Transaction Costs and the Multinational Enterprise: The Case of Tin*

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Until the development of transaction-cost theory, economics did not have a theory of why firms exist and grow. Transaction costs theory seeks to explain which activities are organized within the firm and which ones are performed by independent agents. It is a theory of the role and size of firms. Since multinational enterprises are firms that extend their hierarchies across national boundaries, transaction costs theory can throw considerable light on the reasons behind the existence and the growth of such firms [4; 17; 9; 15].

With a few notable exceptions [5: 9; 15], most applications of the transaction costs approach to the multinational enterprise have focused on the internalization of knowledge. This reflects the postwar predominance of horizontal investments in manufacturing by knowledge-intensive firms. This emphasis on the internalization of knowledge as a cause of multinational expansion may have given the erroneous impression that the applicability of transaction costs theory is restricted to post-World War II multinational enterprises.

This paper argues that this is not the case. It seeks to explain the existence and growth of multinational enterprises in the tin industry, and, in the process, shows that transaction costs can be used to account for a very wide range of multinational enterprises, including those that do not fit the traditional mold. Recent research in business history has shown that the growth of European multinational enterprises differed in many ways from that of their

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European counterparts, and that British foreign direct investment often took unfamiliar forms [24; 25]. This paper suggests that transaction costs theory may prove useful in explaining these forms as well.

APPLICATION OF TRANSACTION COST ANALYSIS TO THE TIN INDUSTRY

A firm's expansion overseas can take four forms: horizontal expansion (producing abroad the same products as at home); vertical integration (into an adjacent stage of the value-added chain); related diversification; and conglomerate diversification. Most foreign direct investments fall into the first two categories.

Horizontal investments result from the internalization by the firm of the international trade in factors of production. Many horizontal investments are made whenever firms find it more efficient to transfer know-how internally than across markets. Technological know-how is not, however, the only factor susceptible to be internalized by firms. High market transaction costs in goodwill explain many investments in services [9]. As we will see, imperfections in international capital markets can also lead to the development of multinational firms.

Vertical investments arise from the internalization of the international market for intermediate inputs. Forward vertical integration is typically motivated by the high cost of using independent wholesalers or retailers whenever distribution involves specific assets, as in the case of products requiring specialized handling or service [15]. Backward vertical integration arises when the international market for the supply of intermediate products is inefficient due to information impactedness, high measurement costs, or small-number conditions.

Historically, the development of multinational enterprises in the tin industry has arisen from two main factors: the internalization of inefficient markets for technology and long-term capital led to the establishment of a large number of "free standing" firms during the first half of the twentieth century. The desire to internalize inefficient markets in tin concentrates led to the development of vertically-integrated multinational enterprises in the lode sector of the industry.

Horizontal Investments

The incentive for horizontal foreign direct investments in tin came in the late 1800s from the rapid expansion of British tin consumption and the gradual exhaustion of Cornish mines, then the main tin producers. Although a

few French and British firms were established in Malaya and in Bolivia in the 1890s, horizontal FDI took off in the first decade of the twentieth century with a gradual increase in British foreign direct investments in Malaya and a speculative wave of flotations of Nigerian tin mining companies. Investments by British firms in Nigeria and Malaya, and to a lesser extent in Burma and Siam, continued until the 1950s, and, in the late 1960s, foreign companies, almost all U.K.-registered, were producing 70 percent of Nigeria's output, and 60 percent of that of Malaysia [3, p. 35].

Those tin mining companies were what Mira Wilkins [24] has called "free-standing" firms. Most of them were incorporated in the U.K., but did all of their business overseas. In the case of Malaya and Siam, they were usually small: each company managed a single deposit. Even contiguous deposits were incorporated as separate firms. To achieve economies of scale, free standing firms resorted to subcontracting: secretarial services in the U.K. were contracted to specialist firms, who held share registers and provided other secretarial services to more than one firm. Arrangements for local management varied: sometimes it was subcontracted to consulting engineers, sometimes to a local mine manager, with technical assistance from mining engineers, sometimes to friends and relatives of some of the London promoters, and, rarely in the case of tin, to agency houses. Consulting engineers, such as Osborne and Chappell of Ipoh, Malaya, helped manage a large number of foreign-based mining companies. This arrangement allowed relatively small firms to access the limited pool of experienced local personnel.

