Firms that announce (and patent) new products.
Some first results

Paper for the workshop on *Empirical Economics of Innovation and Patenting*,
March 14-15, 2003, Centre for European Economic Research (ZEW), Mannheim

(Draft version from February 2003)

by

Gerben van der Panne & Alfred Kleinknecht

The authors are PhD fellow and Professor of Economics
Coordinates:
Faculty of Technology, Policy and Management,
TU Delft,
Jaffalaan 5,
NL-2628 BX Delft,
www.eci.tbm.tudelft.nl.

Acknowledgement:
We thank Cees van Beers for useful comments on the first draft of this paper.

Abstract

We explore a recent collection of 398 new product announcements in 46 trade journals over a two-year period in the Netherlands. All innovators were interviewed with an emphasis on tracing their knowledge network. The data collection has been finalized in December 2002. From our preliminary analyses, three key findings emerge:

1. **Analysing determinants of the regional distribution of new product announcements we find that regional proximity to high tech firms as well as proximity to a university significantly increases the number of new product announcements. In particular, proximity to a technical university increases numbers of new products announced by younger firms.**
2. **187 out of 398 innovators in our database achieved patent protection. Consistent with earlier research (based on quite different data) we find that larger firms, firms in a high tech environment and firms that collaborate on R&D have a significantly higher propensity to patent.**
3. **While we can reproduce several of the patterns found in earlier studies (e.g. by Acs & Audretsch), we have the impression that this type of innovation data strongly undercounts innovations by large firms. The database appears to be biased towards young and small-scale innovators. Therefore, generalizing conclusions with respect to a high innovativeness of small firms in earlier studies (using similar data) appear to be problematic.**

I Introduction: New product announcements in trade journals

This paper evaluates data that have been collected by systematically screening new product announcements in 43 trade journals from September 2000 to August 2002. These 43 journals cover new product announcements from all major sectors of manufacturing and services in the Netherlands. The method of data collection has been used earlier. An early example is the US Small Business Administration database collected by The Futures Group in 1982 that lead to a series of interesting research papers (for a survey see Acs & Audretsch, 1993). Other examples of similar data collection in Europe can be found in Kleinknecht & Bain (eds., 1993).

Our recent data collection deviates somewhat from the earlier approaches:

