The internationalization of the US industrial gases industry, 1970-1990

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Already in the early twentieth century the European pioneers in the industrial gases industry—a new Second Industrial Revolution industry which produced gases drawn from the air and other gas mixtures for use in other industries, mostly for welding at that time—targeted the United States as an early and obvious target for expansion. By 1945, however, as a result of a range of factors associated with the trend between 1914 and 1945 toward "de-globalization" of this and other industries, only the Swedish firm AGA among the key non-American international players in the industrial gases industry had any presence at all in the US market, and even the Swedes were out of the United States by 1949, after divesting their holdings in the immediate aftermath of the Second World War. Throughout the next two decades, the US industrial gases market was the exclusive domain of US-headquartered firms, with a small number particularly dominant. From 1949 through the early 1970s, none of the non-US international players in the industry had any significant presence in the US market.[1]

By the end of the 1970s, however, the situation changed dramatically, not least owing to the response of non-US players in the industry to the entry of US-based

[1] US Court of Appeals decision on BOC vs. FTC, 577 F.2d 24, 1977-1 Trade Cases 61, 446, available at: http://openjurist.org/557/f2d/24/boc-international-ltd-boc-boc-v-federal-trade-commission-airco-inc <accessed 27 April 2011>; C.R. Baker and T.F. Fisher, "Industrial cryogenic engineering in the USA," p. 226, in R.G. Scurlock, ed., *History and origins of cryogenics* (New York: Oxford University Press, 1992).

firms into their markets, spearheaded by Air Products,[2] most of the European firms in the industry embarked on a buying spree in the United States which left them with a substantial market share there. Not surprisingly, French-based Air Liquide (AL), the most internationally active of all the gases companies, made the first successful move starting with a small acquisition in 1968. During the following decade, AL developed a substantial presence in the US market through a series of acquisitions. By the end of the 1970s, AL was joined—indeed eclipsed—by British-based British Oxygen Company (BOC) as a major US player in industrial gases. Not long after, AGA and German-based Messer Griesheim had also acquired US firms to establish a beachhead in the American market. By the early 1980s, these four European companies together boasted a market share of nearly 25 percent in the USA. Japan-based Nippon Sanso was not far behind this group, although its presence was relatively minor at first. That left just German-based Linde AG among the non-American players in the industry waiting in the wings until quite late—indeed really until the 1990s—although not, as we shall see, for want of trying.[3]

In this paper, we begin by examining the structure and key characteristics of the US industrial gases market through the 1960s before turning to an examination of the motivations, and means of entry, for key European-based entrants into the US market. We pay particularly close attention to AL, which pioneered in American market entry; to AGA; and, even more so to BOC, this owing not only to the scale and significance of its US acquisition, but also because of an extremely rich archival source base. The US acquisitions by AL and BOC in particular resulted in a combined

[2] For more on this, see chapter six above, and Ralf Banken and Ray Stokes, "'The trauma of competition': The entry of Air Products Inc. into the industrial gases business in Britain and continental Europe, 1947-1970," *Business History* 52 (December 2010): 1047-1064.

[3] Ebbe Almqvist, *History of industrial gases* (New York: Kluwer Academic, 2003), pp. 235-236; Annia, "Decades," pp. 69-70. Figures on the market share of the four European-based entrants in the early 1980s come from a graph depicting "US Gas market shares, 1979-90," n.d. (ca. 1991), in BOC Collection held in Linde AG Unternehmensarchive, Munich (hereafter BOC LUM), box 939.

share of over one-fifth of the US market by about 1980, something which obviously posed a challenge to their American-based counterparts. We also examine briefly the emergent strategies for market entry by Messer, Nippon Sanso, and Linde AG. We conclude with a consideration of some of the implications of this story.

The US industrial gases market in the 1960s and 1970s

The US industrial gases market in the 1960s shared two key characteristics with those in other industrialized countries. First of all, it featured a very high level of concentration. Union Carbide Corporation's Linde Air Products Division (UCC Linde Divison, or UCC) was dominant. Even though UCC's market share declined significantly during the 1960s, the US Federal Trade Commission (FTC) estimated that it still held about 26 percent of the US market in the mid-1970s (it was probably higher at that point in time). Air Products, whose market share grew steadily during the 1960s in part at the expense of UCC, was second with 18 percent. Air Reduction Corporation (Airco) ran a close third with about 16 percent.[4] This was thus a highly oligopolistic industry structure, a characteristic which was if anything was on the increase during the late 1960s and early 1970s. Between 1967 and 1972, the US market share of the top four firms in terms of sales grew from 67 to 70 percent, while that for the top eight grew during the same period from 84 to 86.5 percent.[5]

