Integration and Disintegration: Baltic Iron and North Sea Markets.

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From ca. 1545-1645 European markets, as has previously been suggested,[1] were totally transformed by massive quantities of Central- and South American silver and gold entering the European economies, sufficient in size to fundamentally alter stock levels in recipient areas and accordingly the exchange relationship between specie and other commodities.[2] Thus in England, the lands of the lower Rhine, South Germany and Northern France the increasing availability of silver, first reduced the purchasing power of the metal in terms of commodities during the years ca. 1545-1575. Thereafter, however, those lands were set on a path of stock accumulation, which by the mid-seventeenth century had over-priced their produce on international markets. Such was not the case in the lands of Northern and Eastern Europe. Here continuing low stock levels caused the purchasing power of silver to remain high from 1575-1610/20 before at first slowly to 1660 and then rapidly, it decreased as stocks increased. At the beginning of the seventeenth century, therefore, those possessing silver could purchase but little with it in Western Europe and could obtain far more in either Northern or Eastern Europe and thus carried the metal to these latter regions to obtain their "cheap" produce. Those, in Western Europe who wished to acquire specific wares for a given amount of silver thus had a choice. They could either acquire a small quantity of such goods from domestic producers who operated at an enhanced silver-cost level or of deploying their silver elsewhere in lands where factor costs, expressed in terms of silver, were much lower and they could acquire far more goods for their money.

"Monetary" factors, which served to reduce unit production costs, in terms of silver, within these Northern and Eastern European production areas were reinforced, moreover, by "real" factors, which transformed Northern and Eastern European production, as a transport "revolution" created a unitary market between the "maritime regions" of Europe. By permitting a more rapid turn-round of ships, freights were lowered with resultant market integration within the European maritime economies.[3] Within an important sector of the economy serviced by the sea-borne trades the market was not only

[1] Ian Blanchard "The Long Sixteenth Century, ca. 1450-1650", unpublished paper presented at the XIIth International Congress held at Madrid 24 to 28 August 1998 which may be consulted on http://www.ianblanchard.com/CEU/Lecture-course.htm.

[2] On the changing relationship between the value of silver and commodities see F Braudel and F Spooner, "Prices in Europe from 1450-1750" in *The Cambridge Economic History of Europe.* Vol. IV. *The Economy of an Expanding Europe in the Sixteenth and Seventeenth Centuries.* Edited by E E Rich and C H Wilson (Cambridge, 1967), pp. 470-473.

[3] The initial studies by D C North, "Sources of Productivity Change in Ocean Shipping, 1600-1850", *Journal of Political Economy,* LXXVI (1968) and "Ocean Freight Rates and Economic Development 1750-1850", *Journal of Economic History,* XVIII (1958). G Walton and J F Shepherd, *Shipping, Maritime Trade and the Development of Colonial North America* (Cambridge, 1972) and C K Harley, "Ocean Freights Rates and Productivity, 1740-1913: The Primacy of Mechanical Invention Reaffirmed", *Journal of Economic History,* XLVIII (1988) relate predominantly to the Atlantic trades. For a recent application of this methodology to the North Sea and Baltic trades see the papers presented at Session II/D "New Perspectives on the Early Modern Baltic World" of the Economic History Society Annual Conference, held at the University of Reading, 31 March-2 April 2006.

