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Regional innovation and firm performance☆

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ABSTRACT

This paper uses novel measures of innovation and engagement, at the county level in the US, to frame the relationship between innovation levels in a region and the performance of publicly traded firms in those areas. In theory, an innovative community should foster improved firm performance, reinvestment, and continued growth for both the firm and the community, feeding back into firm performance, a virtuous cycle. Our results suggest that inventive activity within a county, measured using a patent index, is positively related to revenue and profit growth, while technical creativity, measured using an index of employment in technical fields, is associated with process improvement and net income growth. Finally, the opportunity to collaborate and interact socially within a community is positively associated with firm performance measures, but with only weak statistical significance for the publicly traded firms in the sample.

1. Introduction

Personal growth consultants quip, “if you're the smartest person in the room, you are in the wrong room.” This colloquialism recognizes there is much to be learned from others, and the quote serves to prove the point that knowledge is shared and adapted through social interaction. Social interaction and collaborative “cultures of improvement” within firms breed innovation; it is reasonable to expect that creative cultures in communities further enhance firm performance within those communities.

Existing research, including Swan, Newell, Scarbrough, and Hislop (1999) examination of network communities and their subsequent argument for community-based models of knowledge management, along with the large literature on firm clustering, provide evidence of communal benefits. However, they do not address the spillover effects of innovative cultures in a cross-industry geographic context.

How might the innovative capacity of a community be measured? And how important is community-level “innovativeness” to firm performance? Those questions are considered in the following pages.

The analysis below employs measures of innovation and engagement, at the county level in the US, to frame the relationship between innovation levels in a region and the performance of publicly traded firms within that area. The innovation measures reflect the “innovative capacities” of the region, the engagement index represents the opportunity for ideas to cross between firms, and financial data on publicly-traded firms in the region proxy for firm performance. In theory, an innovative community should contribute to improved firm performance, reinvestment, additional innovation, and continued growth for both the firm and the community - a virtuous cycle. Our results suggest that inventive activity within a county is positively related to revenue and profit growth while technical creativity is associated with process improvement and net income growth. Finally, the opportunity to collaborate and interact socially within a community is positively associated with firm performance but with only weak statistical significance for the publicly traded firms in the sample.

2. Background

Innovation and technological improvement as a positive feedback process is not a new idea. Dosi and Nelson (2010) aptly illustrate the age of the idea using Adam Smith's Wealth of Nations and his discussion of pin workers developing machines to reduce the laborers' workload; Smith also depicts the subsequent improvement of the machines by the machine makers. However, he stops short of recognizing the process as a virtuous cycle, though the laborers who freed themselves through their inventions then had time to produce more goods, and to innovate further; a “virtuous cycle” had begun.

The literature on “cycles” regarding research and development is substantial. An examination of the extant literature reveals patterns around the “three C's” of culture, customers, and collaboration. Customers drive provider firms to improve products, but only if the relationship is collaborative, and the provider firm's culture is supportive of innovation.

Gudmundson, Tower, and Harman (2003) find that cultural and

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organizational support in small businesses is necessary to facilitate innovation. Valencia, Valle, and Jimenez (2010) identify complex relationships between culture, structure, and innovation using survey data from Spanish firms. Firms with ad hoc cultures—an emphasis on freedom to act by employees—and an external focus are more innovative than those with hierarchical cultures. Vallencia et al. suggest collaboration and external orientation are important for innovation and Gundmundson et al. suggest culture is important for implementation.

Successful profit-maximizing firms provide value to their customers by innovating to serve their customers and involving their customers in the innovation process, a symbiotic relationship. This pattern of firms providing value to customers and the customers, in turn, responding favorably with more business leads to higher margins, and more certain expectations of future business, lowering firm risk.

Among the many studies on innovation through partnership, Hsu, Kannan, Tan, and Leong (2008) find that coordination of information between suppliers and buyers leads to collaborative relationships and improved firm performance. Similarly, examining data on Dutch firms, Belderbos, Carree, and Lokshin (2004) find cooperative research and development relationships between a firm and a competitor or supplier is most commonly associated with incremental product improvements, while relationships with universities are more commonly used to develop new products. These results are supported by the work of Kim and Lui (2015) who find institutional networks between firms and public partners are more related to product innovation than market networks.

Much of the literature regarding innovation and performance examines relationships at the firm level. For example, Bloom and Van Reenen (2002) study British firms and find that patents are positively related to firm-level productivity and market cap; stock price is enhanced alongside "innovation." Others, including Bogliacino, Lucchese, Nascia, and Pianta (2016), develop a model of innovative inputs, outputs, and economic performance, and find evidence of innovation encouraging more innovation, a virtuous cycle.