The second characteristic shared among virtually all industrialized countries in the 1960s and early 1970s was utter domination of the industrial gases industry by

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[4]US Court of Appeals decision on BOC vs. FTC, 577 F.2d 24, 1977-1 Trade Cases 61, 446, available at: http://openjurist.org/557/f2d/24/boc-international-ltd-boc-boc-v-federal-trade-commission-airco-inc <accessed 27 April 2011>; C.R. Baker and T.F. Fisher, "Industrial cryogenic engineering in the USA," p. 226, in R.G. Scurlock, ed., *History and origins of cryogenics* (New York: Oxford University Press, 1992); Peter V. Annia, "Decades of Deals: The history of mergers & acquisitions in the US industrial gas industry," *CryoGas International* (August/September 2006), pp. 68-69.

[5] Ernest G. Barnes, Administrative Law Judge, FTC, "Initial decision in the matter of BOC and Airco," Docket 8955, 15 October 1974, pp. 30-31, **AGA Archive**, Stockholm, (hereafter AGA Archive), file E5 SA1. A published, somewhat longer version of this document is available at: http://www.ftc.gov/os/decisions/docs/vol86/FTC_VOLUME_DECISION_86_(JULY_-_DECEMBER_1975)PAGES_1241-1382.pdf <accessed 20 May 2011>.

home-based firms. In the other major industrialized countries it was a bit different. In spite of inroads by Air Products and some others during the 1960s, the lion's share of market share in Britain, France, and Germany was still controlled by the respective national champion (or, in the case of Germany, national champions). In the United States, however, this tendency was even more pronounced, as the market share estimates of the FTC for American-headquartered firms through the mid-1970s indicated. There were no non-American firms present in the US market at all until 1968, and only one, i.e. Air Liquide's Liquid Air of North America (LANA) subsidiary, featured any significant share whatsoever, and that not until 1972. LANA was, by that time, number five in terms of share of the US market, although the French-based company's share stood at only about five percent.[6]

But the US industrial gases market had a number of peculiarities, in particular in comparison with France, Germany, Britain, and Japan. For one thing, the size of the market dwarfed that of any other country. Secondly, unlike the other traditional powerhouses of the industry, the US industrial gases industry through the mid-1970s (and to some extent beyond), although highly concentrated, featured an extraordinarily large number of often family-owned players which were often very significant regionally, even if not nationally. In this respect at least, the US market was more like the Italian one, for instance, and could not have been more different from those of its highly industrialized rivals.

Finally, the US industrial gases market in the period from the late 1950s through the mid-1970s was unique by virtue of the level of innovation which was taking place in the industry. "Level of innovation" is of course difficult to measure, so

[6] Ernest G. Barnes, Administrative Law Judge, FTC, "Initial decision in the matter of BOC and Airco," Docket 8955, 15 October 1974, pp. 29-31, AGA Archive, E5 SA1. LANA's market share is estimated based on figures provided in the document for total US industrial gas sales by firms with primary activity in that industry and by the sales of each of the firms LANA had acquired through 1972.

a number of points need to be made to illustrate and support this contention. Beginning in the 1950s, there was massive growth in demand for gases, in particular from the metallurgical, chemical and chemical-related, food-processing, and agricultural industries. Electronics was also an important growth sector. Scale and growth of demand, the required expertise, and the pace and source of innovation, however, all often differed significantly among these industries. So, for instance, new, often large-scale applications in metallurgy were based on processes which were usually developed by the gases customer themselves, e.g. steel producers. This was an area of massive growth in the 1950s, but here the gas companies did not lead, and instead followed. In the chemical, chemical-related, food, and agricultural industries, however, all of which featured much faster increases in demand for gases compared to metallurgy, a 1974 analysis from the Swedish firm AG indicated, "almost all the new applications have originated in the USA." Moreover, "in many cases the gas companies have discovered and commercially introduced the applications."[7] Electronics was also a growth area in which gases companies often led rather than followed innovation, and US firms were important here as well along with Japanese players in the industry. In other words, the picture that had emerged was that US firms were not only taking advantage of markets with much higher growth potential; they were also actively shaping those markets through development or co-development of processes which created additional demand for their products. The main US firms thus led the way as the industry made its transition from a primary focus on development of production and distribution technology to concentration instead on development of a portfolio of applications technologies.[8]