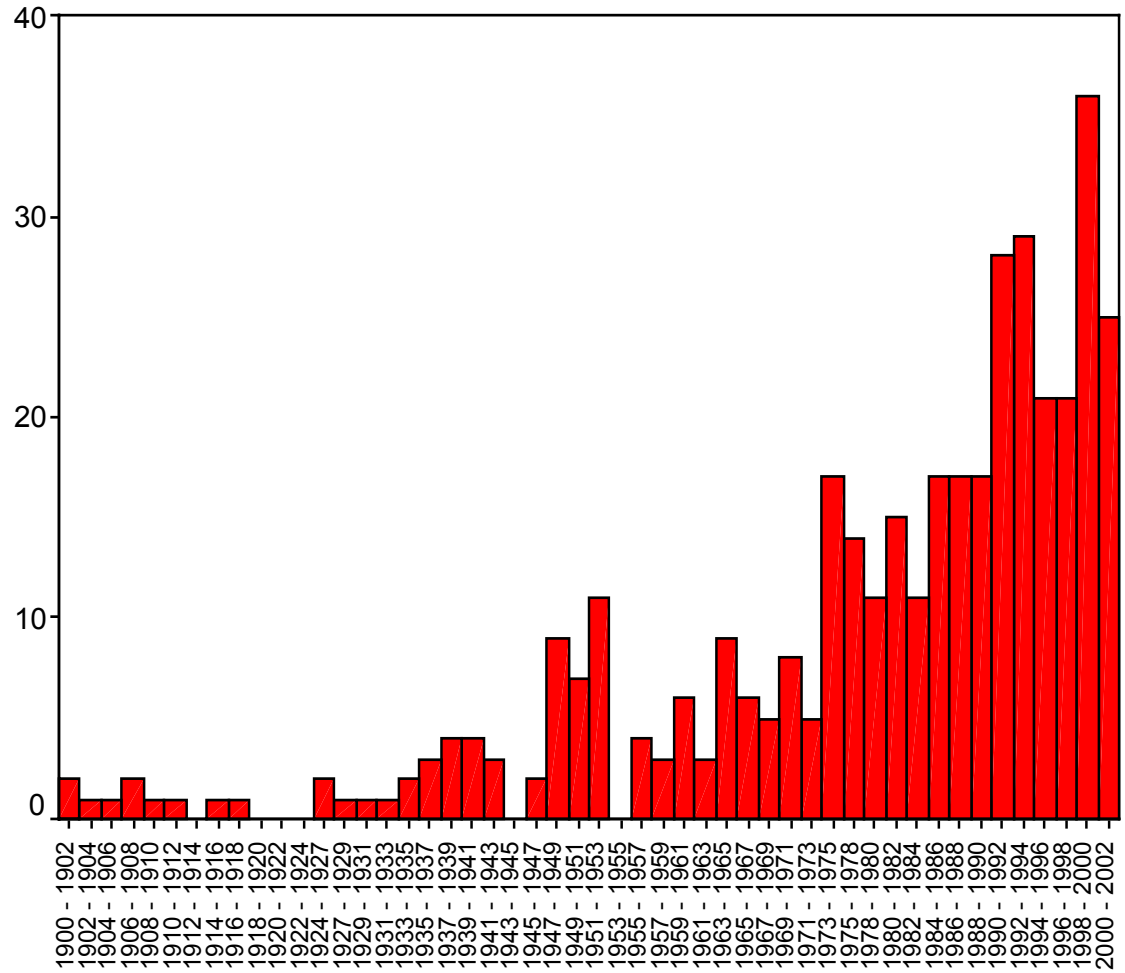
1. We classified all new products (or services) by type of innovation (modest improvements versus radically improved or entirely new products) and by degree of complexity;
2. We confined the collection of data to what we consider 'innovations', omitting mere 'product differentiation'. For a distinction between the two categories we searched in the journal description of the announcement for indications of an improved performance (e. g. 'less energy-consuming', or 'higher performance with respect to …'). If no indication of improved performance compared to existing products could be found, the product was omitted as a case of mere product differentiation.
3. All firms announcing a new product were sent a questionnaire that asked information about the innovating firm and about properties of the innovation project. The response rate to our questionnaire was 67%. Questions related for example to the educational background of the manager/owner of the firm, R&D efforts (total efforts and efforts with respect to the product announced), duration of the project, or patenting. Particular attention was given to the firm's knowledge network, distinguishing between: (a) sources of valuable information, (b) partners for contracting out of R&D and (c) R&D collaboration partners. Moreover, we know the location and the type of partner (e. g. public research institutes, universities, suppliers, clients, competitors and others).
4. Firms were explicitly asked whether they had indeed developed the new product themselves. In a large number of cases, it turned out that the innovation was developed by some other organisation and that the product-announcing firm was simply serving as a distribution channel. Such cases were omitted from the database. In the end, we kept only cases that were developed by the firms themselves and within the Netherlands.
5. In September 2002 we started a second interview round among the innovators found in September 2000. We intend to ask all innovators about the (degree of) success (or failure) of their product 24 months after the announcement. This will later on allow for multivariate analyses of factors that distinguish between successful and failed innovation projects. Obviously, this is beyond the scope of the present paper.

In collecting cases, new product advertisements were excluded. Ultimately, our search procedure resulted in 398 counts of new product announcing firms between September 2000 and August 2002. After a period of data cleaning, the database became operational in December 2003. In this paper we intend to report outcomes from a first round of data exploration. First we give descriptive information that can say something about (in)-consistencies of this indicator with other innovation indicators. Second, we present a first analysis of factors that influence the distribution of innovators across 43 Corop regions. Third, we analyse properties of innovators who applied for patent protection. This can say something about factors behind differences in what Mike Scherer once called the 'propensity to patent'.

II Descriptive information

Our method of data collection does not follow standard statistical procedures. In other words, we do not know the population of new products from which to draw a sample. The number of new product announcements depends on the intensity of search efforts and, in particular, on numbers of journals covered. It is nonetheless reassuring that some straightforward correlation analyses showed a fairly good correlation across sectors between numbers of products announced and the independently collected innovation output indicator from the *Community Innovation Survey* (covering shares in sales of new products). However, our data collection seems to deviate strongly from other innovation data with respect to the firm size and firm age distribution of innovators. Figure II/1 shows that half of the innovating firms in our database were founded after 1985, one quarter after 1994 and 10 percent after 1998. Obviously, this age structure is somewhat younger than the population of firms in the entire country. Moreover, it turned out that about one third of the younger firms (founded after 1996) were founded with the explicit aim of developing and commercialising the new product announced in the journal.