The historical record of tin mining in Malaya and Siam suggests that horizontal multinational enterprises in the tin industry were caused by inefficiencies in the international market for technology and capital. A privileged access to capital, in the absence of a clear technological advantage, was insufficient to overcome the additional costs of adapting to a foreign environment. Foreign firms gained a foothold when they developed new techniques which offset their initial handicaps. Because these innovative techniques were mainly developed outside the industry, they could be bought by their local competitors. Privileged access to capital appears to have been the crucial factor which gave foreign direct investors a clear advantage, at least until the development of international capital markets in the 1960s.

That technological advantage was a requirement for the development of multinational enterprises in the industry appears clearly from the early history of Western investments in Malaya and Siam. Up until the 1890s, the development of tin mining in Malaya was a purely Chinese endeavor. Chinese immigrants used primitive, labor intensive methods to mine and concentrate the tin ore. Between 1882 and 1897, 35 companies were registered in the U.K. to mine tin in Malaya. There were also an unknown number of Australian and French ventures. By 1897, only four Western companies were still ac-

tively mining tin in Malaya, all the others having folded [28, pp. 97-99; 26, p. 143].

The British and French firms which invested in Malaya were experienced in mining lode tin. Tin deposits in Malaya, with the exception of one deposit in the state of Pahang, are alluvial. Many of the mining and prospecting techniques with which foreigners were familiar were therefore not suited to Malayan conditions: given the difficulty of assessing alluvial deposits, the high fixed-investment Western mining methods were a handicap, for it meant that it was costly to discontinue mining once started. Chinese miners, on the other hand, mined with labor intensive methods. They could easily abandon a disappointing deposit for a profitable one [28, pp. 102-3].

European firms had also disadvantages vis-a-vis Chinese miners. The best workers were immigrant Chinese. European firms found it difficult to obtain Chinese mine workers because the immigration system was tightly controlled by Chinese mine owners. European mine managers had to hire Chinese interpreters and overseers to supervise Chinese labor, a source of additional cost. The Chinese, having come first, controlled the best mining land. The superior efficiency of the Chinese during the period is confirmed by the fact that they often successfully took over the land abandoned by bankrupt Western companies [21, p. 341]. Western firms did better in lode mining, where they had a technological advantage. The Pahang Corporation, floated in London in 1887 to exploit the largest of Malaya's tin lodes, was one of the four surviving firms by 1897.

Western dominance in Malaya (and Siam) was achieved by the introduction of two new mining techniques, first gravel pumping, and then dredging. Both these methods were borrowed from another mineral industry, gold mining. Both allowed Western foreign direct investors to overcome the handicaps they had vis-a-vis the Chinese. Gravel pumping, which used jets of water to break the ore, had two main advantages: (1) it saved on skilled (Chinese) labor; (2) it could treat very poor deposits, which could not be profitably mined by the Chinese.

Tin dredging was introduced in Siam in 1907. Dredging intensified the advantages of gravel pumping. It was labor saving: by World War I a typical dredge, employing 90 Chinese under European supervision, could extract and treat in one day as much tin-bearing ground as 2,000 Chinese in a traditional mine [28, p. 134]. Dredges could efficiently operate on swampy ground, where Chinese could not mine. They could also profitably work very low grade deposits, including ground which had been already mined by the Chinese [28, p. 133].

