



■ Research Report

The Rapid Internationalisation of High-Tech Young Firms in Germany and the United Kingdom

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EXECUTIVE SUMMARY

Key findings

- *The majority of UK and German high tech young firms have international sales. For this majority, it is not a question of whether, but rather when, to internationalise.*
- *These high tech young firms internationalise quickly after formation. A quarter of the sample internationalise in their first year. 80% of the sample will have internationalised by the 10th anniversary of their founding.*
- *Internationalisation is associated with higher performance than domestic-only firms when measured by sales and employment growth, and by labour productivity.*
- *Firm age, size at start-up, regular R&D activity, and founders with international experience prior to start-up are all associated with a greater likelihood of internationalisation.*
- *Firms with highly customised products and/or specialising in software activities are less likely to sell into foreign markets.*
- *UK high-tech start-ups have higher levels of international sales than their German counterparts despite the latter internationalising more quickly.*
- *The degree of internationalisation of a firm is influenced by management's experience of internationalisation and by the level of co-operation with foreign partners. Simply put, a firm with greater experience of international sales has a greater level of international sales.*
- *Europe is the primary regional focus for exports from German and UK firms. North America is the most popular destination for UK exports. France is the most popular country for German exports.*
- *The founder managers of German young high tech firms are generally more risk averse than their UK counterparts. Their choice of export strategies is consistent with this greater risk aversion.*
- *Exporting directly or via a distributor are the two most common modes of internationalisation for high tech young firms and represent over 70% of all contemporary market entries.*
- *Young firms experience a 'liability of alienness' when trying to sell to major foreign buyers. Large firms are unwilling to purchase directly from young firms with little reputation or track record. This barrier tends to oblige the young firms to use distributors despite these agents likely being a more costly alternative to direct sales activity.*
- *Venture capitalists are confirmed as good at spotting 'winners'. Their finance and advice raise the labour productivity of investee firm recipients but do not significantly increase the likelihood of internationalisation or rapid growth 'per se'.*
- *Public grant or subsidy has little positive impacts on measures of firm performance. There remains a wide disparity in the knowledge of, or interest in, available grant schemes by high tech young firms in both Germany and the UK.*

The Research Objectives

This is the third study of high tech, young firms (New Technology Based Firms) that has been supported by the Anglo-German Foundation for the Study of Industrial Society. It was conducted by a joint research team from the Centre for European Economic Research (ZEW) at Mannheim, Germany and from Warwick Business School, and, latterly, London Business School, England. The purpose of the research was to look at the phenomenon of the rapid internationalisation of NTBFs. The researchers were particularly interested to understand the spectrum of circumstances faced by young high tech firm that either stimulate or discourage rapid internationalisation. It was hoped that the research findings would result in both theoretical insights and practicable advice for young high tech firms.

In ascertaining important factors, whether at the level of the environment, the firm or the product/market, the relevance of existing theoretical models of internationalisation were appraised in the specific context of contemporary NTBFs in two major European economies - Germany and the UK. This Anglo-German survey of NTBFs represents the largest study of its kind known to the researchers.

The Survey

The research activity was simultaneously conducted in the UK and Germany over the period Autumn 1997 to Spring 1999. Given access to large commercial databases in the two countries, a random, stratified sample of firms was constructed within 19 known high technology sectors. The selection criteria stipulated that the respondent firms were legally independent; employed three or more 'full-time equivalent' workers; and were under ten years of age. Of critical importance, the survey process was designed to generate 'matched samples' of firms which were similar in all major characteristics other than one set of respondents had internationalised and the other set had remained exclusively domestic in their sales activity. Two thousand high tech, young firms in both the UK and Germany were sent an extensive postal questionnaire. This resulted in a total, usable sample of nearly 600 returns (UK 362 and Germany 232). The firms were subsequently categorised by key variables including age, sector, technology employed, sources of finance etc.