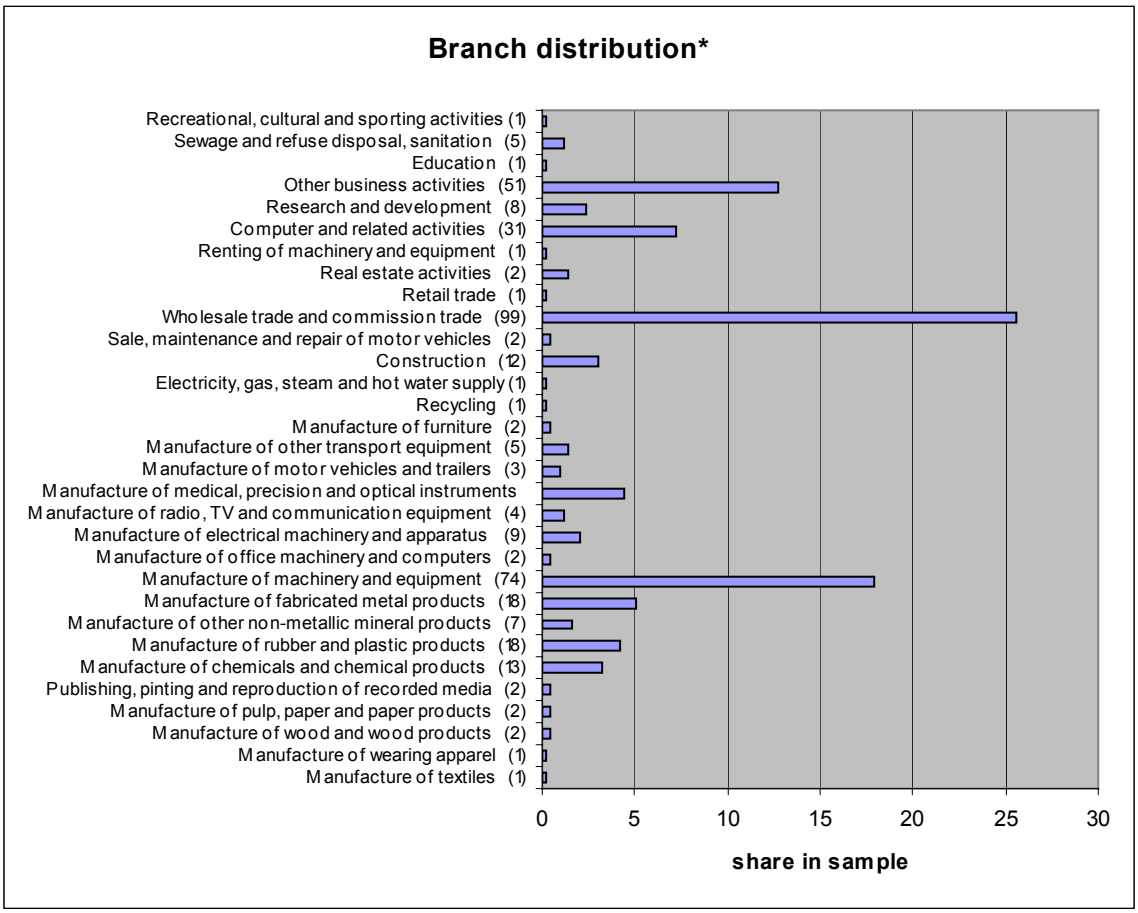
Figure II/1: New product announcing firms by year of foundation



Even more surprising is the size structure of the innovators. Ten percent of our firms have two employees or less, one quarter has six employees or less. Only 25% of the innovators have more than 70 employees. The mean size is 65,7 employees, but the more realistic median is 22 employees. Seemingly, our data collection is strongly biased towards young and small firms. We have no explanation for this. Intuitively, we had expected the opposite. As our data collection relied on innovations reported in the edited part of branch journals (ignoring advertisements), we expected that large firms would have more chance to get their new product announcements publicised, as they have specialised public relations departments that can write smart press releases.

Figure II/2 shows the distribution across sectors. Service firms develop a fairly high share of new products. However, only a modest share (less than 5%) is actually classified as 'service innovations'. Most remarkable is that wholesale trade firms develop about one quarter of all innovations found. Within manufacturing, machinery manufacturers take a lion's share.