extended to incorporate new products but was also reshaped as relocation took place in terms of comparative advantage. In relation to the production and distribution of low-value, bulk commodities therefore, the years 1500-1800 witnessed the emergence of new regional consumption patterns as there was superimposed upon a European-wide market a new bipartite structure with regard to the consumption of bulk commodities. From the seventeenth century a new distribution pattern was imposed on the international trades which would continue to exist to 1800. By the latter date a “Maritime Europe,” embracing regions bordering the Baltic and North Seas, and Atlantic Ocean was juxta-positioned against a “Continental Europe”. The inhabitants of the former area enjoyed, save where they were impeded by government interference with supplies, bounteous quantities of bulk raw materials and semi-fabricants, unlike their counterparts in the latter zone. The raw materials and semi-fabricants of Northern and Eastern Europe, thus flowed to North-western Europe. Initially, at least, these wares were paid for with specie. Domestic manufactures, produced by traditional methods, had become too expensive to export. Only by a technological transformation of the industrial production base, economising on high (silver) cost inputs, could the manufactures of North-western Europe once more enter into the trade to Northern, Eastern and Mediterranean Europe. This, however, required, not inconsiderable quantities of capital to be raised on markets, wherein all over Europe during the years 1540-1740 those with money to lend were forced to adjust to very different situations.[4]

In most instances, such lenders seem to have responded in much the same way and interest rates changed in line with prices. “Monetary” rather than “real” factors exerted a dominant influence on their decision making. Only in England and the lands of the Lower Rhine[5] was the situation again seemingly different (figure 1). Here as elsewhere during the years from ca. 1545-1575 prices and base interest rates had risen but thereafter, as prices continued to increase, interest rates actually fell and stabilised about a five per cent norm until about 1645.[6] An increasingly rich population with enhanced savings was

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[4] Ian Blanchard, "International Capital Markets and their Users, 1450-1750" in Maarten Prak (ed.), *Early Modern Capitalism. Economic and Social Change in Europe, 1400-1800* (London & New York, 2001), pp 107-124.

[5] Henceforth used to describe the Netherlands, Cleves, Jülich-Berg, Speyer, Nassau and the archbishoprics of Trier and Cologne.

[6] Base interest rates, representing the rate of return on first-class securities and measured in terms of the price of a perpetual fixed-rent charge secured on land and later in terms of the price of consuls, are entirely supply-driven, being determined by the amount of investible funds available to the market. Commercial interest rates, which incorporate a risk element, are related to what a potential borrower can offer, itself related to the marginal efficiency of capital of the investment to be made, which is measured by the amount that the commercial rate is ABOVE base rate. Base interest rate statistics have been taken from M. Neumann, *Geschichte des Wuchers in Deutschland* (Halle, 1865), pp. 266-273. This data is supplemented from R. C. Mueller, “Foreign Investment in Venetian Government Bonds and the Case of Paolo Guingi, Lord of Lucca, early 15th Century” in H. A. Diederiks and D. Reeder (eds.), *Cities of Finance: Proceedings of the colloquium. Amsterdam, May 1991 (Amsterdam: Royal Netherlands Academy of Arts and Sciences, 1996),* pp. 69-71 and H. J. Habakkuk, “The Long-term Rate of Interest and the Price of Land in the Seventeenth Century”, *Economic History Review,* Second Series, V, 1 (1952); J. G. van Dillen, “Oprichting en functie der Amsterdamsche Wisselbank, in de zeventiende eeuw, 1609-1686”, *Mensen en Achtergronden. Studies uitgegeven ter gelegenheid van de tachtigste verjaardag van de schrijver* (Groningen, 1964), p. 376; T. S. Ashton, *Economic Fluctuations in England 1700-1800* (Oxford, 1959), p.187 and B. R., Mitchell and P. Deane, *Abstract of British Historical Statistics* (Cambridge, 1962), p.455. The data utilised here makes no pretension to either spatial or chronological comprehensiveness.

allowing “real” interest rates to equilibrate to a new low level. Then from 1645-1695 as prices fell, in England, “real” interest rates began to rise bringing this first phase in the restructuring of its capital market to a close. This, however, was merely an interlude in the long-term evolution of that market for as the eighteenth century opened a second phase in its development began. Again, from 1695-1745 “real” interest rates on the English market fell heavily before the pace of decline first slackened and then in ca. 1800 rates once more began to increase.

