

Seidman Business Review

Volume 6 | Issue 1

Article 11

4-1-2000

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Recommended Citation

Isely, Paul and Simons, Gerald P. W. (2000) "Has Tokyo Unknowingly Helped Detroit Innovate?," *Seidman Business Review*: Vol. 6: Iss. 1, Article 11.
Available at: <http://scholarworks.gvsu.edu/sbr/vol6/iss1/11>

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Has Tokyo Unknowingly Helped Detroit Innovate?

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Introduction

Between 1977 and 1997 there was a 66% increase in the number of patents issued by the "Big 3" U.S. auto manufacturers. This significant change in new product creation and innovation begs an explanation. In the existing research on product innovation, few studies have taken an empirical approach to determining the different factors that influence innovation rates. We are in the process of empirically investigating the connection between innovation in the U.S. automobile industry and a variety of micro and macroeconomic factors. In this article we present a summary of our work so far.

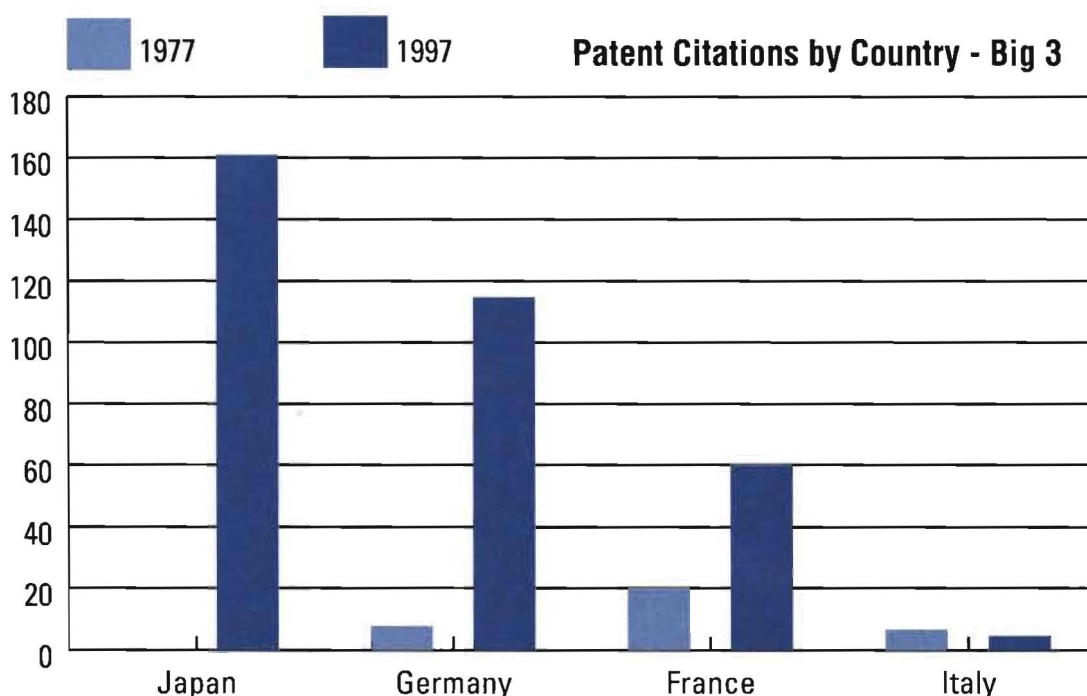
The U.S. automobile industry has shown large changes in both vertical integration and international information flows over the last 20 years. One shift we are exploring is a movement from the U.S. auto industry primarily creating ideas, to now receiving an information inflow (as is evidenced by the growth in foreign patent citations, see Figure 1). For example, General Motors, Ford, and Chrysler referenced Japanese patents in 20.7% of their own patents in 1997 compared with only 12.8% in 1987 and 0% in 1977.

Methodology

We use the U.S. Patent and Trademark Office (PTO) database to check international patent citations as a measure of information flows between countries. And we look at the relationships between the U.S., France, Germany, Italy, and Japan for the time period 1979-1997. Our choice of countries represents the home office locations for the world's ten largest automobile manufacturers. From the PTO database we obtain the total number of patents issued by General Motors, Ford, and Chrysler, and the cites therein, to patents from companies located in the above countries.

With respect to trade data, we use the four-digit Standard Industrial Classification (SIC) code 3711 (motor vehicles and car bodies). From the National Bureau of Economic Research and the U.S. Bureau of the Census, we obtain data for this classification on U.S. exports to and imports from the above countries. We use COMPUSTAT to gather data on R&D expenditures, net sales, total assets, and labor force for GM, Ford, and Chrysler.

Figure 1.



Results

One relationship on which we are focusing in our statistical analysis is that between total patent output and information flows from Germany and Japan. This subset is of interest because a substantial amount of automotive innovation occurs within these two countries.

