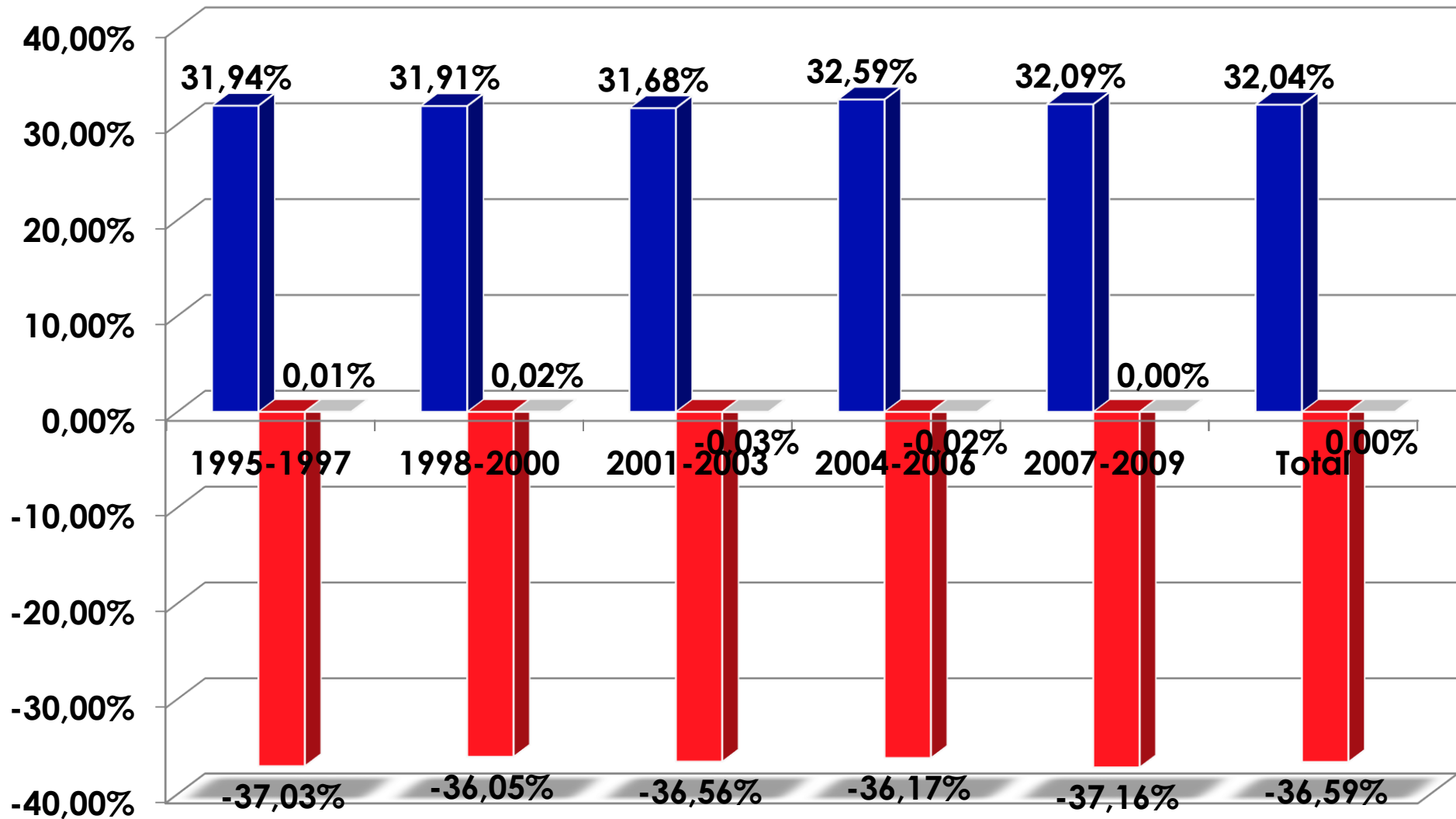
- Heterogeneity at the regional level
 - For the 35 regions we can reject the null that the HGF share is equal to the other 34 regions:
 - at the 1% level of significance for 7 regions (20% of the regions) we can reject the null hypothesis of no statistically
 - at the 5% level of significance for 10 regions (29%)
 - at the 10% level of significance for 12 regions (34%).