The Focus

The data from the questionnaires were used to operationalise a series of econometric models. These models were designed to explore the following key areas of research interest concerning NTBFs:

- *the incidence of international activity*
- *the differences between internationalising and non internationalising firms*
- *the degree of internationalisation*
- *the timing of entry into international markets*
- *the mode of market entry employed*
- *the impact of internationalisation on performance (labour productivity, sales and employment growth)*

In addition to using the postal survey to generate, primarily, quantitative data on the respondent

firms, forty case study firms (twenty in each country) were selected from the six hundred respondents. Again, a matched sample technique was used to explore specific characteristics of the internationalising/non internationalising firms.

The Findings

1. INCIDENCE OF INTERNATIONALISATION

Our first and arguably most important finding is that international activity is the norm for a majority of young technology based firms. Firms with a solely domestic market focus are the minority and, over time, become an increasing exception to the rule. This conclusion holds true for the NTBF populations of both Germany and the UK even after accepting that the data collection process is likely to have had a positive bias towards selecting export oriented firms. 57% of the total sample had international sales. More than 20% of non internationalisers stated that they were considering the initiation of export activities in the foreseeable future. Nearly one third (29%) of the respondents had sales in at least three foreign markets. 40% of firms had generated 10% or more of their revenues from international sales, with 15% of this subset of firms deriving over half their sales from foreign markets.

Small firms are frequently characterised as parochial in interests and scope. Technology based, young firms are shown to be the very opposite.

2. DIFFERENCES BETWEEN INTERNATIONALISING AND NON INTERNATIONALISING FIRMS

There are significant differences between those firms which internationalise and those which do not. These differences are more marked when firms have made significant commitments to internationalisation activities beyond the occasional or happen chance foreign sale. When compared to the base case of 'a software company without R&D activities and incorporating 'tried and tested' technologies in its products', a number of characteristics can be used to discriminate accurately between the two types of firm.

Internationalisation activity is more likely to occur if the firm:

- *is older*
- *is larger (i.e. employment at start-up)*
- *undertakes regular R&D activity*
- *has founders with international managerial experience*

Internationalisation activity is less likely to occur if the firm:

- *sells products that are highly customised to the needs or demands of one or a small number of customers*
- *sells software services as opposed to manufactured products*

Importantly, the results do not suggest that firm size is an insurmountable barrier. The positive effect of size on the propensity to internationalise decreases as the firm gets larger. Small firms as well as large firms can, and as the study shows, do internationalise. However, when moving from a threshold of casual to more committed internationalisation (best measured by the number of foreign markets entered), the impact of the above mentioned variables becomes even more visible. For example, excessive customisation and shortage of sales skills assume a greater importance as barriers to internationalisation.

UK and Germany firms are broadly similar in their propensity to internationalise. However, there are a number of significant, country differences. The regularity of R&D is an important discriminator in Germany while R&D intensity (measured as a % of sales) is more influential for UK firms. UK firms that venture abroad tend to use more innovative technologies than their domestic peers. This difference in the technology applied is not evident in Germany. However, in Germany, East German firms lag significantly behind their West German counterparts in terms of the likelihood of early internationalisation.

3. *DEGREE OF INTERNATIONALISATION*

The degree or intensity of internationalisation was defined as the share of non-domestic revenues of the firm. The results indicated that West and East German firms had 9% and 17% lower shares of international revenues, respectively, than their UK counterparts. On the evidence of this survey, British NTBFs are markedly more international.

The size of the firms at start-up had no influence on the subsequent intensity of internationalisation. However, a particularly strong, positive influence was the firm's historic experience of international sales. The longer a firm has operated abroad, the greater the likelihood of having a high level of international sales at the time of the survey. Similarly, being in the engineering and life science sectors increases the importance of international sales when compared to software activity.