In contrast to tin smelting, the technology of both gravel pumping and dredging was not developed by the mining firms themselves, but by subcontractors. Gravel pumps were manufactured by Western engineering firms supplying the gold mining industry. They were initially imported into Malaya by Malaya-based European mining engineering firms, who taught Chinese mine owners how to use them. By 1925, nearly all Chinese mines used gravel pumps, which by then were locally manufactured [27, pp. 210-11; 1, p. 153]. Dredges were designed and set up by specialist firms and built by independent shipyards. The skills needed to operate dredges were quickly picked up by the Chinese: as early as 1917 they were employed as winchmen on European dredges "with great satisfaction" [7, p. 79].

Yet, in contrast to the gravel pump sector, where Western enterprise was soon displaced by the Chinese, dredging remained the safe preserve of Western firms, and the development of this technique between 1920 and 1927 gave them the control of the industry. By 1940, dredging companies, all Western controlled, accounted for 52 percent of Malaya's tin output, where the overall share of Western firms was 71.5 percent, and 60 percent of Siam's production [28, pp. 400, 402; 23, p. 62]. The first Chinese-owned dredging company did not start operations until 1965.

The difference in the speed of Chinese adoption of dredges and gravel pump points out to an important advantage which led to the long-term survival of Western firms. The advantage was privileged access to the London equity market. While the capital cost to equip a mine with gravel pumps is relatively modest, dredges are much more expensive (the cost of a relatively large gravel pump mine was estimated in 1977 at around half a million US$, vs. 15 million for an onshore, and 25 million for an offshore dredge) [2, pp. 71-74, 145]. Financing such investments posed problems for the Chinese. Domestic sources of finance were limited, as the Malayan Chinese remitted a large part of their savings to their relatives in China, or invested them in mortgages or real estate [19, p. 116]. The British banks which had branches in Malaya followed the British banking tradition of specializing in short term credit to finance foreign trade and commercial activities, leaving the provision of long-term financing to the London stock exchange [1, p. 203; 11, p. 232; 12, p. 150]. The flotation of joint stock companies in London or in Cornwall was an efficient way to accumulate the long-term sources of finance necessary to enter dredging. Because shares in such companies could be easily sold, the risk to the investor was lower. The Chinese, whose familiar forms of organization were individual ownerships or partnerships, and whose capital came from relatives and friends, were unfamiliar with joint stock companies, and unwilling to adopt this new form of organization [28, p. 347]. Furthermore, they lacked the European connections that would have made a London (or Redruth) flotation possible.

To understand why British-based firms may have had an advantage in this respect, one must focus on the characteristics of capital markets. Because of the non-simultaneity of both sides of the transaction, lending involves the risk that the borrower may be unable to meet his obligations, either because he has willfully spent the funds with no intentions to repay, or because he has been unsuccessful in his investments. The easiest way for the lender to protect himself is to obtain some collateral, the value of which is greater to the lender than the value of the loan. Another possibility is to lend only to borrowers who are personally known to the lender as having both the intention and the ability to honor their obligations. These considerations suggest that raising capital will be easier the greater the personal contacts between savers and borrowers, the larger the borrower's assets, and the longer he has been profitably in business. Foreign entrepreneurs, especially if they are proposing new, unproved ventures, are at a special disadvantage, since it is difficult for them to establish personal contacts with savers. Conversely, domestic savers are unlikely to be aware of foreign investment opportunities.

A look at early British free-standing firms active in Malaya shows clearly how such firms could reduce transaction costs in the international transfer of capital from the U.K. Many of the first successful ones were floated in Redruth, then the center of Cornish tin mining--this was the case, for example, for the Gopeng Tin Mining Co., established in 1892, the first company to successfully operate gravel pumps in Malaya. The story of the company starts with a concession to mine tin being granted to F. D. Osborne, an Irish mining engineer then in Malaya, and to the former Warden of Mines of the State of Perak, E. R. Pike. Pike was the son of a well-known Cornish mine purser, and he enlisted the help of his father to contact a local share broker, James Wickett, who, in turn, persuaded 10 of his friends to put 700 pounds each into the company. All of these 10 initial subscribers were major investors in Cornish mines. Later, James Wickett's son, a mining engineer, went to Malaya to report and prospect on mines, which, in some cases, were subsequently floated by his father. The story, which is representative of the experience of at least three of the major U.K. promoters of foreign tin ventures, illustrates the personal links which facilitated these early investments. Promoters became aware of profitable opportunities through direct personal contacts with friends or family members who were, or had been, in the foreign country. Stock in the companies they floated was initially sold to friends and associates in the U.K. Later, as the success of these early companies became known, stock was subscribed by the general public. Given the speculative nature of tin mining and the general ignorance of Malaya by the British public, appeal to the London equity market by Chinese-owned companies would not have had the slightest chance of success.