=> There is heterogeneity at the regional level

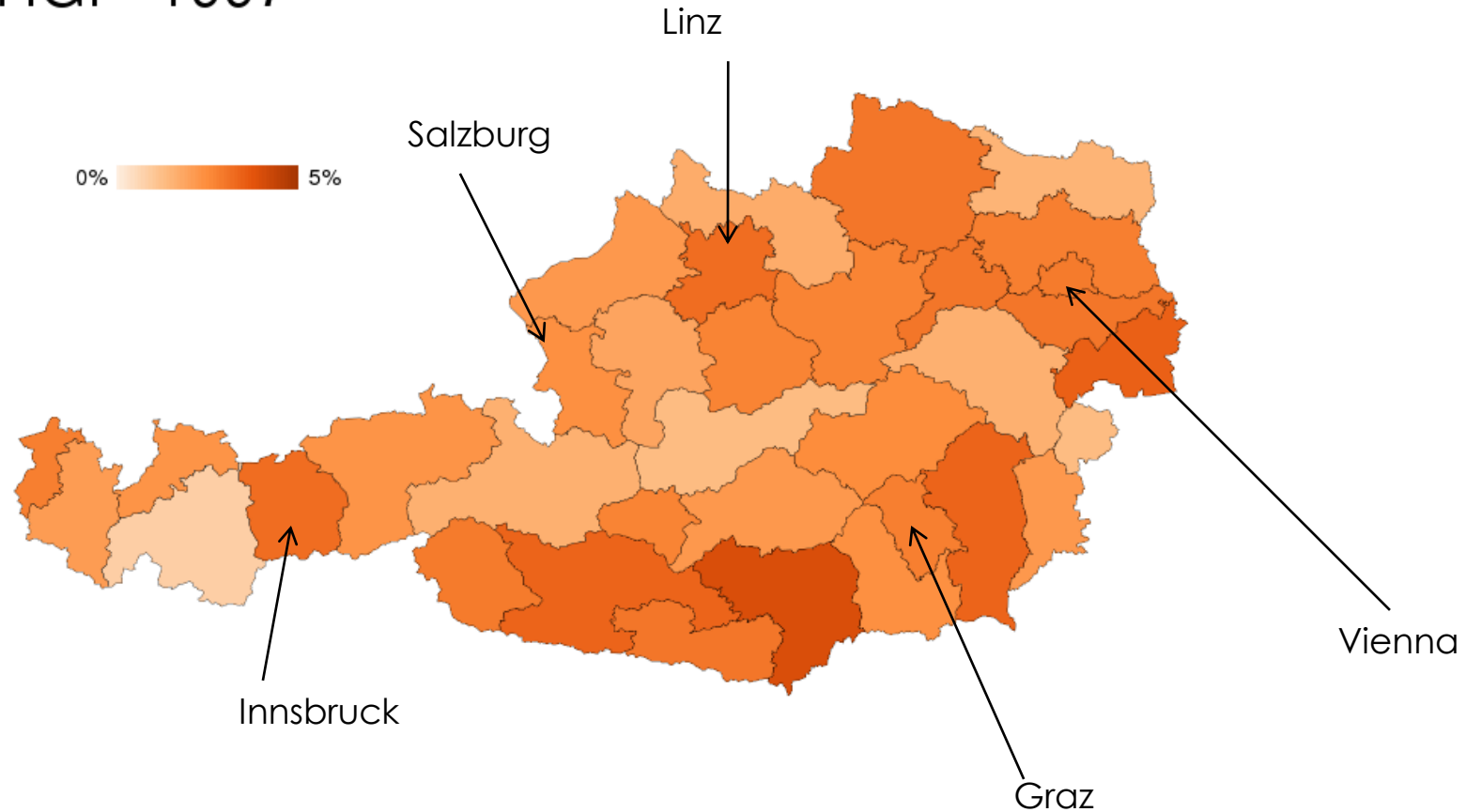
Growth rate distribution at the firm level across NUTS3 regions and time