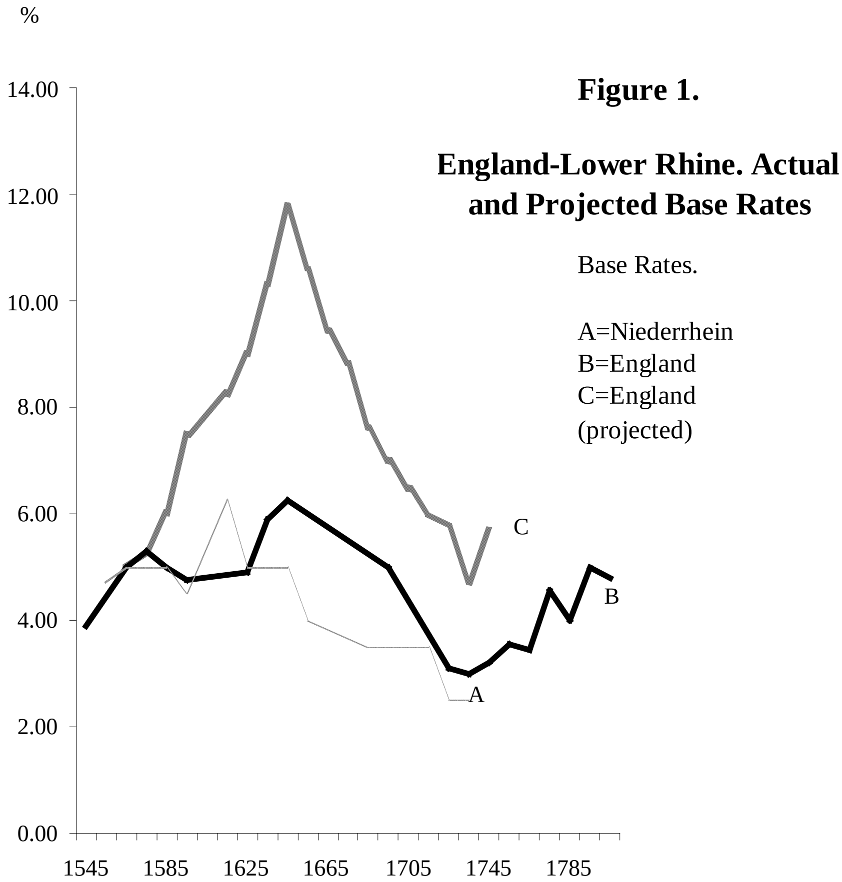

Figure 1.

England-Lower Rhine. Actual and Projected Base Rates

Key: A-B= ‘real’ interest rates. Nominal Rates deflated by changes in the general price level. C= inflationary adjustment index applied to constant base rate.

Whilst during the years 1550-1750 “real” interest rates stabilised throughout most of Europe, therefore, in England and the Lower Rhine lands these years witnessed an alternating pattern and secular decline in base interest rates. Initially a slow and then, from 1575, a rapid rise in income and saving levels meant that investors were willing to accept a steadily diminishing rate of return on first class securities. Such changes before the eighteenth century were measured in England in terms of the price of land or rather in terms of the price of a perpetual fixed rent charge secured on land and thereafter in terms of the yield on consuls. From a level of 4 per cent in 1545 "nominal" rates had risen, as a hedge against inflation, to 5.3 per cent (19 years purchase) in 1575 before stabilising at just below 5 per cent to 1625. At no point, however, was the rate of increase comparable with that of the general price level, so that by the latter date the "real" rate of return was less than half (45 per cent) of what it had been eighty years earlier. Subsequently the rate of decline slackened. Then in the years to 1695 "real" rates actually increased. But this was merely a passing interlude and as the eighteenth century opened rates once more tumbled until in 1730 the "real" rate of return on land or consuls was a mere third of what it had been two centuries earlier. With rising incomes and savings levels money for investment was becoming in the early modern period progressively cheaper and more available, making England and the Lower Rhineland an oasis of cheap money in a European market where traditional "real" rates continued to prevail.