Because of the importance of personal links in the establishment of free-standing companies, their distribution across tin mining countries was un-

even. We would, for example, expect more companies to be set up in countries where Britishers were residing than in those where there were fewer British expatriates. Consider, for example, the contrast between Siam, then an independent country, and Malaya, where the British exercised a strong political and economic influence. Both countries have similar tin deposits, and in recent years Siam's (now Thailand) production of tin concentrates has been about half of Malaysia's. Yet, by 1914, British investments in Siam were much smaller than in Malaya: there were only 9 foreign companies active in Siam, 6 Australian and 3 British, compared to 48 in Malaya, 35 of them registered in the United Kingdom [14].

If free-standing firms internalize imperfect capital markets, then they may result from firms in capital-rich countries undertaking operations in capital-poor locales, or from operating companies in capital-poor countries floating concerns in capital-rich countries. Perhaps because Britishers were reluctant to establish operations in Bolivia, a number of Bolivian entrepreneurs floated tin mining companies in London. Such was the case, for example, of Aramayo Francke and Co., a company registered in London in 1906 by the Aramayo family to tap the British capital market. Similarly, Vilaque Bolivian Tin Mines was floated in London in 1913 by the French owners of Bolivian tin and gold mining properties. In both cases, the appeal to the British public does not seem to have been successful. By 1916, the Avelinos and the Franckes still held most of the stock of Aramayo Francke, while the vendors of Vilaque, the Berthin brothers, still held most of the shares in the company.[1] Later, Patino was to register his firm in Delaware to tap the U.S. capital market, with much greater success.

The decline of Western free-standing firms can be explained by the same causes which led to their emergence. Two factors combined in the postwar period to reduce the comparative advantage that these firms enjoyed relative to their domestic competitors. First, the independence of host countries increased the costs experienced by free-standing firms in channeling funds from capital-rich countries. Unsettled political conditions in the host countries, adverse changes in the U.K. tax treatment of dividends earned overseas, as well as an increasingly hostile Malaysian view towards foreign investments, led to a disinvestment by foreigners in Malaysian tin companies. At the same time there was a development of alternative sources of finance. Between 1954 and 1964, the percentage of shares held by Malaysians in Western-controlled companies registered in Malaysia increased from 22 to 64 percent [28, p. 359]. This increased investment by locals in tin mining firms, as well as the growth of development assistance and of international bank lending, removed the only tangible advantage enjoyed by Western free-standing firms.

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[1]Public Record Office, Kew, BT 31 17888/90459 and 21352/128143.

If capital could be obtained by local firms from local sources or from international banks, the British-based free-standing company had no longer any raison d'etre. By 1986, such firms had just about disappeared from Malaysia, replaced by locally-incorporated companies and by a growing state sector. By contrast, the greater backwardness of local tin miners in Nigeria, their greater lack of managerial expertise, and the absence of a local stock market meant that British free standing firms met little competition. Were it not for "Nigerianization" policies followed by the local government, those firms might still be profitably active today.

Vertical Investments

Transaction costs theory can also help explain the pattern of vertical investments in tin. Markets work well when there are many buyers and sellers. They suffer from high transactions costs when the number of buyers and sellers falls. In that case, it is possible for a trader to opportunistically renegotiate the terms of trade. His trading partner will have no other alternative than accepting the new terms if he experiences significant switching costs. In small-number conditions, traders can thus be "held up" by their partners. The level of transaction costs in markets, and therefore the likelihood of vertical integration, will hinge on the factors that determine the number of potential buyers and sellers, i.e., scale economies, transportation costs, and the degree to which parties make investments which are dedicated to their partner's inputs or outputs.