Average growth intensity HGF, LGF and stationary firms

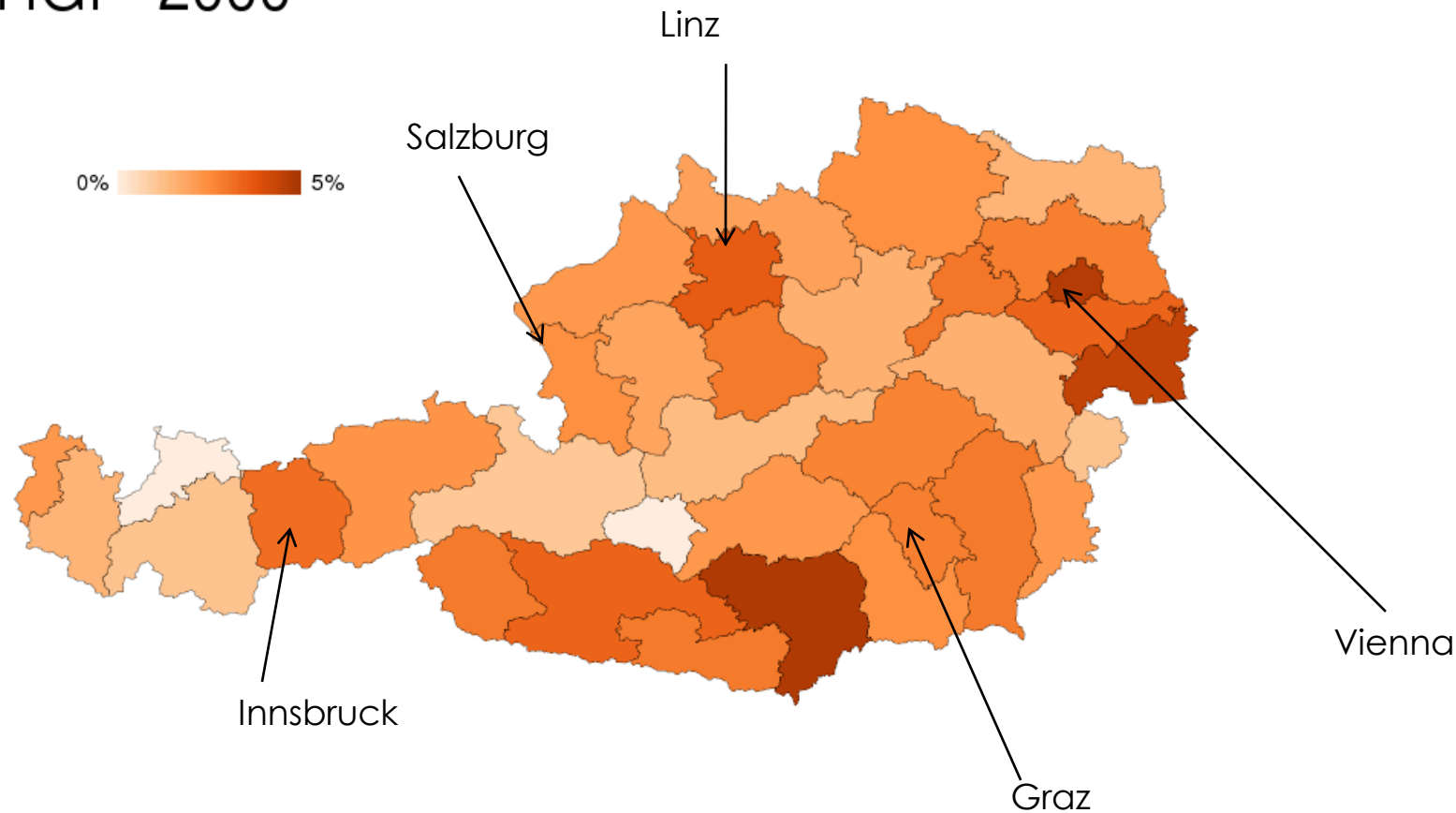


HGF 1997



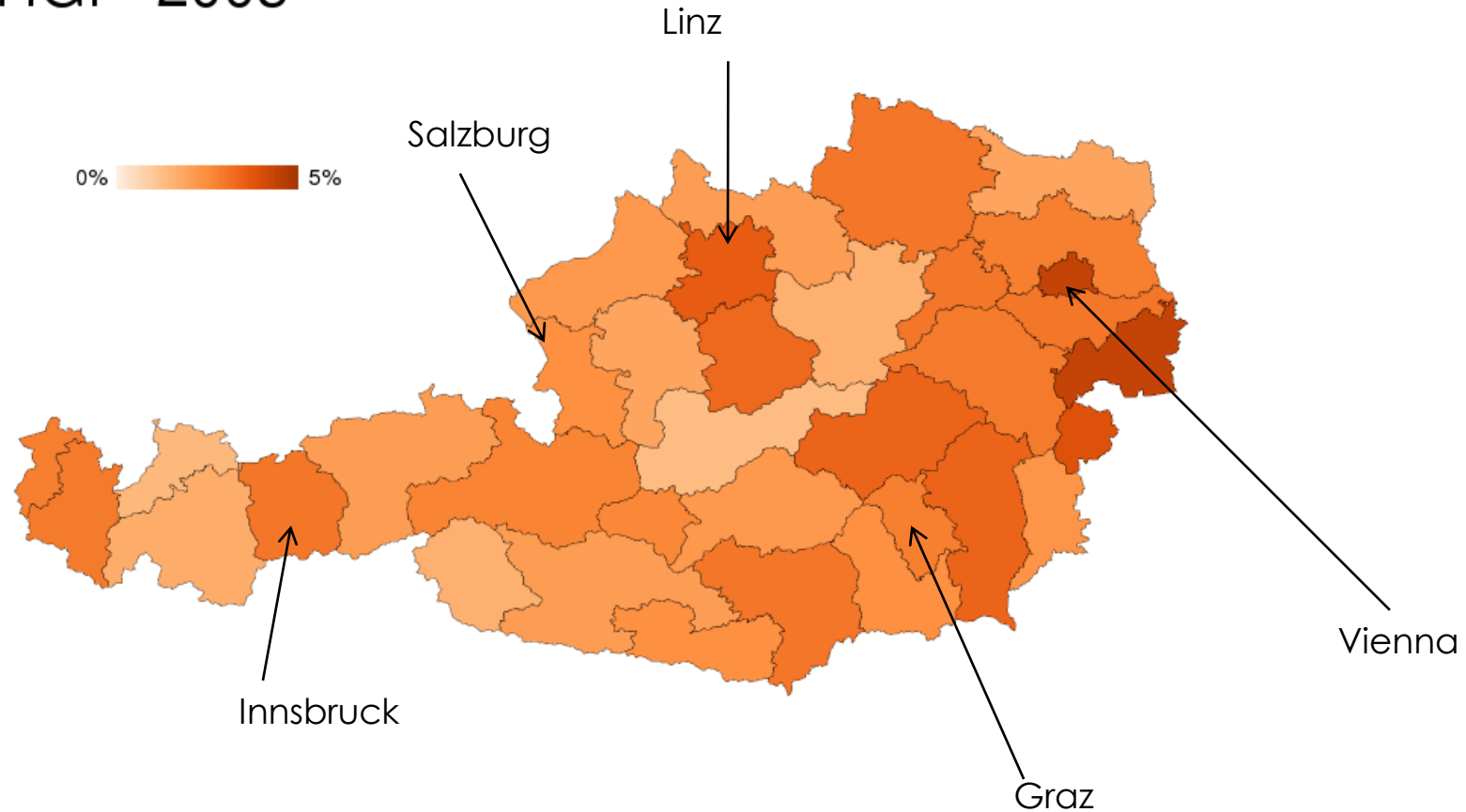
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HGF 2000