Figure II/2:
Branch distribution of new product announcing firms



* Absolute numbers of new announcements in parentheses

It should be noted that 79 percent of our innovators engage in R&D activities on a *permanent* basis. Only 19 percent considers R&D as an *occasional* activity. The mean duration of development projects is 1,87 years (median: 1,5 years). The median R&D budget of a product-announcing firm is about 172.000 Euro, covering 2,5 man-years. The median R&D budget dedicated to the product announced in the journal is about 50.000 Euro or 1 man-year. Remarkably enough, the R&D intensities of our firms do *not* differ significantly between branches. This is in contrast with everything we know about differences in R&D intensities between branches that are measured in standard R&D surveys (covering older and larger firms).

Our 398 innovators have remarkably high rates of networking. During the development trajectory, 82% have used at least one of three possible forms of networking:

(a) Consultation of an important source of information;
(b) Contracting out of some R&D or
(c) Collaborating on R&D.

Detailed figures can be found in table II/1.

Type of partner:	%	N	Information sources	Contracting out	R&D collaboration
Secondary business units or subsidiaries	15	54	22	11	36
Headquarter	7	25	15	1	14
Suppliers	56,3	202	106	86	108
Customers	35,1	126	87	5	58
Competitors	11,7	42	34	1	8
Consultants/engineers	17,8	64	26	34	22
Universities	12,3	44	18	9	28
Colleges	6,1	22	8	8	12
Research institutes	13,4	48	24	26	17
Others	4,6	16	8	3	7

III Determinants of the regional distribution of new product announcements

Figure III/1 shows the distribution of new product announcing firms across 43 Corop regions of the Netherlands. For insiders, it is surprising that the most densely populated region of the country (i.e. the 'Randstad', including four large cities: Amsterdam, Utrecht, Rotterdam and Den Haag) does not belong to the most favourite innovation 'breeding places'. It rather looks as if our innovators favour intermediate regions between the country's periphery and the centre. In our attempt to explain this location pattern, we use an agglomeration index developed by Manshanden (1996). The Manshanden index essentially measures population density. It is based on a large literature on agglomeration economies. For our purpose, the most important point is that knowledge transfer requires 'face-to-face' contacts and trust between people, and agglomerated regions simply offer more such contacts.

The Manshanden index distinguishes five ordinal degrees of agglomeration externalities according to physical distances between a Corop region's central town and those in all other Corop regions, weighted by the region's population density. It does not capture all relevant dimensions of agglomeration externalities, such as the de-

gree of specialisation, competition and diversity of the local production milieu (Ouwersloot & Rietveld 2000; Van Oort 2002). Nevertheless, the index has several times been used for reasons of data availability and comparability and proved useful (Manshanden 1996; Brouwer *et al*. 1999).

Figure III/1:
Numbers of new product announcing firms in 90 Dutch zip code regions