The rate that any would-be borrower could offer, however, depended on the efficiency with which he could use the capital. The greater the efficiency, the greater were the returns he could offer investors relative to other enterprises and the easier, accordingly, it became to attract the capital required. Whilst the English market thus looked increasingly attractive to would-be borrowers who either earlier or elsewhere found difficulty in raising funds, it was not only base lending rates which determined whether they would be successful in contracting a loan. Equally important were the activities of others who also required money and the amounts that they could bid for a loan.

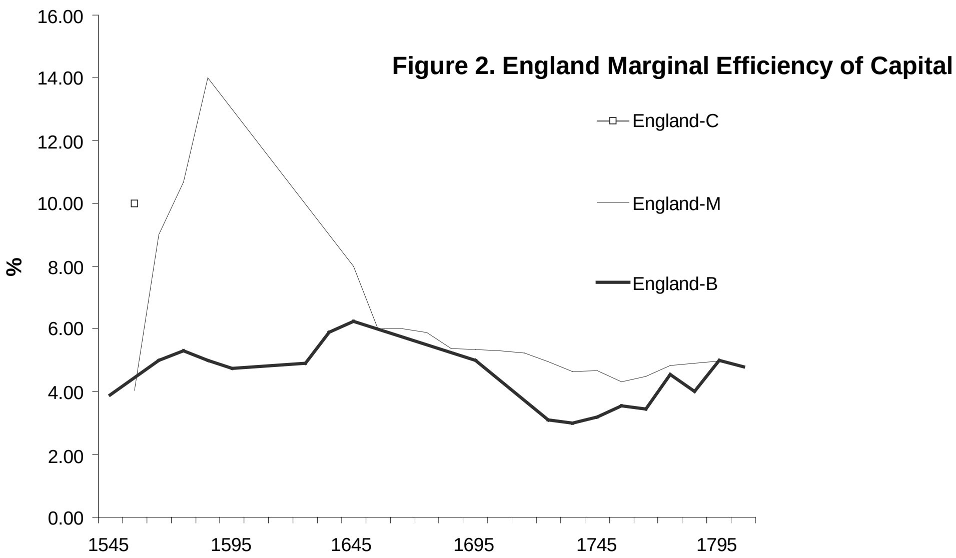

Figure 2. England Marginal Efficiency of Capital

Key: England C= commercial rates, M= Mortgage Rates and B= Base Rates

The 1540s witnessed in England as on the Continent, a major transformation of the market as inflationary pressures induced lenders to enhance rates in line with contemporary price changes. Yet in England and the Netherlands, unlike in most of continental Europe, this trend was superimposed on another. Technological change in the English agrarian sector, following some twenty years after similar changes in the lands of the Lower Rhine, set in motion a process which, in enhancing incomes, from ca. 1575 caused base interest rates, even in "nominal" terms, to fall.[7] Agrarian change thus created conditions of cheap money within England and Lower Rhineland. It also created a major investment demand for that money. From about 1575, accordingly, the market situation was transformed as in England, at least, farmers and landowners began to offer rates of ca. 14% on mortgages, reflecting the returns that could be obtained by the first innovators in the new agrarian regime. Such pioneers enjoyed the best of both old and new worlds. They made little contribution to total output, which continued to be dominated by traditional producers. The price level was thus unaffected. Unit costs, however, for the innovators were reduced markedly and profits accordingly were enhanced, allowing them to offer high interest rates to investors for the capital they required. As more and more farmers, attracted by these profits, innovated, however, output expanded and prices fell until in the second half of the seventeenth century with the achievement of total market domination prices fell towards the new low cost level and farmers could make only "normal" profits. Each new producer entering the business thus pushed down prices, profits, the rate of return on capital invested and the rate of interest on mortgages