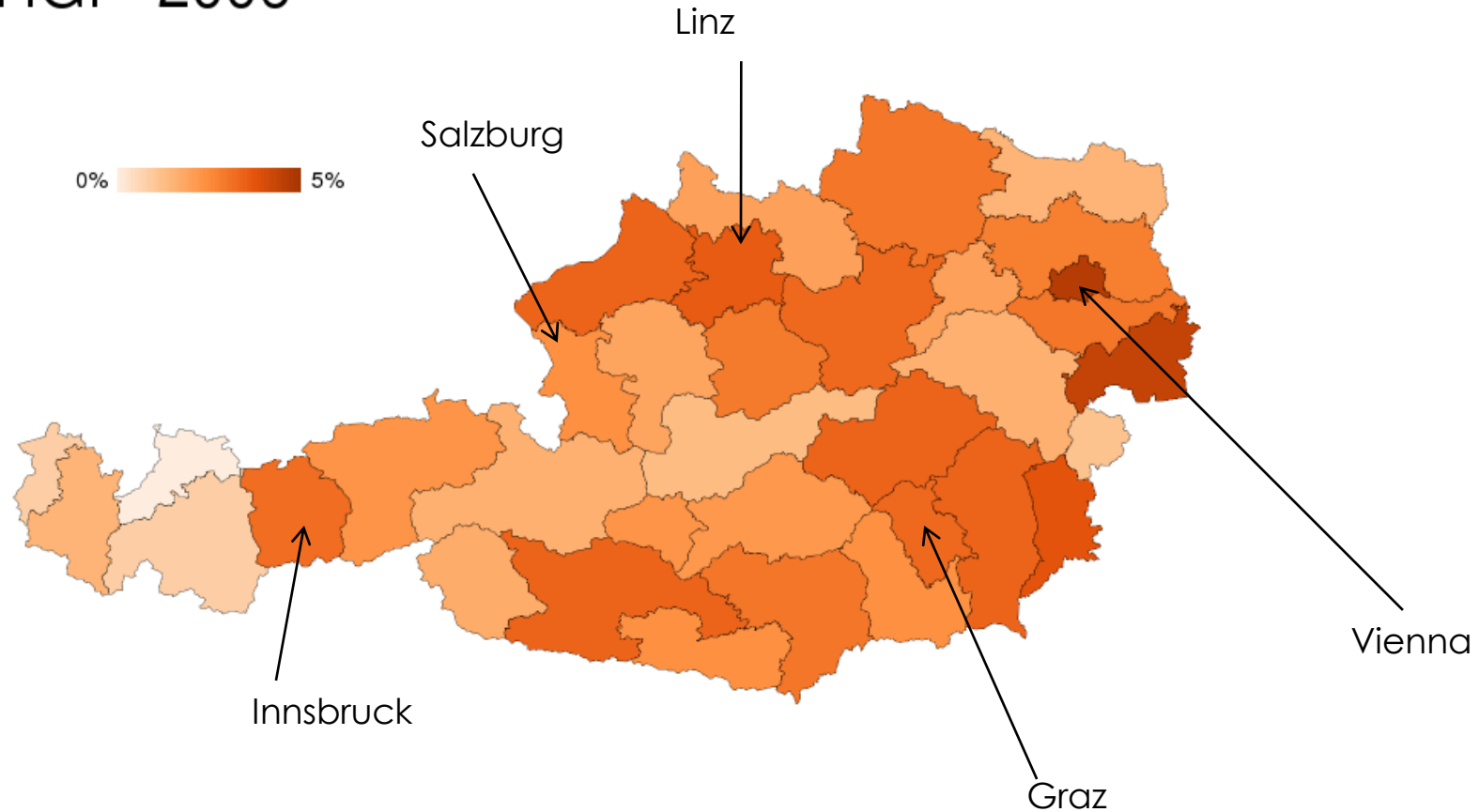
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HGF 2003