[7] AGA Group Planning, "Innovation in Gas Applications," February 1974, in AGA archive, E5 SA1.
[8] The terminology used here is based on that used by Jörg-Michael Willke in a presentation and conversation at the Linde AG Applications Center in Munich on 22 November 2010 attended by Ray Stokes. The authors are grateful to Mr. Willke, Michael Graf, Henning Tomforde, Wilfried-Henning

There were two additional key developments which had taken place during the 1960s in the US. First of all, there had been a wave of concentration. One of the most aggressive companies in this regard was Air Products, which, as part of a strategy of securing national status and challenging the dominance of UCC Linde Division and the market share of Airco, acquired a number of small companies in 1961. More importantly, perhaps, Air Products also pursued a strategy of increasing market share by convincing the smallest of producers to shut down their plants and instead to purchase their gas from Air Products, thus changing the smaller companies into mere distributors. As a result of these initiatives, Air Products experienced very rapid growth, with sales nearly doubling between 1967 and 1972. The other company promoting extensive consolidation and concentration in the US industrial gases industry, of course, was Air Liquide, to which we will return shortly.[9]

Another way the US industrial gases market changed significantly during the 1960s was through substantial expansion of some of the regional players. In particular, for instance, Big Three Industries grew rapidly in conjunction with the growth of refining and petrochemical production in the Texas oil industry by specializing in particular on development of an extensive pipeline network. Sales more than doubled between 1967 and 1972. Another good example of this was Burdett Oxygen of Cleveland (Burdox), which invested very heavily in expansion of

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Reese, and Dr. Dirk Hüpperich of Linde AG for an enormously fruitful discussion on that day, and to Klaus Schönfeld, at that time head of Corporate Heritage at Linde AG, for not only arranging, but also participating actively in this meeting and discussion.

[9] On AP and AL acquisitions in 1960s and early 1970s, Ernest G. Barnes, Administrative Law Judge, FTC, "Initial decision in the matter of BOC and Airco," Docket 8955, 15 October 1974, p. 31, AGA Archive, E5 SA1. On AP's strategy of convincing SMEs in the industry to stop manufacturing, see Peter V. Annia, "Decades of Deals: The history of mergers & acquisitions in the US industrial gas industry," *CryoGas International* (August/September 2006), p. 68. On AP growth between 1967 and 1972, AGA Group Planning, "Profile: Big Three Industries, Inc.," 17 January 1974, in AGA Archive, E5 SA1.

capacity in the second half of the 1960s in a bid to enlarge its geographic footprint in the industrialized Midwest.[10]

Entry into the US industrial gases market by European-based firms: Strategies, their realization, and their impact on the US market

European-based gases firms were of course interested in expansion into the lucrative US market as soon after the end of World War II as they were in a position to so financially, something which, owing to reconstruction, capital shortages, and foreign-exchange controls they could contemplate again only beginning in the 1960s, and then only in a modest way. An additional motivation for expansion, however, was provided by Air Products' forays into previously secure European markets at about the same time. Turnabout was seen by the European producers not just as fair play, but as absolutely necessary to remain competitive in a rapidly expanding and changing business. Speaking in 1974 and recalling the late 1960s, two BOC officials testified to a US hearing that they "realized that BOC could not operate as a truly international industrial gases company without being in the U.S. industrial gases market." The other major non-American players thought along the same lines.[11]

Initially, however, the focus was almost entirely on plant building rather than gases per se, mainly because of the fact that building air separation units and associated plants was possible without encountering the problems and risks associated with mounting a challenge to existing and virtually unassailable gases supply and distribution networks. In addition to that, "various surveys" in the early 1960s indicated "that more than 50% of the anticipated future market for plants" would be in

[10] AGA Group Planning, "Profile: Big Three Industries, Inc.," 17 January 1974, in AGA Archive, E5 SA1; Memo to file by William A. Washburn, "Burdett Oxygen Co. of Cleveland, Ohio," 4 August 1969, AGA Archive, E5 RC7.