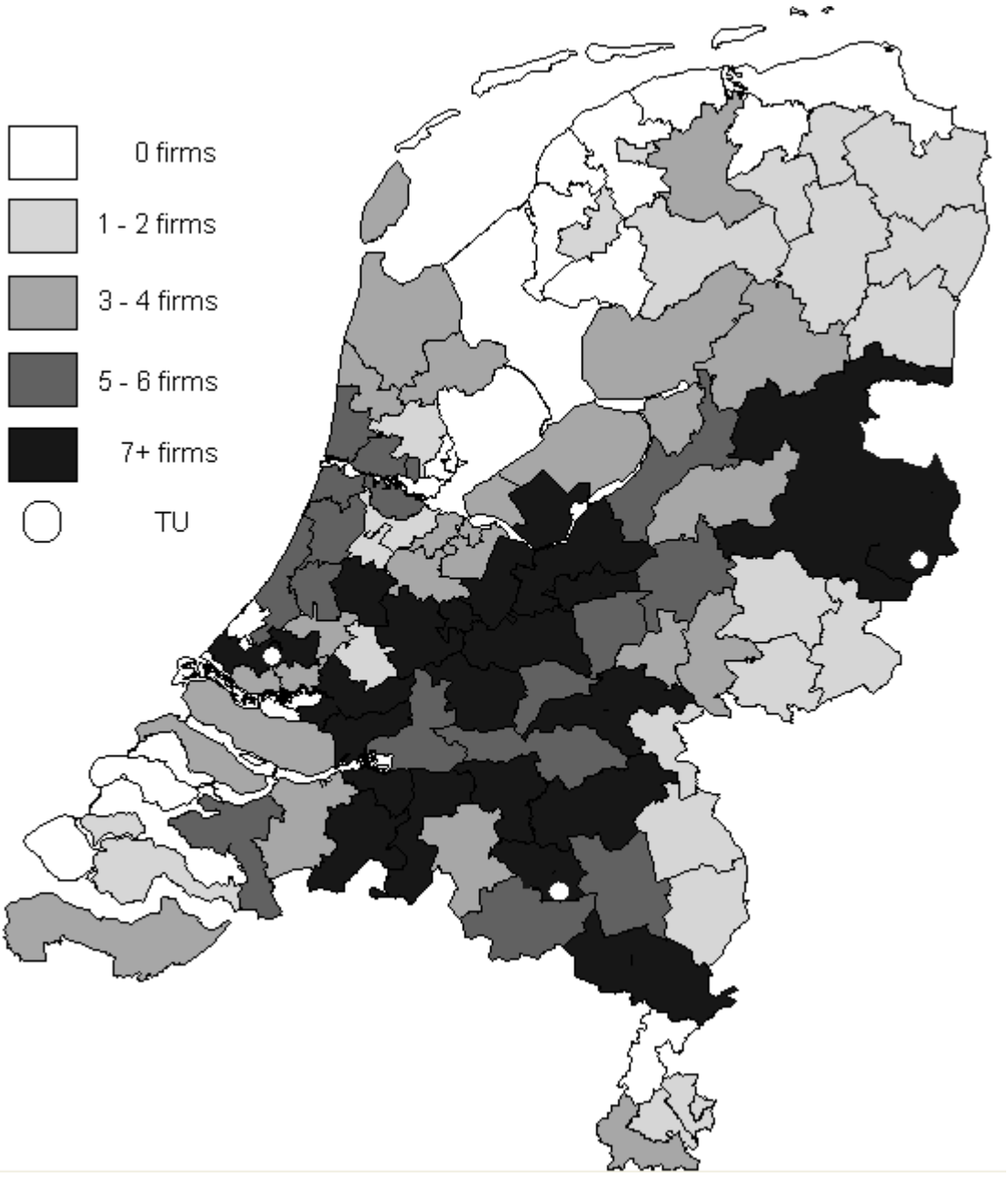
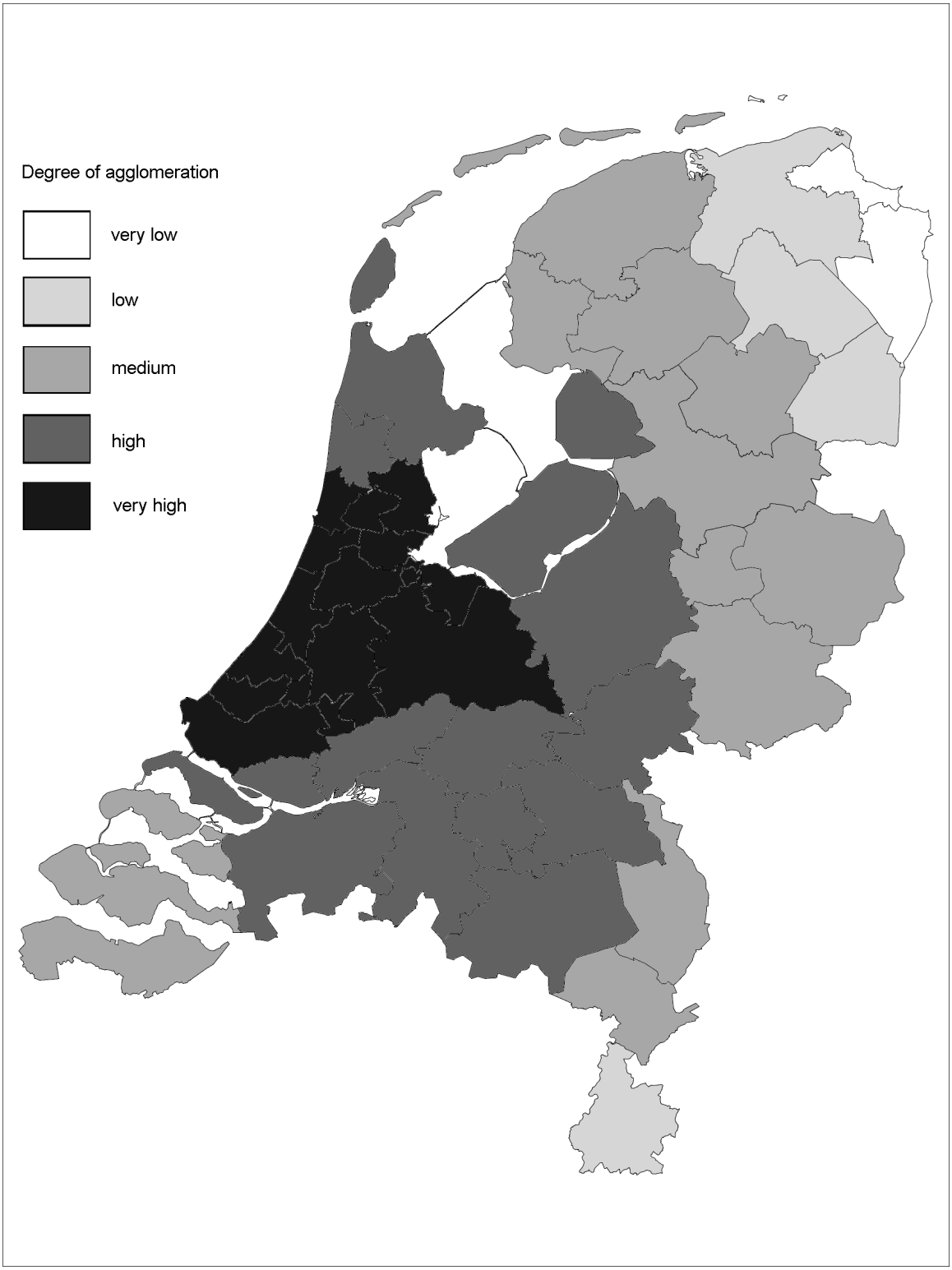