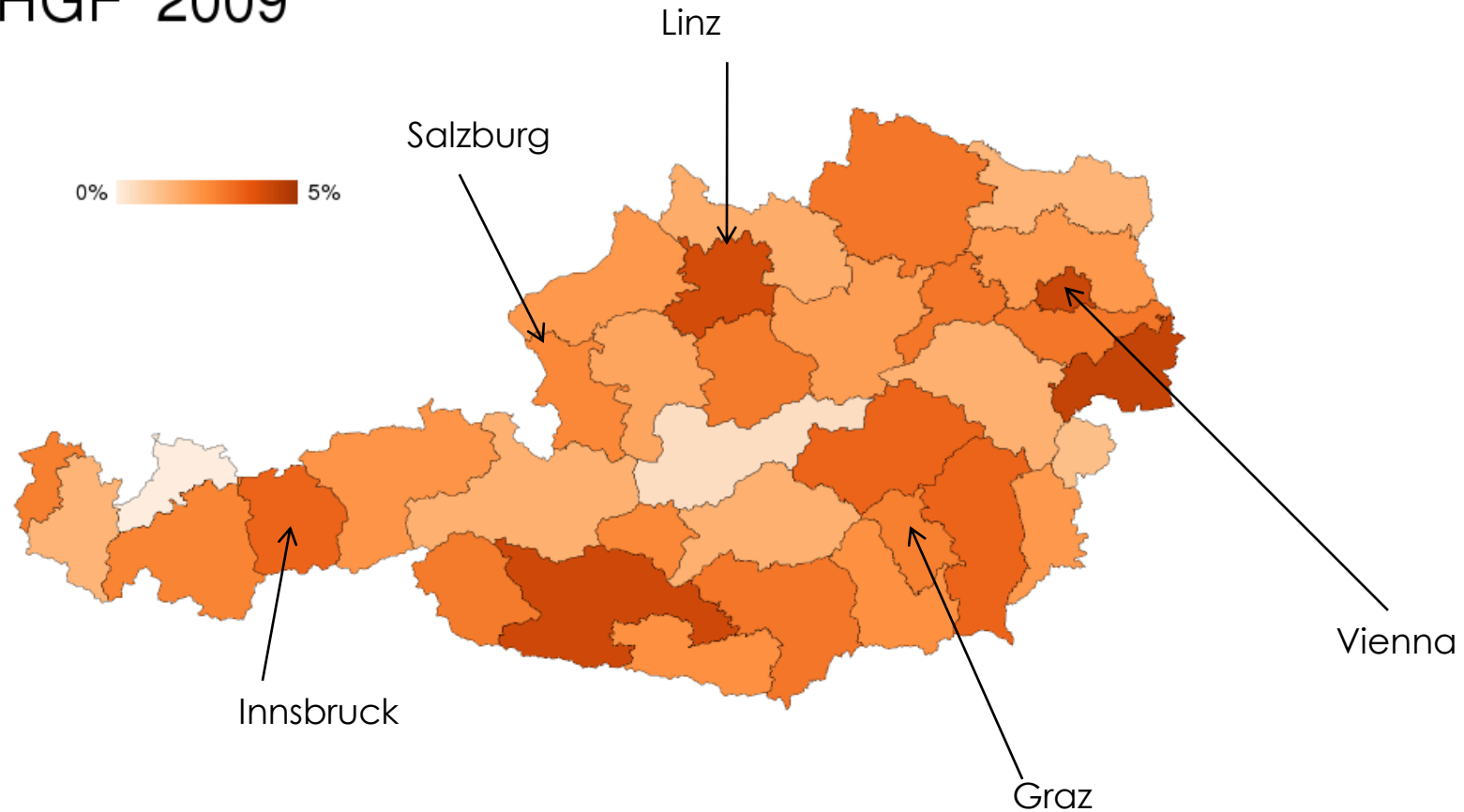
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HGF 2006



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HGF 2009



- **Regional differences seem to be systematic**
- **Higher share of HGF in urban areas**
- **Some degree of persistence over time**

- **Regional differences seem to be systematic**
 - **Location factors are persistent**
 - **Industrial specialization is persistent**

■ Firm vs. regional level

- **Very low persistence at the firm level**

~6 % of the ~ 2.8 % HGF
continue to be HGF; ~0.21%
of all firms

- **Quite high persistence of HGF shares at the Nuts3 level**

Correlation coefficient: 0.45

We think that this may be related to structural features (e.g. industry composition)

| | matched sample E(t-3) | |
|-------------|-----------------------|-----------------------|
| years | 3 | 9 |
| HGF | 0.0556*** (0.004) | 0.0196*** (0.003) |
| age | -0.0019*** (0.000) | -0.0010*** (0.000) |
| ln(E) | 0.0014 (0.003) | 0.0095*** (0.002) |
| Ind. Growth | 0.2304*** (0.043) | 0.1580*** (0.061) |
| XJCR | 0.0877 (0.108) | -0.3839*** (0.106) |
| Ind. Size | -0.0029 (0.003) | 0.0043 (0.003) |
| Constant | 0.0635* (0.037) | -0.0271 (0.033) |
| Observation | 12,620 | 7,375 |
| R-squared | 0.023 | 0.010 |

S.: Hölzl, 2014

SF 4: HGFs are not more common in high-tech industries

This stylised fact has often been interpreted in a way that industry does not affect the presence of HGFs.

However, there are much more important determinants of competitive churn and industrial dynamics than innovation intensity.

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- **Market coordination affects firm behaviour but primarily aggregate outcomes.**
 - **Persistence of the HGF share is thus an emergent property of competitive interaction that is unrelated to the persistence of high growth at the firm level.**

Share of HGF explained by:

■ Regional characteristics

- Urban – rural (rural =1 / urban =0)
- Variety measures (Frenken et al., 2007)

Related variety (RV)

Measure of technological complementarities; within sector variety (Marshall / Jacob's externalities)

Unrelated variety (UV)

Diversification measure; between sector (portfolio effect)

- Population in 2001 (control for region size)

■ Employment growth (Nuts 3 regions)

■ Turbulence/Volatility

- Firm demography - Firm Entry (Exit), Firm Turnover
- HGF indicators (HGF persistence and high decline firms)
- Excess Job Creation (firms >5 employees)

Employment turbulence. The sum of job creation and destruction rates less the absolute value of the net employment growth rate. The measure captures the “excess” reallocation over and above that needed to accommodate net employment growth. (Davis et al. 1996)