Firms that have co-operated with foreign partners on R&D are more likely to have higher levels of international sales. For UK firms, the commitment to internationalise or the involvement of venture capital finance both have a strong positive effect on foreign sales. However, neither of these two factors was important for German firms over the survey period. Again, for UK firms which sold abroad, more innovative technology is associated with greater overseas sales. Interestingly, the maximum effect of technological innovation is found when the technology incorporates novel features but is not too advanced. For German firms, again innovation was not a discriminatory variable. In Germany, firms which sold capital goods are more likely to be international. Product related variables such as the degree of customisation, installation or maintenance requirements do not impact on the degree of internationalisation for either country.

The results showed that East German firms were no less likely to be highly international in intensity than their West Germany counterparts once they had started to sell to foreign markets. This finding again supports the likely indication of export thresholds suggested by the importance of experience. For the British firms, building up greater technical innovation capability and preparing business plans are each part of surmounting that threshold.

4. *TIMING OF INTERNATIONAL SALES*

The results indicate quite categorically that the incidence of internationalisation increases over time. That data demonstrates that, by the eighth year of existence, 70% of the sample firms had internationalised regardless of their country of origin. For the majority of NTBFs the question is not *whether* the firm will internationalise but *when*.

The analyses indicated that the older the business and the more regular the commitment to R&D, the more rapid the development of international sales. The involvement of founder managers who have worked abroad or for a multinational company also increases the speed of foreign market activity. However, the influence of educational experience abroad is much less strong and is not statistically significant. Working against rapid internationalisation was the (high) level of

product customisation. The production of end-user rather than capital-good type products also appears to deter rapid internationalisation.

The findings suggest that timing of internationalisation is a dynamic process which is influenced by initial human capital endowment, permanent R&D activity, the products' innovative technological characteristics, and the learning effects of day to day activities. The power of these variables to influence the timing of internationalisation, however, erodes over time. Thus, for example, the ability of product customisation to reduce the speed of internationalisation is seen to diminish over time.

5. *TARGET COUNTRIES*

Respondents were asked to note the three most important, contemporary foreign markets. Both British and German firms are common in that they each direct approximately three-quarters of their total foreign activities to other members of the European Community/European Free Trade Area and the US/Canada. Thus, Germany and the UK are only materially different regarding their country preferences within this dominant block, or in their marginal sales to other regions.

History is important. The UK is more than twice as likely to sell to North America (UK 19% Germany 8%). The US is the UK's single most important foreign customer. France holds this position for Germany. On aggregate sales, Germany remains more European with 68% of current market entries compared to 56% for the UK dedicated to the EU/EFTA. The new emerging markets of Eastern Europe are over four times more important to Germany than to the UK (Germany 9% UK 2%). Not surprisingly, Australia and New Zealand are much more popular markets for the British.

6. *MODE OF INTERNATIONALISATION*

Internationalisation, given its demand on scarce resources, increases the level of risk and uncertainty faced by a young firm. Therefore, the selection of an appropriate mode of internationalisation is a critical strategic choice. Two low-cost modes, i.e. foreign direct sales and the use of a distributor, accounted for approximately 70% of all sales choices. Direct exporting can be a viable, low cost strategy particularly if the product does not require frequent or complex interactions between the manufacturer and user. The use of distributors is seen as a more substantial economic commitment given that relationships between economic agents have to be fostered in order to transfer technical capabilities from the manufacturer to the seller. This latter agency relationship may also involve significant monitoring costs. The study explored which firm or product variables influenced the means by which firms internationalised.

Products which require a significant level of installation costs or are highly customised were invariably sold directly and not via agents or distributors. If the founder managers had international experience or if the firm had a high R&D intensity, this also increased the tendency of the firm to export directly. Conversely, increased technological innovation in the products and the previous commitment to international sales in a business plan each increased the likelihood that a distributor would be employed in foreign markets. Firms from industries which traditionally employ distributors, such as ICT hardware and pharmaceuticals, are also more likely to continue to adopt this accepted market channel.