[11] Ernest G. Barnes, Administrative Law Judge, FTC, "Initial decision in the matter of BOC and Airco," Docket 8955, 15 October 1974, pp. 36-38, AGA Archive, E5 SA1. Quotation is from p. 38 and is based on testimony by Leslie Smith and Peter Laister.

the United States.[12] Thus, Linde AG and BOC—through a joint venture with Airco—entered this market in the US during the 1960s, although with varying degrees of success. In fact, Linde's US operation, Lotepro (so named because of UCC's control of the Linde name in the US), involved high costs, small market share, and the inability to use the Linde name to gain sales. The German company's board believed that this was all offset by the opportunity to observe the technical and economic situation in the American market firsthand.[13] BOC's joint venture with Airco, in contrast, was dissolved by mutual consent in 1971 owing to reputational damage that had ensued when problems arose with plants the JV had constructed.[14]

All of the non-American gases companies were interested, though, in entering the more lucrative and predictable, but extremely challenging, US gases market. The first to succeed was Air Liquide, the most international of the large gases companies and also, and not coincidentally, with a large presence in Canada (where it competed heavily with BOC). AL started fairly small, acquiring through its Liquid Air North America (LANA) subsidiary Dye Oxygen, American Cryogenics, Industrial Air Products, and Gulf Oxygen between 1968 and 1972.[15] The new purchases were small players in the US gases industry, with relatively modest market shares. But they represented a beachhead for substantially expanding AL's business in the United States and also functioned as a model for *how* that expansion would take place over

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[12] "Notes of an interview with Sir Leslie Smith, Hammersmith House, 21 July and 26 July 1983," p. 16, BOC LUM, Box 488, File 8.
[13] Minutes of the Linde AG managing board, 11 and 13 January 1964 (TOP 20), in Protokolle des Vorstandes 1962-1964, LARM.
[14] "Notes of an interview with Sir Leslie Smith, Hammersmith House, 21 July and 26 July 1983," p. 16, BOC LUM, Box 488, File 8; Paper for BOC Board Meeting of 21 September 1971, BOC LUM Box 488, File 4; Notes from Minutes of Parent Company for 1971, n.d., p. 1, BOC LUM Box 488, File 7.
[15] Almqvist, *History of industrial gases*, p. 235-236; Annia, "Decades," p. 69; AGA (Christer Danielsson), Memo: Burdett Oxygen of Cleveland, Ohio, n.d. (ca. July 1968), AGA archive, E5 RC7. Danielsson indicated that the three acquisitions in 1968 by AL were via Canadian Liquid Air (its Canadian subsidiary) and included American Cryogenics, Industrial Air Products, and Dye Oxygen. According to a court decision from 1974, Liquid Air acquired Gulf Oxygen in 1972. Ernest G. Barnes, Administrative Law Judge, FTC, "Initial decision in the matter of BOC and Airco," Docket 8955, 15 October 1974, p. 43, AGA Archive, E5 SA1.

the next decades, not just for the French-based firm but also for the other international gases companies seeking to enter the US gases market, including BOC, AGA, Messer Griesheim, Nippon Sanso, and eventually even Linde AG. Not surprisingly, given the network character in the business of gases production and distribution, all of them deployed a strategy of acquisition of US-based firms, although there were significant variations in the scale of acquisitions. The strategy was immediately noticed by AL's competitors. According to an AGA manager who was visiting the US with an eye toward possible acquisition of Burdett Oxygen Co. of Cleveland, Ohio, in summer 1968, "One might say that a market has been created [by virtue of AL's acquisitions] for industrial gases companies."[16] For the moment, however, although there was considerable speculative fever over potential acquisitions, especially on the part of AGA, there was as yet little movement. AL went on to extend its strategy to larger prey by the late 1970s when it acquired the industrial gases business of Chemetron (with the exception of its carbon dioxide division, Cardox) from Allegheny Ludlum Corporation in 1978-1980. As a result of all of these acquisitions, AL gained share of about 6-8 percent of the American gases market by 1979.[17]

The big story in the United States gas industry during the 1970s, however, involved not the traditionally internationalized firms, AL and AGA, but rather BOC, which was of course active around the globe, but almost exclusively in the UK and in the countries of the British Commonwealth. Already in spring 1968, BOC secured the services of Dr. Albert Muller, a consultant specializing in the industrial gases

[16] AGA (Christer Danielsson), Memo: Burdett Oxygen of Cleveland, Ohio, n.d. (ca. July 1968), AGA aAchive, E5 RC7.