- **Variety measures (Frenken et al., 2007)**
 - **Related variety (RV)**
Measure of technological complementarities; within sector variety (Marshall / Jacob's externalities)
 - **Unrelated variety (UV)**
Diversification measure; between sector (portfolio effect)
- **Turbulence/Volatility**
 - **Firm Turnover, Firm Entry**
 - **Excess Job Creation (firms >5 employees)**
The sum of job creation and destruction rates less the absolute value of the net employment growth rate. The measure captures the “excess” reallocation over and above that needed to accommodate net employment growth. (Davis et al. 1996)

| | hgf_share | UV | RV | employme | Excess_job | high declir | entry rate | HGF persis | population |
|-----------------|-----------|---------|---------|----------|------------|-------------|------------|------------|------------|
| hgf_share | 1 | | | | | | | | |
| UV | 0.5366 | 1 | | | | | | | |
| RV | 0.4233 | 0.7634 | 1 | | | | | | |
| employment g | 0.2149 | -0.0435 | -0.0483 | 1 | | | | | |
| Excess_job_vol | 0.1404 | -0.0436 | 0.1411 | -0.0732 | 1 | | | | |
| high decline sh | 0.1855 | 0.2245 | 0.2686 | -0.355 | 0.3047 | 1 | | | |
| entry rate | 0.2127 | 0.1725 | 0.1659 | 0.3852 | 0.371 | 0.0793 | 1 | | |
| HGF persist | 0.0003 | -0.0436 | 0.0144 | 0.0085 | 0.0378 | 0.024 | 0.0488 | 1 | |
| population | 0.4465 | 0.5281 | 0.4156 | -0.1179 | 0.1634 | 0.3984 | 0.1576 | -0.0101 | 1 |
| urban | -0.3468 | -0.6557 | -0.5317 | 0.1211 | -0.0216 | -0.4019 | -0.2605 | 0.0016 | -0.4907 |

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|-------------------|---------|---------|---------|---------|---------|---------|---------|
| UV_s | | 0.01** | | 0.01** | 0.02** | 0.02** | 0.02** |
| | | (0.001) | | (0.002) | (0.003) | (0.003) | (0.003) |
| RV_s | | | 0.01** | 0.00 | -0.00 | -0.00 | -0.00 |
| | | | (0.002) | (0.002) | (0.003) | (0.003) | (0.002) |
| employment_growth | 0.24** | 0.20** | 0.23** | 0.20** | 0.23** | 0.24** | 0.25** |
| | (0.079) | (0.076) | (0.077) | (0.077) | (0.073) | (0.076) | (0.081) |
| m_ind2_vol3 | | | | | 0.14* | 0.15* | 0.15* |
| | | | | | (0.057) | (0.059) | (0.057) |
| lgf_share | | | | | | | 0.03 |
| | | | | | | | (0.045) |
| HGF_persist | | | | | | | 0.00 |
| | | | | | | | (0.007) |
| entry_r | | | | | | -0.02 | -0.02 |
| | | | | | | (0.044) | (0.043) |
| popmn | 0.01** | 0.01** | 0.01** | 0.01** | 0.01** | 0.01** | 0.01** |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) |
| urbandummy | -0.00** | 0.00 | -0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Constant | 0.02** | -0.05** | 0.01** | -0.05** | -0.07** | -0.07** | -0.07** |
| | (0.001) | (0.007) | (0.003) | (0.009) | (0.016) | (0.017) | (0.016) |
| Observations | 175 | 175 | 175 | 175 | 175 | 175 | 175 |
| R-squared | 0.264 | 0.349 | 0.297 | 0.349 | 0.399 | 0.398 | 0.408 |

Regression results - entire economy

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|-------------------|--------------------|--------------------|-------------------|--------------------|--------------------|--------------------|--------------------|
| UV_s | | 0.01** (0.001) | | 0.01** (0.002) | 0.02** (0.003) | 0.02** (0.003) | 0.02** (0.003) |
| RV_s | | | 0.01** (0.002) | 0.00 (0.002) | -0.00 (0.003) | -0.00 (0.003) | -0.00 (0.002) |
| employment_growth | 0.24** (0.079) | 0.20** (0.076) | 0.23** (0.077) | 0.20** (0.077) | 0.23** (0.073) | 0.24** (0.076) | 0.25** (0.081) |
| m_ind2_vol3 | | | | | 0.14* (0.057) | 0.15* (0.059) | 0.15* (0.057) |
| lgf_share | | | | | | | 0.03 (0.045) |
| HGF_persist | | | | | | | 0.00 (0.007) |
| entry_r | | | | | | -0.02 (0.044) | -0.02 (0.043) |
| popmn | 0.01** (0.002) | 0.01** (0.002) | 0.01** (0.002) | 0.01** (0.002) | 0.01** (0.002) | 0.01** (0.002) | 0.01** (0.002) |
| urbandummy | -0.00** (0.001) | 0.00 (0.001) | -0.00 (0.001) | 0.00 (0.001) | 0.00 (0.001) | 0.00 (0.001) | 0.00 (0.001) |
| Constant | 0.02** (0.001) | -0.05** (0.007) | 0.01** (0.003) | -0.05** (0.009) | -0.07** (0.016) | -0.07** (0.017) | -0.07** (0.016) |
| Observations | 175 | 175 | 175 | 175 | 175 | 175 | 175 |
| R-squared | 0.264 | 0.349 | 0.297 | 0.349 | 0.399 | 0.398 | 0.408 |