Figure III/2:
Agglomeration zones in the Netherlands according to the Manshanden index



For our estimate in table III/1 we use a count data technique, which is consistent with the Poisson-distributed counts of new product announcing firms by Corop region. Besides Manshanden's agglomeration index, we use as a control variable the total number of firms in a Corop region. Moreover, in order to assess regional knowledge spill over pools, we include the following exogenous variables:

- A dummy variable for Corop regions that have a university;
- A dummy variable for Corop regions in which one of the three *technical* universities is located;
- The number of public research institutes located in a Corop region;
- The number of firms in a Corop region that belong, according to the OECD (1986) definition, to 'high tech' sectors';
- The number of private research and consultancy firms per Corop region.

Unfortunately, the latter two variables had to be omitted from our estimate since they were highly collinear with each other and with the total number of firms in a Corop region. Moreover, the number of private research institutes was strongly collinear with the presence of a university. All three variables were highly significant if included separately. Table II/2 summarised our count data estimate.

Table II/2:
Factors that explain the distribution of new product announcements across the 43 Corop regions of the Netherlands
(Summary of count data estimates; z-values)

Independent variables:	Total number of innovators	Young innovators (<10 years)	Innovators older than 10 years
Constant term	-0,72	-0,73	-0,02
Number of firms in Corop region	2,50**	2,06**	1,64*
Number of public research institutes in the region	1,28	1,37	0,62
Dummies for degree of agglomeration*:			
• low	1,68*	1,16	0,02
• medium	2,41**	1,16	0,02
• high	2,90***	1,68*	0,02
• very high	2,45**	1,34	0,02
Corop region has a university	2,60***	0,57	2,78***
Corop region has a *technical* university	4,02***	3,81***	1,93*
Number of observations:	43	43	43
pseudo R-square	0,29	0,25	0,25

* Reference group: 'very low' agglomeration; the index is taken from Manshanden (1996).
Levels of significance: * = 10%, ** = 5%, *** = 1%.