[17] "Allegheny Ludlum sells Chemetron gas division," *Chemical and Engineering News* 56 (19) (1978): 5-6. Technically, the acquisition was by Liquid Air of North America, a 78 percent subsidiary of AL. As part of the deal, Allegheny Ludlum was given a 30 percent stake in Liquid Air of North America, which meant that the AL stake decreased to about 54 percent. See also William Storck, "Liquid Air: The firm that acquisitions built," *Chemical and Engineering News* 58 (12) (1980): 11-13. For market share, "US Gas market shares, 1979-90," n.d. (ca. 1991), in BOC LUM box 939.

industry, for advice on how best to enter the US market. By "December 1969, the chairman of BOC informed Dr. Muller that BOC was going to be represented in the United States; the only questions were what, how, when and where." Over the course of the next couple of years, BOC entered into more or less serious deliberations about acquiring a number of US firms.[18] None of the prospective deals worked out, however, until suddenly and unexpectedly, a chance arose in summer 1973 for the British gases giant to purchase a stake in its former JV partner, Airco, mainly because the American firm wished to avoid being taken over by another American company that was pursuing it and sought out a potential cooperation with a company it had worked with for some time. The British firm, for its part, set out its strategic options for the proposed takeover in a paper considered by the BOC board in July 1973 called "Project Blindfold."[19]

The story of BOC's takeover of Airco between 1974 and 1978 is complex and fascinating, but there is not time to go into detail in this relatively short presentation. We do so in one of the chapters of our forthcoming book on the international industrial gases industry on the basis of rich and extensive archival material, and can of course answer any questions about this that the audience may have. Suffice it to say just now, though, that the process was far from straightforward and involved not only the sometimes convergent and sometimes diverging interests of the men who ran the two companies, but also major changes in mindset for the British in particular, not least owing to the unprecedented level of financing—and debt—that was required for the acquisition. In addition, the process involved extensive intervention by the US

[18] Ernest G. Barnes, Administrative Law Judge, FTC, "Initial decision in the matter of BOC and Airco," Docket 8955, 15 October 1974, pp. 36-38, AGA Archive, E5 SA1.
[19] "Notes of an interview with Sir Leslie Smith, Hammersmith House, 21 July and 26 July 1983," p. 23, BOC LUM Box 488, File 8; BOC Group Strategy Office, "Project 'Blindfold'", 11 July 1973 (restricted) BOC LUM Box 488, File 4; BOC, Information on acquisition of approximately 35% of Airco stock for BOC shareholders, 14 March 1974, p. 3 BOC LUM Box 488, File 4.

Federal Trade Commission intent on establishing new ground rules for competition policy, and subsequent challenges in US courts, the ultimate outcome of which set the stage for further acquisitions of US gases firms by non-US based companies.

We have already mentioned AL's acquisition of Chemetron, which started in 1978 and ended in 1980, with which AL gained a substantial presence in the United States market. It was not only the very largest foreign firms which were seeking to enter the US market, though. From the mid-1960s, AGA, too, was active in attempting to enter it by means of acquisition, something which gained greater urgency owing to BOC's moves to acquire a stake in Airco in 1973. Indeed, AGA staff eventually used some of the same strategic arguments that the British firm had used in its "Project Blindfold" report of July 1973 about the American market and how to enter it, which was probably no accident since a verbatim transcript of the report was circulated among AGA group planners by March 1974 at the latest, even as the first BOC-Airco deal was being finalized![20] The Swedish firm was repeatedly stymied in its endeavor, however. Sometimes, the problem for AGA in attempting entry into the US market was lack of clear fit, and sometimes lack of funds or information. But other times it was intense competition, both from other industrial gases producers and from American companies, generally US firms from outside the gases industry because of potential antitrust action. In the end, AGA set its sights on Burdox, as it had in fact already in the late 1960s, but now faced a difficult task in the form of competition from Air Liquide, Linde AG, Messer, and three US firms, among them Ashland Oil. AGA's tender offer of $25 per share combined with a fair share of wining and dining and cajoling of the family owners of Burdox won the day, and the

[20] BOC Group Planning, "Operation [sic] Blindfold", 8 March 1974, (in Swedish) and accompanying transcript of "Project Blindfold" memo (in English), which is a word for word copy of BOC Group Strategy Office, "Project 'Blindfold'", 11 July 1973 (restricted), BOC LUM Box 488, File 4.