| VARIABLES | (1) OLS | (2) OLS | (3) FE | (4) FE | (5) RE | (6) Kiviet |
|--------------------|--------------------|--------------------|------------------|--------------------|--------------------|------------------|
| lag. Dep. | | 0.16 (0.211) | | | 0.16+ (0.086) | 0.04 (0.119) |
| UV | 0.02** (0.003) | 0.01** (0.004) | 0.02+ (0.013) | 0.02** (0.005) | 0.01** (0.005) | 0.00 (0.016) |
| RV | -0.00 (0.002) | -0.00 (0.003) | 0.00 (0.014) | -0.00 (0.004) | -0.00 (0.003) | 0.03 (0.018) |
| empl. Growth | 0.25** (0.081) | 0.15+ (0.091) | 0.17* (0.077) | 0.22** (0.069) | 0.15+ (0.077) | 0.15 (0.097) |
| excess emp. vol. | 0.15* (0.057) | 0.11 (0.067) | 0.07 (0.070) | 0.13* (0.056) | 0.11+ (0.064) | 0.10 (0.087) |
| high decline share | 0.03 (0.045) | 0.01 (0.037) | -0.05 (0.051) | 0.00 (0.046) | 0.01 (0.053) | -0.04 (0.056) |
| entry rate | -0.02 (0.043) | 0.04 (0.039) | -0.04 (0.058) | -0.02 (0.044) | 0.04 (0.048) | 0.04 (0.075) |
| HGF persistence | 0.00 (0.007) | 0.00 (0.006) | 0.00 (0.006) | 0.00 (0.005) | 0.00 (0.006) | 0.00 (0.006) |
| population (2001) | 0.01** (0.002) | 0.01* (0.003) | | 0.01* (0.004) | 0.01* (0.003) | |
| urban | 0.00 (0.001) | 0.00 (0.001) | | 0.00 (0.002) | 0.00 (0.002) | |
| Constant | -0.07** (0.016) | -0.06** (0.020) | -0.10 (0.068) | -0.07** (0.022) | -0.06** (0.021) | |
| Observations | 175 | 140 | 175 | 175 | 140 | 140 |
| R-squared | 0.4 | 0.46 | 0.35 | 0.43 | 0.46 | |

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|
| | total | sectors | agri. | manuf. | constr. | serv. | bus. serv |
| UV | 0.02** | 0.01 | 0.03 | 0.02** | -0.04+ | 0.01+ | 0.03** |
| | (0.003) | (0.008) | (0.023) | (0.004) | (0.023) | (0.006) | (0.010) |
| RV | -0.00 | 0.00 | 0.00 | -0.00 | 0.02 | 0.05** | 0.02 |
| | (0.002) | (0.003) | (0.018) | (0.004) | (0.014) | (0.013) | (0.017) |
| empl. Growth | 0.25** | 0.27** | 0.31** | 0.20** | 0.19 | 0.19** | 0.20** |
| | (0.081) | (0.051) | (0.097) | (0.063) | (0.202) | (0.066) | (0.075) |
| excess emp. vol. | 0.15* | 0.00 | 0.09 | 0.08+ | -0.16 | -0.06 | -0.07 |
| | (0.057) | (0.066) | (0.226) | (0.048) | (0.139) | (0.057) | (0.116) |
| high decline share | 0.03 | 0.03 | 0.01 | 0.08+ | -0.06 | -0.02 | 0.06 |
| | (0.045) | (0.027) | (0.042) | (0.046) | (0.146) | (0.057) | (0.039) |
| entry rate | -0.02 | -0.01 | -0.15 | 0.10 | -0.10 | 0.07 | -0.10 |
| | (0.043) | (0.035) | (0.140) | (0.068) | (0.113) | (0.052) | (0.094) |
| HGF persistence | 0.00 | 0.00 | 0.01 | -0.01+ | 0.06 | -0.00 | 0.01 |
| | (0.007) | (0.015) | (0.069) | (0.006) | (0.049) | (0.010) | (0.032) |
| population (2001) | 0.01** | 0.01** | 0.01 | -0.00 | 0.02** | -0.00 | 0.01+ |
| | (0.002) | (0.003) | (0.008) | (0.002) | (0.006) | (0.009) | (0.006) |
| urbandummy | 0.00 | 0.00 | 0.02** | 0.01** | -0.01 | 0.00 | 0.01 |
| | (0.001) | (0.003) | (0.007) | (0.002) | (0.006) | (0.005) | (0.004) |
| Constant | -0.07** | -0.05 | -0.14 | -0.09** | 0.18+ | -0.06* | -0.11* |
| | (0.016) | (0.040) | (0.107) | (0.015) | (0.103) | (0.031) | (0.047) |
| Observations | 175 | 875 | 175 | 175 | 175 | 175 | 175 |
| R-squared | 0.408 | 0.066 | 0.098 | 0.276 | 0.198 | 0.343 | 0.146 |