It is remarkable that public research institutes do not seem to have a significant influence on the number of new product announcements in their region in spite of their mission: providing technical support, research and consultancy to firms. As already mentioned, tentative inclusion of the variable 'number of high tech firms' (instead of the total number of firms in a region) leads to highly significant results. Seemingly, high shares of high tech firms have considerable spill over effects - or they are themselves an important source of new pro-

ducts [still to be investigated]. The same holds for private research institutes. The agglomeration index by Manshanden behaves as was to be expected from inspection of the above figure on numbers of new product announcements by region. With an increase in agglomeration density, the rate of new product announcements increases quite substantially. However, in the region with the highest degree of agglomeration (the 'Randstad'), the rate of new product announcements decreases. In this respect, our results differ from estimates with the *Community Innovation Survey (CIS)* innovation output indicator that is based on shares in total sales of new products among firms with 10 and more employees. The CIS indicator shows a linear relationship with the Manshanden index; i.e. firms in the region with the highest degree of agglomeration have the highest score on innovation output.

Last but not least, it is interesting to note that the presence of a technical university significantly increases numbers of firms announcing new products. Technical universities seem to have their strongest impact on numbers of newly founded innovating firms. While the rate of all types of new product announcing firms roughly doubles, the rate of younger firms announcing new products increases by 170% if the region has a technical university. For general universities, the opposite holds and effects are a bit weaker. The presence of a university in a region seems to increase the total number of innovators by about 45% and the numbers of older firms that announce new products by 62%, while their impact on newly founded innovating firms is insignificant.

Summarising the above outcomes, we can say that they are fairly consistent with a large regional economics literature on the beneficial effects of agglomerations on innovation, with one important exception: The region with the highest degree of agglomeration (the 'Randstad') is only a second rate 'breeding place' for new product announcements, predominantly by younger and smaller firms, while innovative output by larger and older firms is strongest in the region with the highest degree of agglomeration (Brouwer et al. 1999). It seems as if congestion effects and the driving up of factor prizes by older firms are driving out some of the innovators, notably the smaller and younger innovators. Moreover, it is interesting to note that Dutch universities, and especially the technical universities, have a significantly positive impact on numbers of innovators in 'their' region. The presence of a technical university seems to favour, in particular, innovations by firms of less than ten years old. The presence of a general university seems to favour innovations by older firms.

IV Determinants of the propensity to patent

Table IV/1 shows that 187 (out of 398) new product-announcing firms have applied for some type of patent protection either at a national or a European or an outside European scale, or some combination of these possibilities. The mere number of observations does not allow separate analyses of patenting by country or World region. All we can do is to run a simple logit estimate that identifies factors that enhance or reduce the probability that an innovator will apply for any type of patent protection.

Table IV/1:
Patenting by 398 firms that announced a new product

Number of firms that have:		NL	EU	Outside EU
• patented *only* in NL	38	38		
• patented *only* in EU	55		55	
• patented *only* outside EU	33			33
• patented in NL *and* EU	20	20	20	
• patented in NL *and* outside EU	1	1		1
• patented in EU *and* outside EU	8		8	8
• patented in NL, EU *and* outside EU	32	32	32	32
TOTAL	**187**	**91**	**115**	**74**

There have recently been three studies about the relationship between innovative output and patents. The first is by Acs & Audretsch (1989). Comparing their data on new product announcements with patent data, they conclude from their cross-industries regression 'that patents vary with company R&D, total R&D, and skilled labour in the same manner as does innovative activity. In general, the results support the validity of patent counts as a measure of innovative activity.' (1989: 180). This result is challenged by a more recent study by Arundel & Kabla (1998). Using a sample of large firms from all EU countries, Arundel & Kabla (1998) found considerable differences across branches in rates of innovation cases that are patented. In a third study, using a representative manufacturing sample from the Netherlands, Brouwer & Kleinknecht (1999) tend to corroborate the findings by Arundel & Kabla. While Arundel & Kabla (1998) used numbers of innovation cases that are patented, Brouwer & Kleinknecht (1999) used two types of data:

- Data on the appreciation by entrepreneurs of patents as a protection against imitators; and
- Data on shares in sales of innovative products from the CIS.

The first data source essentially confirms the results of Arundel & Kabla: There is considerable variation in the propensity to patent across branches. The second dataset allows for a more detailed multivariate investigation. Confronting shares in sales of innovative products with numbers of patent applications (and controlling for several other factors), systematic deviations between the two types of innovation indicators have been discovered. It turned out that firms having the same score on innovative output have a systematically different score on patent applications along the following lines:

- Smaller innovators have a significantly lower probability of applying for at least one patent;
- However, given that smaller innovators apply for patents, they file applications in higher numbers;
- Firms that collaborate on R&D file significantly higher numbers of patent applications;

- Firms in high technological opportunity sectors tend to file significantly more patent applications.