Swedish firm acquired its American toehold in spring 1978.[21] One other major non-American international industrial gases firm established a presence in the US by the late 1970s. Messer Griesheim acquired one of the other "interesting small companies" in the American market, Burdett of Norristown. This involved a truly toehold acquisition, on a completely different scale from those of AL, BOC, and even AGA. ("Little Burdett" had about $3 million in sales in 1972, as opposed to Burdox's $22 million.) Thus, although it was not all that far down from the top eight gas producers in America, its sales were less that 15 percent of Burdox, which had ranked eighth on the eve of the AGA takeover. [22]

That left just Linde AG of Germany and Nippon Sanso of Japan without any presence in the United States market at the end of the 1970s. We have already seen that Linde AG was active in the plant building business already in the 1960s and was one of the unsuccessful suitors of Burdett Oxygen of Cleveland when AGA acquired it in 1978. The company was thus trying to enter the United States, and its efforts would redouble in the 1980s when it went head to head with Air Liquide and others in competition for some of the other "big minors" and "interesting small companies." Here, caution about taking on too much debt and/or paying over the odds for an acquisition played a big role, and it would not be until after the period we consider in this paper that Linde AG became involved in the gases business in America. In passing, it may be of interest that that the way for that involvement was paved in part owing to the commercial and organizational fallout of the 1984 Bhopal disaster on UCC, which ultimately entailed the hiving off of the Linde Division from Union Carbide 1992, which became known as Praxair. Subsequently, German-based Linde

[21] Bernard Wysocki, Jr., "Seeking a suitor. How an Ohio concern increased stock value, found Swedish buyer," *Wall Street Journal* (13 April 1978), in AGA archive, E5 RB19.
[22] AGA Group Planning (Project group: Richard Wathen, Bertil Kusoffsky, and Rune Österlund), "U.S. Gas Market: Interim report with an outline of a strategy for AGA's entry on [sic] the U.S. market," November 1973, Introduction, pp. 60, 63, in AGA archive, E5 SA1.

AG was therefore able to reacquire the use of the Linde name, an important step in the German firm's gradual development into one of the two major players internationally in this industry.

For its part, Nippon Sanso, a large firm with a significant presence through the 1970s only in its home market of Japan, had also decided to internationalize. In 1980, besides opening an office in Singapore, Nippon Sanso founded Japan Oxygen, Inc., as a small presence in the United States. Again, though, it was only later, beginning in 1982 and 1983, that the Japanese firm moved more heavily into the American market, first through a joint venture with Amerigas and then through a small acquisition which formed the basis for building a larger presence over the next decades.[23]

In the meantime, by 1990, the American gases market was both more heavily consolidated than ever before and also heavily internationalized. Four firms, Air Products, UCC, BOC, and AL, controlled over 80 percent of the market. The European share of the US market rose from zero in 1967 to 40 percent in 1990, with BOC and AL controlling market shares of 17 percent each. AGA had a share of four percent, and Messer just two percent.[24]

Conclusion

The US was the most important single market in the world for industrial gases in the period after 1945, both in terms of size and in terms of pace of innovation and growth. But, until the 1970s, it was also the most insular. The attractions of entering such a market for non-US headquartered gases were therefore considerable, with added incentive arising out of the fact that US-based firms, led by Air Products, had begun to move aggressively into markets the European pioneers had previously practically monopolized. The challenges of entering were substantial, however, owing

[23] Ebbe Almqvist, *History of industrial gases* (New York: Kluwer Academic, 2003), pp. 289-290; Annia, "Decades," p. 70.
[24] "US Gas market shares, 1979-90," n.d. (ca. 1991), BOC LUM, box 939.

in large part to the network character of the gases ind*ustry, which was one reason that greenfield investment was not a viable market entry strategy. Acquisition, the strategy adopted eventually by all of the non-American firms, on the other hand required not only substantial investment, and therefore new approaches to financing, but also entailed considerable competition. In this oligopolistic industry, once one company started doing something, others followed. In addition, competition law and its interpretation and enforcement in the US made for a hurdle to market entry, although because it effectively barred American-based competitors in the industry from acquiring small firms, it also limited the competition to the other non-American players.

BOC and AL, the two companies which were most successful in overcoming these barriers and establishing significant market presence in the US, were quite different from one another in various ways, but they shared a number of characteristics. They were, first of all, strong in terms of finance and experience in the industry. They also had especially strong motivations for moving into the market owing to head-on competition with the key American-based firms in other markets, in the home one in the case of BOC, and in other international markets in the case of AL. Finally, both firms started their US adventures with a substantial presence in Canada, which was an important vantage point for market intelligence and technical support.

The internationalization of the US-American market between 1970 and 1990 was an essential step in the growing internationalization, consolidation, and eventual globalization of this “invisible industry”.