It was expected that higher levels of innovation incorporated in the firm's products would be more associated with the direct sales mode. Given the greater sophistication of these products, it was believed that the intervention of a third party, sales agent would decrease the efficiency of information transfers. The observed reality is that the opposite is true. More innovative products

tend to be sold via distributors. This was explained through the introduction of the concept of “the liability of alienness”. By this term we mean that a demanding corporate user may not be prepared to accept the product or service of an unknown and untested company unless supply is mediated through a familiar and trusted intermediary. This intermediary or ‘value-added reseller’ by accepting to distribute the product of the young firm in effect enfranchises the young firm within its own reputation. This sharing is at the expense of a part of the young firm’s sales margin captured by the distributor. Thus, while a firm may wish to sell directly, this choice may not be available to it given its limited track record with established potential customers.

7. *FIRM PERFORMANCE AND INTERNATIONALISATION*

The performance of an NTBF firm was measured both in terms of non-R&D labour productivities and in the ability of internationalising firms to grow more quickly both in sales revenues and employee numbers. Labour productivity is higher by a factor of 40-50% for German and UK firms which had internationalised. This benefit was equivalent to an additional firm revenue per employee of ECU 50-60,000 per annum. As expected, R&D intensity has a positive effect on factor productivity.

Given that the survey only measured the performance of ‘surviving’, i.e. the more successful, firms, these figures contain a bias. However, accepting this caveat, the sales growth rates of 25-35% per annum and the employment growth rates of 17-25% per annum are impressive. There is some evidence that British firms were more represented in the higher growth ranges. Internationalisation increased the elasticity of sales growth by 13%. Thus, if a firm doubles the level of its international sales, its annual growth rates will increase by thirteen percent. However, internationalisation does not have a similarly observable effect on the rate of employment growth. Firms and their founders appear to be using internationalisation to create additional sales rather than more jobs.

The smaller the firm’s ‘window of opportunity’, i.e. the (limited) time period during which the firm’s new products do not have serious competition, the greater the firm’s tendency to grow both sales revenue and employment. However, looking specifically at the most rapidly growing firms in the sample, no clear conclusions can be drawn other than that this extreme outcome was the result of random external factors or unobserved managerial choices.

8. *IMPACT OF VENTURE CAPITAL*

A little under 10% of the sample firms had received venture capital. UK firms were more likely to be recipients of this form of equity finance than German firms given the greater development of the UK private equity market. However, the sampling period only partly covers the recent boom in VC markets in Germany and the UK which has taken place since 1997. The recent growth in venture funds financing early-stage German businesses has been particularly marked. The existence of a firm having venture capital finance at start-up is associated with a larger productivity of non R&D labour in 1997. This resulted in additional revenues to the VC backed firm of an average of ECU 30,000 per annum. This suggests that venture capitalists may well provide more than just additional finance. However, the receipt of venture capital by a firm did not significantly increase the firm’s sales or employment growth rates. This latter result may also indicate that venture capitalists are able to select the more productive firms right from the time of start-up.

9. *IMPACT OF PUBLIC GRANTS*

The receipt of public grants was associated with a negative but insignificant effect on labour productivity. This finding would suggest that the firms were not capital constrained given the negligible impact of a public financial subsidy. Grants were not seen to influence significantly either sales or employment annual growth rates, although their impact generally was not in a negative direction. At best, it can be said that grants generally had neither positive nor negative impacts on firm growth. However, public grants and subsidies may well have an impact on the composition of the input structure of firms (e.g. enabling a firm to invest more in R&D). This difference in the input structure in turn may well have a positive impact on long-run growth prospects.