Our data show that there are decreasing returns to R&D expenditure in terms of new patents. It should also be noted that for most of our time period, Ford and Chrysler both produce fewer patents than GM (see Figure 2).

We also find that as U.S. companies cite more Japanese patents, their own patent output increases. However, as U.S. companies cite more German patents, their own patent output decreases. Although an explanation for this difference cannot be determined directly from the data, it does suggest that U.S. researchers use information from Japan differently than that from Germany. Our findings indicate that U.S. researchers are able to assimilate the knowledge created in Japanese patents, thereby allowing the Big 3 to benefit from the research undertaken by their Japanese counterparts.

were created between Japanese and U.S. companies. This facilitates knowledge creation that is being used collaboratively as opposed to independently.

Another possibility is that there is a fundamental difference in the type of innovation arising from Germany and Japan. As a generalization, Japanese research opens up more new avenues for additional innovations, whereas German research is not conducive to being “built” upon with additional innovations, at least not by U.S. researchers.

Our industry-specific study also sheds some light on national policy issues. The U.S. government’s stance on research and development early in the Clinton administration suggested that there should be a focus on applied research, for two reasons: (1) Applied research does not flow easily across borders, so the value of this research is not “lost” and we do not end up subsidizing the R&D efforts of foreign industry as we might with basic research; and (2) Applied research leads directly to the creation of a new product, so that the immediate result of the research is more “visible” and has a quicker impact on the economy. In our

Patents by Big 3

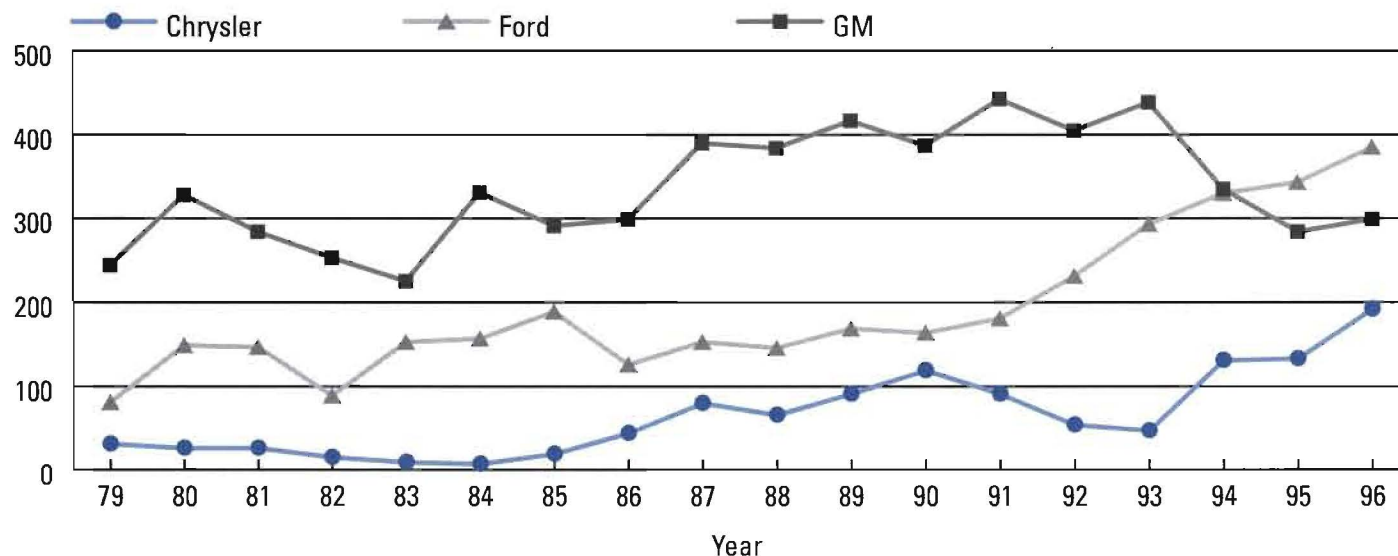


Figure 2.

Another way that information flows is through imports. Again we see a difference between Japan and Germany. Our analysis indicates that as U.S. imports from Japan increase, total patent output decreases; while as U.S. imports from Germany increase, total patent output increases.

Discussion

One possible explanation for the differences noted above is that Japanese firms strategically use their patents to block possible future research by other companies. Therefore, firms in other countries must follow suit when patenting in the same areas. In addition, in the years specified in this study, many joint ventures

research we find that information that results from applied research is flowing between countries at a faster rate in the auto industry compared to 20 years ago. This tends to negate argument (1) above, particularly when combined with other work in the field that finds no evidence that basic innovations diffuse more rapidly than others. Our findings, that a quasi-protectionist focus by the government on applied research may well be misguided, fit with the Clinton administration’s current policy shift towards increasing funding on basic research.