Simmie (2003) goes even further and suggests the most successful firms tap into knowledge networks that extend beyond the geographic region. While not focusing on innovation directly, Pirinski and Wang (2006) study US firms and find co-movement in regional asset prices. They hypothesize that the co-movement is caused by home bias in investors, and a regional price formation process, but regional spillovers and innovative processes are likely at work, as well.

Franke and Shah (2003) find that innovators often develop a product prototype, in their case a sports-related product, and then receive feedback and constructive ideas from peers and other "community" members. Going beyond retail-level user feedback, Oerlemans and Meeus (2005) use survey data from manufacturing and service firms in the Netherlands to provide support for theoretical models that suggest close proximity between buyers and suppliers with innovative ties tends to result in these firms outperforming their less-connected peers.

Hilary and Hui (2009) proxy for firms' corporate culture and decision-making processes by positing that firms are composed of individuals from the community in which they are located. They use county-level measures of religiosity as a measure for corporate culture. Jang, Kim, and von Zedtwitz (2017) suggest that regional effects may come from geographic areas smaller than counties, even sub-city micro-regions.

Our work contributes to this literature by examining innovation from a regional perspective and suggests firms located in innovative areas are more successful than similar firms located elsewhere. As with corporate culture being a product of the firm's regional environment, innovative capacity and cultural emphasis may also depend on the regional environment.

The work presented in this paper examines the relationship between community innovation culture, using multiple innovation measures, and firm performance.

3. Data and methods

To examine the effect of regional innovation and engagement environments, measures of firm performance are regressed on measures of regional innovation and engagement. Firm performance data, including total revenue, net income, shareholder equity, etc. are extracted from the Compustat database. Annual patent data is available from the US patent office at the county level, and sectoral employment by industry is available from the Bureau of Economic Analysis at the county level.[1] The number of establishments and civic organizations in each county is available through the Census Bureau's County Business Patterns program. Other demographic data and controls come from the Census Bureau's American Community Survey or the Bureau of Economic Analysis. All firm level data is cleaned to remove outliers and data mismatches by removing observations above the 95th percentile and below the 5th percentile for each firm characteristic.[2] In addition, counties with an innovation index value more than three times the national average are removed. Regional data used in the analysis below is annual, county-level data for the United States from 2001 through 2014.

Innovation is a term that connotes the development of new products, processes and ideas, but is difficult to measure with a single dimension, thus, we incorporate multiple measures: a patent index to capture inventiveness, a technical worker index to capture innovative capacity, and an engagement index to capture opportunities for regional collaboration outside formal channels. Oltra, Kemp, and de Vries (2008) suggest that patents are a useful measure of the levels of "inventiveness" and technological strength of regions. However, they admit patents may not fully capture innovation, as only a fraction of ideas are patented, and patent counts do not reflect the value of the patented inventions. Popp (2005) suggests relationships based on patent counts may best be thought of as the effect of an average patent.[3] Furthermore, patents are designed to restrict use of an invention, and are more prevalent for product inventions that can be reverse-engineered once on the market. By comparison, firms may decide to keep process improvements secret rather than patent and disclose them. Galasso and Schankerman (2015) find the effect of patents and limitations on the use of invention in downstream innovation to be heterogeneous and vary across industries. For example, they suggest patents impede downstream innovation in computers and medical devices but not in manufacturing technologies.

Nevertheless, patent data remains an attractive measure of innovative activity because the data are readily available for many regions over a long time period. Acs, Anselin, and Varga (2002) compare patent data to proprietary innovation data and find patents to be a reliably proxy. In addition, Koh and Reeb (2015) cast doubt on using R&D expenditure data as firms may under-report or omit R&D expenditures from financial statements yet still receive patents. Koh and Reeb's work suggests inventive activity is taking place despite a lack of financial reporting. In addition, R&D expenditure data includes monetary inputs but no other innovative inputs such as contributions by line workers, etc. (Acs & Audretsch, 1989). Thus, while imperfect, patent data remains a commonly used proxy for innovation and is included in our regressions. To numerically represent a region's inventive activity, a patent index is constructed as follows:

$$Patent\ Index = \left(\frac{Regional\ Patents}{Regional\ Emplyoment}\right) \Big/ \left(\frac{National\ Patents}{National\ Employment}\right) \quad (1)$$

[1] To avoid disclosing individual firm data, the BEA suppresses data for geographic regions with only a single firm or a small number of firms in an industry.

[2] While the cleaning process results in a sizable loss of observations, outliers on variable are often outliers on others, minimizing the observation costs.

[3] Popp's comments suggest patent data may not be ideal for regional analysis when small regions lack a sufficient number of patents to hone in on the average value.