The tin industry is singular in that it can be partitioned into two distinctive sub-industries, lode deposits and alluvial deposits, which require different mining and smelting methods. These differences have led to different levels of transaction costs in the case of lode than in that of alluvial concentrates.

Alluvial deposits are found mostly in Southeast Asia. They are low grade, but close to the surface, and can be mined by low-scale methods. They are easily concentrated through gravity to 70-77 percent tin. These concentrates contain few impurities, and can be smelted through simple methods. Lode deposits are of higher grade, but are usually found underground, mainly in Bolivia. The ores are more complex, containing many troublesome impurities. Elimination of these impurities involves a loss of tin, and lode concentrates only grade 20 to 60 percent tin. Smelting such concentrates is tricky, as the process must be tailored to the particular characteristics of the ore [10].

Those technological differences have had profound influences on industry structure. Because mining of alluvial ores is a relatively low-scale operation, the mining sector of Malaysia and Thailand has been relatively atomistic. Smelting alluvial ores is also competitive, with low barriers to entry.

Alluvial concentrates are of high grade and value and are homogeneous: they can be smelted anywhere and transported over long distances. Alluvial miners thus face a potentially large number of buyers for their concentrates. As a result, and until recently, the traditional industrial pattern in alluvial tin has been one of vertical disintegration: the miners and the smelters have organized their interdependence through spot prices set on the Penang market. The two Malaysian smelters have matched the supply of concentrates received from independent miners with bids for tin metal from independent traders and processors, and paid the miners the clearing price minus a smelting fee. Mining firms have not been integrated into smelting, while investments by the two Malaysian smelters into mining have been minimal.

Lode tin is mined and smelted under very different conditions. The lode mining sector has always been more concentrated. In contrast to Malaysia and Thailand, where tin is mined close to the coast, Bolivian mines are located in relatively inaccessible parts of the Andes. Because of the need to build extensive infrastructure, operation at high scale has conveyed significant advantages. Concentration of Bolivian ore also requires expensive equipment. Lastly, the size of lode deposits is larger than that of alluvial deposits: the Uncia lode, which launched Patino as a major tin producer, is the largest tin deposit ever found.

Smelting lode ores requires greater skill and investment. Smelters able to smelt Bolivian concentrates have always been few in number. As with mining, the smelting of lode ores have been concentrated. The market for lode concentrates has therefore been narrower than that for alluvial concentrates. These considerations explain why the main instances of vertical integration between mining and smelting (excluding the more recent politically-motivated ones) have taken place in the lode sector of the industry.

The best known example of a vertically integrated multinational in tin is Patino Mines and Enterprises. Simon Patin's tin fortunes started with his discovery in 1899 of an extremely rich tin vein in a small mine he had purchased. By 1910, he was the largest Bolivian producer of tin concentrates, with close to 10 percent of world production. Patino's output ws first sold on commission by the British trading firm of Penny and Duncan to smelters in Liverpool and Germany. One of them was Williams, Harvey, initially built to process Cornish ores, but by now dependent on Bolivian concentrates. As his production increased, Patino took increasing control over the marketing of his ores, bypassing Penny and Duncan and setting up an office in Hamburg in 1911 to place his own concentrates and to receive in consignment the concentrates of other producers [6, p. 123]. The blockade of Germany that followed the outbreak of World War I closed to Patino the Goldschmidt smelter that was smelting his ores, and they were all sent to Williams, Harvey in Liv-

erpool. That smelter, then the largest in Europe, had developed a proprietary technique to process complex Bolivian ores.