10. *DIFFERENCES BETWEEN GERMAN AND UK NEW TECHNOLOGY BASED FIRMS*

The key point to make is how similar UK and German NTBFs are when based on the descriptive and analytical findings of this research. UK and German high tech young firms have considerably more characteristics in common than those factors which separates them. However, German firms appear more risk averse than their UK counterparts. They start with larger founder teams, they internationalise more rapidly but most commonly venture to neighbouring countries within the European community. Their primary focus remains the domestic market of Germany and their strongest trading partners tend to be large, international German firms to which they sell customised products and services. German firms give the impression of being more closely integrated into the value chain of both suppliers and customers than their British competitors. Further, German firms are likely to exhibit less skill shortages over time as the efficient infrastructure and a broader skill base compensates for a less flexible labour market.

British firms, conversely, appear to be more international in scope selling more of their total production to a wider compass of customers in foreign markets. They are more strongly present in most international markets, particularly the US and the former British Commonwealth countries. The most important geographic exception is Central and Eastern Europe which is traditionally a more German dominated region. A relatively greater proportion of British firms undertake R&D activities. However, those German firms which do undertake R&D do more of it than their UK counterparts. British firms are more likely to sell less customised products (and therefore produce more 'scaleable' business models) to a wider spectrum of buyers with whom they typically have less closely integrated relationships than their German counterparts. Technology, unlike German exporters, is used to differentiate between domestic and export markets with the most innovative products being sold overseas. British firms start with stronger marketing skills and commercial experience. Over time, initial weaknesses in insufficient R&D labour supply are less well corrected in UK firms. The stronger entrepreneurial management style of UK firms, linked to entrenched, mercantile traditions and the wider applicability of less customised products and services, has resulted in the UK having a higher level of internationalisation when measured by sales revenues. The UK firms were also more likely to be represented in the upper decile of the most rapidly growing firms than their German counterparts. This may well be correlated with the slower economic growth of the German economy in the mid nineties.

11. Eighteen Research-Based Lessons for a Would-be International, High Growth, New Technology Based Firm

One important objective of this Anglo-German study was to be able to offer pragmatic and practicable advice to new technology based firms wishing to improve their chances of successfully growing and internationalising. Therefore, the key findings of the study have been distilled into a number of recommendations to the firm's founders and management. In each case, there is evidence of a significant association between the actions recommended and the incidence of successful international activity by the high tech firms that we have observed.

- 1. Recruit as good a team of founders and managers as possible* with high levels of international experience, preferably gained in both large and small firms.
- 2. Start as large an enterprise as possible* including the size of the founding team and the financial, technical and experiential resources available.
- 3. Incorporate highly innovative technologies* into products and services but not at the cost of usability and reliability.
- 4. Select products which are sold to industrial users* rather than consumers.
- 5. Build a portfolio of demanding customers* but do not become excessively committed or integrated into the non-standard needs of a few large customers.
- 6. Commit the firm to international sales from Day 1* in both actions and all planning targets.
- 7. Build a business model that is scaleable* in both volume and number of market targeted.
- 8. Be prepared to enter additional new countries rapidly* after the first internationalisation activity.
- 9. Plan for significant additional costs* in developing international sales and marketing activities.
- 10. Appraise markets* in terms of aggregate international demand rather than domestic demand and growth.
- 11. Develop a permanent and focused R&D activity.*
- 12. Avoid 'deep niche' products* if high growth is a desired goal. Ensure a wide range of applications for both products and technologies.
- 13. Continue to reduce product adaptation/transaction costs*, particularly the installation and maintenance costs incurred by new customers or the vendor.
- 14. Assess rigorously the 'pros and cons' of exporting direct versus the use of distributors*, and consider the effect of industry sector, target country and technological innovativeness on channel selection.
- 15. Manage distributor relationships effectively* recognising the need for continued investment of time and resource in supporting network linkages.
- 16. Get known quickly* and recognise the existence of the "liability of alienness", i.e. larger firms, including customers, are likely to be very wary of entering into trading relationships with unknown firms.
- 17. Be prepared for the rapid entry of new competitors* into your product/market space.
- 18. Consider objectively the merits of external finance* (venture capital, business angels), particularly the consequential benefits of factor productivity, reputational effects and advice for fast growth firms.

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