This implies that if we were to rely exclusively on patents as an innovation indicator, we would underestimate the numbers of small firms that innovate while overestimating the innovation intensity of small innovators. Second, we would undercount the innovation activities of firms that do not collaborate on R&D. And under-counting would also hold for firm in low technological opportunity sectors.

It seems interesting to investigate whether similar outcomes will hold for our sample of 398 new product-announcing firms that is biased towards small and young firms. As far as our database allows for, we shall formulate a similar model. Table IV/2 summarizes our logit estimate. The logit model says something about factors that influence the probability that an innovator in our sample of 398 firms will belong to the group of 187 firms that achieved patent protection. As endogenous variables we include firm size and a firm's number of partners for R&D collaboration. Besides, we include three variables that approximate high technological opportunity: (1) a dummy variable for innovators that have products new for the *branch* (other than only new to the *firm*); (2) a dummy for innovators that perform R&D on a *permanent* (other than *occasional*) basis; and (3) the percentage of firms in an innovator's region that belongs to high tech industries according to the OECD (1986) definition. We expect all these variables to have positive signs.

Table IV/2
Factors that influence the probability that a new product-announcing firm will achieve patent protection

Exogenous variables:	z-values	signif.*
Firm size (number of employees)	2,66	***
Dummy: New product is new for the branch	1,98	**
R&D activities are permanent (other than occasional)	1,41	
Number of partners for R&D collaboration	3.52	***
Share of high tech firms in a firm's Corop region	2.23	**

* Levels of significance: * = 10%, ** = 5%, *** = 1%

The above table confirms that larger innovators in our sample have indeed a higher probability of achieving patent protection than their smaller counterparts. Not surprisingly, new products that are new for the branch have a higher chance of being patent protected than innovations that are new to the firm only. Firms that collaborate with others will be more eager to protect their precious knowledge; this can be due to lack of trust, but also because patenting makes knowledge more easily tradable in contract negotiations. Finally, a high share of high tech firms in an innovator's regional environment is conducive to patenting.

V References

Acs, Z. J. & D. B. Audretsch (1989): 'Patents as a measure of innovative activity' in: *Kyklos*, Vol. 42, pp. 171-180.

Acs, Z. J. & D. B. Audretsch (1993): 'Analysing innovation output indicators: The US experience', in: A. Kleinknecht & D. Bain (editors): *New concepts in innovation output measurement*, London: Macmillan, pp. 10-41.

Arundel, A. & I. Kabla (1998): 'What percentage of innovative activity is patented?' in: *Research Policy*, Vol. 27, pp. 127-141.

Audretsch, D.B. & M. Feldman (1996): 'R&D spillovers and the geography of innovation and production' in: *American Economic Review* 86 (3), pp. 630-639.

Brouwer, E. & A. Kleinknecht: 'Innovative output, and a firm's propensity to patent. An exploration of CIS micro data' in: *Research Policy*, Vol. 28, pp. 615-624.

Brouwer, E., H. Budil-Nadvornikova & A. Kleinknecht (1999): 'Are urban agglomerations a better breeding place for product innovation?' in: *Regional Studies* 33 (6), pp. 541-549.

Kleinknecht, A. & D. Bain (eds.): *New concepts in innovation output measurement*, London: Macmillan.

Kleinknecht, A., K. van Montfort & E. Brouwer: 'The non-trivial choice between innovation indicators', in: *Economics of Innovation and New Technology*, Vol. 11 (2), p. 109-121.

Kleinknecht, A. & T.P. Poot (1992): 'Do regions matter for R&D?' in: *Regional Studies* 26, pp. 221-232.

Manshanden, W. (1996): *Zakelijke diensten en regionaal-economische ontwikkeling*, Ph.D. thesis, University of Amsterdam.

OECD (1986): *OECD science and technology indicators, NO 2: R&D, invention and competitiveness*. Paris: Organisation for Economic Co-operation and Development.

Ouwersloot, H. & P. Rietveld (2000): 'The geography of R&D: Tobit analysis and a Bayesian approach to mapping R&D activities in the Netherlands' in: *Environment and Planning A* 32, pp. 1673-1688.

Van der Panne, G. & W.A. Dolfsma (2001): 'Hightech door Nederland' in: *Economisch Statistische Berichten* 86 (4318), pp. 584-586.