During the initial phase of agricultural innovation, (1560-1610) investment in English agriculture was thus highly profitable, as farmers were able to offer rates of 10-14 per cent to venturers of capital on mortgages for the purposes of agricultural improvement. Nor did this rate fall rapidly as sustained population growth to 1650 allowed the consumption of marginal output whilst acute inflationary pressures sustained "nominal" prices above their "real" level. Thus during the years 1560-1650 and particularly from 1560-1610 English agriculture attracted funds from all sectors in the economy. Merchants and manufacturers, whose products were overpriced on international markets and who were unable to compete with the specie exporter[8] for funding, could not make comparable returns in their own enterprises. They thus increasingly deployed their funds either directly or indirectly on the financing of estates for the purposes of agricultural improvement. Tudor and Stuart merchants might thus, as so often has been suggested, have had a desire to acquire landed status - but it was also a very profitable way of diversifying their investment portfolios. Indeed the capital markets

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[7] See on this first phase of technological change in England, Eric Kerridge, *The Agricultural Revolution* (London, 1967) and his *Agrarian Problems of the Sixteenth Century and After* (London 1969) whilst van Herman van der Wee in *The Growth of the Antwerp Market and the European Economy (fourteenth-sixteenth centuries)* (The Hague, 3 vols., 1963), II, chapter 6, section B-1, pp. 166-176 deals with the earlier changes in the Low Countries.

[8] The bullion exporter, able to maintain his position by exploiting regional differentials in the purchasing power of specie, was able to develop an active import trade in raw materials and semi-fabricants from eastern and northern Europe. See for instance on the example of the Dutch grain trade and even when war disrupted these trades, diversification into privateering provided an alternative source of profit. M. van Tielhof, "Profits in the Dutch Grain Trade on the Baltic, 1550-1650" and M. t'Hart, "Booty, benefits and power," unpublished papers presented at 4e Journées Braudèliennes. NIAS-MHS seminar on "Early modern capitalism", held at Wassenar, 23rd-24th May 1997

of England and the lands of the Lower Rhine were incomparable in investment opportunities attracting, during the years 1590-1610, funding from South Germany.[9]

Yet, the situation was both ephemeral and unstable. Many who had taken up funds in conditions of rising prices from ca 1610-1640 subsequently, as prices fell, found that their previous profit margins were illusionary and got into difficulties. Some, by the exercise of extreme economy, extricated themselves from this difficult situation.[10] Others did not and the years 1640-1695 witnessed many foreclosures on mortgages, turning merchants into reluctant landowners at a time when the decline in interest rates on mortgage bonds was once more encouraging a counter-flow of money to the non-agrarian sector. Indeed, with the decline in interest rates on mortgage bonds from ca. 1640-1695 and their assimilation with base rates from ca. 1660, there was a wholesale search for new investment opportunities in the non-agrarian sector of the English economy and beyond.[11] Investors, when unimpeded by legal restrictions, thus once more found industry an attractive outlet for their money.[12] The great mercantile companies attracted a flood of would-be subscribers to take up their shares and, in attempting to secure capital gains by limiting equity issues whilst expanding their business on the basis of bond finance, initiated a frenetic series of "raids" aimed at opening up these companies to outsiders.[13] Other investors showed willingness to rollover short-term bill finance[14] to provide long-term investments in the plantation economies of the New World and thus found another outlet for their funds. But investment opportunities were limited and as the marginal efficiency of capital fell there began a frenzied struggle to find new investments in a situation which was aggravated by Dutch investors seeking outlets in England - much to

[9] Reinhardt Hildebrandt, "The Effects of Empire: Changes in the European Economy after Charles V" in Ian Blanchard et aliis (eds.), *Industry and Finance in Early Modern History. Essays presented to George Hammersley on the occasion of his 74th Birthday* (Stuttgart: Franz Steiner Verlag, VSWG-Beihefte, 98. 1992), p. 73. The relevant sources about these almost unknown investments are quoted by the same author in "Interkontinentale Wirtschaftsbeziehungen und ihre Finanzierung in der 1. Hälfte des 17. Jahrhunderts", in Herman Kellenbenz (ed.), *Weltwirtschaftliche und währungspolitische Probleme seit dem Ausgang des Mittelalters* (Stuttgart and New York: Forschungen zur Sozial- und Wirtschaftsgeschichte Bd. 23. 1981), pp. 61-76. Because of the legal complexities involved in participation in the mortgage market, described in J. M. Holden, *The History of Negotiable Instruments in English Law* (London, 1955), it remained largely the preserve of native investors. The activities of foreigners were predominantly concerned with the shares of the great English chartered companies which, like their Dutch counterparts, were involved predominantly in exporting specie to exchange for cheap imports of raw materials and semi-fabricants.