| VARIABLES | (1) total | (2) sectors | (3) agri. | (4) manuf. | (5) constr. | (6) serv. | (7) bus. serv |
|--------------------|--------------------|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|
| UV | 0.02** (0.003) | 0.01 (0.008) | 0.03 (0.023) | 0.02** (0.004) | -0.04+ (0.023) | 0.01+ (0.006) | 0.03** (0.010) |
| RV | -0.00 (0.002) | 0.00 (0.003) | 0.00 (0.018) | -0.00 (0.004) | 0.02 (0.014) | 0.05** (0.013) | 0.02 (0.017) |
| empl. Growth | 0.25** (0.081) | 0.27** (0.051) | 0.31** (0.097) | 0.20** (0.063) | 0.19 (0.202) | 0.19** (0.066) | 0.20** (0.075) |
| excess emp. vol. | 0.15* (0.057) | 0.00 (0.066) | 0.09 (0.226) | 0.08+ (0.048) | -0.16 (0.139) | -0.06 (0.057) | -0.07 (0.116) |
| high decline share | 0.03 (0.045) | 0.03 (0.027) | 0.01 (0.042) | 0.08+ (0.046) | -0.06 (0.146) | -0.02 (0.057) | 0.06 (0.039) |
| entry rate | -0.02 (0.043) | -0.01 (0.035) | -0.15 (0.140) | 0.10 (0.068) | -0.10 (0.113) | 0.07 (0.052) | -0.10 (0.094) |
| HGF persistence | 0.00 (0.007) | 0.00 (0.015) | 0.01 (0.069) | -0.01+ (0.006) | 0.06 (0.049) | -0.00 (0.010) | 0.01 (0.032) |
| population (2001) | 0.01** (0.002) | 0.01** (0.003) | 0.01 (0.008) | -0.00 (0.002) | 0.02** (0.006) | -0.00 (0.009) | 0.01+ (0.006) |
| urbandummy | 0.00 (0.001) | 0.00 (0.003) | 0.02** (0.007) | 0.01** (0.002) | -0.01 (0.006) | 0.00 (0.005) | 0.01 (0.004) |
| Constant | -0.07** (0.016) | -0.05 (0.040) | -0.14 (0.107) | -0.09** (0.015) | 0.18+ (0.103) | -0.06* (0.031) | -0.11* (0.047) |
| Observations | 175 | 875 | 175 | 175 | 175 | 175 | 175 |
| R-squared | 0.408 | 0.066 | 0.098 | 0.276 | 0.198 | 0.343 | 0.146 |

| VARIABLES | (1) total | (2) sectors | (3) agri. | (4) manuf. | (5) constr. | (6) serv. | (7) bus. serv |
|--------------------|--------------------|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|
| UV | 0.02** (0.003) | 0.01 (0.008) | 0.03 (0.023) | 0.02** (0.004) | -0.04+ (0.023) | 0.01+ (0.006) | 0.03** (0.010) |
| RV | -0.00 (0.002) | 0.00 (0.003) | 0.00 (0.018) | -0.00 (0.004) | 0.02 (0.014) | 0.05** (0.013) | 0.02 (0.017) |
| empl. Growth | 0.25** (0.081) | 0.27** (0.051) | 0.31** (0.097) | 0.20** (0.063) | 0.19 (0.202) | 0.19** (0.066) | 0.20** (0.075) |
| excess emp. vol. | 0.15* (0.057) | 0.00 (0.066) | 0.09 (0.226) | 0.08+ (0.048) | -0.16 (0.139) | -0.06 (0.057) | -0.07 (0.116) |
| high decline share | 0.03 (0.045) | 0.03 (0.027) | 0.01 (0.042) | 0.08+ (0.046) | -0.06 (0.146) | -0.02 (0.057) | 0.06 (0.039) |
| entry rate | -0.02 (0.043) | -0.01 (0.035) | -0.15 (0.140) | 0.10 (0.068) | -0.10 (0.113) | 0.07 (0.052) | -0.10 (0.094) |
| HGF persistence | 0.00 (0.007) | 0.00 (0.015) | 0.01 (0.069) | -0.01+ (0.006) | 0.06 (0.049) | -0.00 (0.010) | 0.01 (0.032) |
| population (2001) | 0.01** (0.002) | 0.01** (0.003) | 0.01 (0.008) | -0.00 (0.002) | 0.02** (0.006) | -0.00 (0.009) | 0.01+ (0.006) |
| urbandummy | 0.00 (0.001) | 0.00 (0.003) | 0.02** (0.007) | 0.01** (0.002) | -0.01 (0.006) | 0.00 (0.005) | 0.01 (0.004) |
| Constant | -0.07** (0.016) | -0.05 (0.040) | -0.14 (0.107) | -0.09** (0.015) | 0.18+ (0.103) | -0.06* (0.031) | -0.11* (0.047) |
| Observations | 175 | 875 | 175 | 175 | 175 | 175 | 175 |
| R-squared | 0.408 | 0.066 | 0.098 | 0.276 | 0.198 | 0.343 | 0.146 |

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- **Regional persistence of HGF shares, but no persistence at the firm level**
 - **HGF shares and employment growth**
 - **More HGFs in regions with higher employment growth rates**
 - **HGF shares and dynamics**
 - **More HGFs in regions with higher excess labour turnover. But Firm entry and firm dynamics seem not to be as relevant for HGFs.**
 - **HGF shares and variety**
 - **More HGFs in regions with higher (unrelated) variety: Jacobs spillover dominate specialisation: Jacobs**
 - **At the industry level differentiated results; Marshall externalities (RV) important for service industries**

It is nice to know “that” but about the “why” (causal analysis) we do not know much yet

What is behind the importance of unrelated variety?

Thank you for your attention

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- **Locational factors are persistent and affect the presence of HGFs**
 - **Industrial specialization and sectoral variety determine number of HGFs but not persistence of firm growth within firms over time**
 - **Might have implications for cross-country differences in HGF**

$$P_g = \sum_{i \in S_g} p_i$$

$$UV = \sum_{g=1}^G P_g \log_2 \left(\frac{1}{P_g} \right)$$

$$RV = \sum_{g=1}^G P_g H_g$$

$$H_g = \sum_{i \in S_g} \frac{p_i}{P_g} \log_2 \left(\frac{1}{p_i/P_g} \right)$$