Institutional Context and Growth of New Research Fields. Comparison between State Universities in Germany and the United States

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Introduction
The paper examines the capabilities of universities to rapidly build up and expand research capacities in new and emerging scientific fields following major scientific breakthroughs. Based on the Scanning Tunneling Microscope (STM), developed in 1982 (Nobel Prize in Physics, 1986), and Buckminsterfullerenes (BUF), discovered in 1985 (Nobel Prize in Chemistry, 1995), the paper investigates how fast scientists in German and US state universities built up follow-up research in response to these two breakthroughs. Most importantly, the paper explores to what extent the institutional framework in which universities are embedded supported such expansion and renewal.

Methods and Data
The methodical basis of the study is the construction of a strictly comparable set of state universities. The paper analyses longitudinal quantitative data of 84 German and 155 US state universities that award doctoral degrees. In addition, the paper provides case study evidence for state universities in Bavaria and California, two states in which both STM and BUF follow-up research has been particularly strong.

Results
Our bibliometric findings (dependent variable) demonstrate that scientists in US state universities were several years ahead of their colleagues at German universities in seizing on STM and BUF. Our institutional findings (explanatory variables) suggest that in the years following STM and BUF, i.e. the 1980s and 1990s, US universities provided better institutional conditions for scientific renewal than German universities.

First, a high percentage of professors among scientific staff is conducive to building up and expanding research capacities in new and emerging fields. Two mechanisms are involved: A high percentage of professors raises the frequency by which new research opportunities are both detected and followed up by those who are expected to conduct independent research; in addition, a high percentage of professors raises the frequency by which new peers are hired, and new research topics and areas thus are imported in replacement of previous ones. A low percentage of professors, as in Germany, indicates that many more young scientists work in the academic system than can be possibly absorbed into professorial ranks. As a consequence, there is a bottleneck at the transition to professorial status, leading to prolonged periods of dependency and job insecurity in academic biographies. In the US, the transition to assistant professor, and thus scientific independence, takes place earlier in the biography, thus providing favorable conditions for seizing upon new and promising scientific opportunities.

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Second, growth in the number of professors, growth in basic funding, and a high percentage of grant funding among all funding streams are key factors positively associated with building up and expanding research capacities in new and emerging fields. In fact, a declining or stagnating number of professors severely constrains the capability of universities and their departments to respond swiftly to new and emerging research fields by recruiting outstanding scientists, as demonstrated in our German case studies. Furthermore, if growth of basic funding is channeled into facilities and laboratories that are shared by professors both inside and across departments, supportive conditions for effective collaborations in new and emerging fields are created. Yet, too strong dependency of professors on grant funding and too high competitive pressure for external research resources may inadvertently end successful scientific collaborations before all fruits are harvested.

Third, our findings point to significant and increasing differences in the state university systems of Germany and the US with major implications for innovations in science. Although the percentage of professors decreased in both countries since the 1980s, this decrease took place at different scales. Furthermore, inflation adjusted basic funding for US state universities has grown by factor 2.0 since the 1980s with tuition fees providing the lion’s share in growth; in contrast, basic funding for state universities in Germany has grown by factor 1.5 only. Tuition fees, which had been introduced in the mid 2000s in some German Länder states, were abolished recently, thus reducing the level of basic funding in German universities. Based on our empirical findings, the conditions for scientific innovations in German universities are worse today than they were in the 1980s and 1990s, in contrast to the US.

Discussion and implications

The results have implications for research policy in Germany and the US. For Germany, the study identifies as major policy problem the scientific staff structure which appears to severely impede intellectual renewal and growth of new research fields. Recent government funding initiatives such as the DFG excellence funding did not target the extremely low percentage of professors and are thus unlikely to improve reception speed. For the US, the rising percentage of “contingent faculty” might compromise the strong position of US state universities in the future.

References