German submarines soon made transportation to England difficult, and with the opening of the Panama canal, it became apparent that Bolivian ores could be advantageously smelted in the U.S., the main consumer of the metal. In 1915, Asarco decided to build a smelter near New York to treat Bolivian ores. The opening of that smelter in 1916 persuaded Williams, Harvey and Asarco's main competitor, National Lead, that they should join forces and do the same. In 1916, National Lead took a half share in Williams, Harvey in exchange for cash and a half share in the new U.S. smelter. Before proceeding, Williams, Harvey attempted to enlist the support of the Exploration Company to take over Patino's properties. Unsuccessful, it then asked Patino for a five year contract for the production of his mines, then about 10,000 tons a year, enough to support an efficiently-sized smelter. Patino proposed instead to purchase a one-third share in both smelters, a proposition which was readily accepted.[2] Patino's vertically integrated empire was broken up in 1952 with the nationalization of his Bolivian tin properties, but the vertical links were reconstituted with the establishment of state-owned smelters in Bolivia in 1970. There are other historical examples of the tendency for the market for Bolivian concentrates to be vertically integrated, such as Asarco's development of a captive Bolivian property in the 1920s and Goldschmidt's interest in a Bolivian mine before 1914 [18; 13, p. 675].

CONCLUSION

Taking the example of the tin industry, this paper has attempted to show that transaction costs theory can provide a useful framework for understanding the growth and development of multinational firms. The bulk of horizontal investments in tin were made by British-based free standing firms. These firms, which differ considerably from present day multinationals, can be explained within the context of transaction costs theory as institutions devised to facilitate the international transfer of capital from capital-rich to capital-poor countries.[3] They evolved as a solution to a paradox: because of significant communication costs due to cultural and geographic distance, local businessmen, who knew best of local opportunities, had difficulties obtaining

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[2]This information is derived from the records of Frank Harvey, one of the partners in Williams, Harvey, kept at the Cornwall County Records Office, Truro, Cornwall.

[3]The argument is similar to that put forth in a recent piece by Wilkins [25]. I differ from her, however, in my assessment of the reasons behind the decline of free-standing companies.

finance, while those individuals who had investible funds were unaware of these profitable investments. In Malaya, the local offices of British Imperial banks, who had both the funds and the knowledge, would not lend long-term to local miners. Tapping the London capital market was difficult for foreigners, as they did not have in London the reputation necessary to instill confidence. Instead, the initiative of internalization often proceeded from the other side: Britishers who had learned about opportunities in Malaya through personal contacts, and who were well connected and reputable, floated companies in the U.K. to operate in Malaya. Case studies of the development of free standing firms seem to support this view: they show promoters to be individuals active in tin (engineers, solicitors, or share brokers) and with personal links to the places of investment.

Although the transfer of capital through free-standing firms was often characterized by high transaction costs, and a large number of such firms were swindles, the history of these firms in tin shows that, in contrast to their record in the United States [20; 24], Canada [16], and Australia [8], many were efficient, profitable, and long lived. They survived as long as they filled their original role, and the political and tax environments were not too unfavorable.

The development of vertically integrated multinational enterprises in tin also supports the view that vertically integrated multinational enterprises arise in specific circumstances, i.e., whenever intermediate markets are subject to high transaction costs. Miners in Malaya and Siam never took control of the Malaysian firms that smelted their ores because they could sell their concentrates on competitive markets. Because of economies of scale at both stages, and because the number of smelters able to handle Bolivian concentrates has always been limited, the market for such concentrates is much narrower. Consequently, and in contrast to Malaya and Siam, miners and smelters of lode concentrates have sought to organize their interdependence through common ownership, and one uncovers many instances of vertical integration in that segment of the tin industry.

Naturally, not all features of multinational expansion can be explained by transaction costs. Transaction cost theory posits that the boundaries of firms are determined by the minimization of such costs. The applicability of the model is thus restricted to situations where individuals are both free to choose the most efficient institutional forms and forced to do so through competitive pressures. The theory also focuses on the internalization of non-pecuniary externalities, and ignores institutional changes that result from market power. This paper has attempted to show that, these limitations notwithstanding, transaction costs theory can provide a useful framework to understand a wide range of multinational firms.

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