[10] Eric A Hopkins, "Nobleman and His Debts: John, Second Earl of Bridgewater, 1622-1686" in Ian Blanchard *et al.* (eds.), *Industry and Finance* … pp. 58-76.

[11] On such investments in the transport sector of the economy see John R Ward, *The Finance of Canal Building in Eighteenth-Century England* (Oxford, 1974)

[12] See for instance the unpublished paper of Ian Blanchard, "La loi minière anglaise 1150-1850. Une étude de la loi et de son impact sur le developpement économique", 2e partie, "Mythe, 1550-1850" presented at the Ecole des Hautes Etudes en Sciences Sociales, Paris, 1985

[13] See eg. "Old" East India Company and the creation of the "New" and the Darien Companies discussed in W. R. Scott, *The constitution and finance of English, Scottish and Irish joint-stock companies to 1720* (Cambridge, 3 volumes, 1910-12) and K. G. Davies, "Joint-stock investment in the later seventeenth century", *Economic History Review*, Second Series, IV (1952)

[14] See eg. Jacob M. Price, *Capital and Credit in British Overseas Trade: the View from the Chesapeake, 1700-1776* (Cambridge, MA, 1980). K. G. Davies, *The Royal Africa Company* (London, 1957), pp.316-325 and his "The origins of the commission system in the West India trade", *Transactions of the Royal Historical Society*, Fifth Series, II (1952), pp. 89-108

the ire of Englishmen seeking ways to place their money.[15] The basic problem was that at the end of the seventeenth century the English and Dutch capital markets were awash with money and investors were accordingly prepared to put out their money on the most speculative of ventures.[16]

Nor did this situation change as that market underwent a basic restructuring during the early eighteenth century. Those proffering agricultural mortgages were again able at that time to offer a premium over base rate as a second phase of innovation transformed that sector.[17] Yet such was the fall in base rates and the relatively low returns to the innovator that interest rates on mortgage bonds continued to fall from their late seventeenth-century level. The amount of funding available for non-agrarian investment was enhanced again in a domestic market lacking investment outlets and in a situation where overseas investment opportunities were restricted by the continuing existence of bi-metallic premiums on exchange dealings. By the 1720s therefore conditions were again ripe for a new phase of acute speculative activity - the South Sea Bubble.[18] This, however, was merely a passing interlude in a market, which since the late seventeenth century was beginning to assume a new aspect, for as domestic opportunities failed to materialise investors began to look elsewhere. During the period 1670-1770 Anglo-Dutch merchants, working in co-operation with each other, now showed themselves quite willing to roll-over short-term bill finance to provide long-term investment in foreign agriculture and industry.[19] Initially observable in the Americas trades, with the removal of bi-metallic impediments to the operation of foreign exchange markets in the 1730s, such investments became characteristic of many branches of European commerce. Bill rates on such foreign bourses as St Petersburg increasingly moved to the rhythm of English base rates.[20] The second third of the eighteenth century thus saw England and the Netherlands become major capital exporters, alleviating shortages abroad and providing necessary funding for the expansion of foreign industrial and commercial enterprises. By

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[15] On Dutch investment at this time see Charles Wilson, *Anglo-Dutch Commerce and Finance in the Eighteenth Century* (Cambridge, 1941), pp. 88-196; the articles of Alice Carter, “The Dutch and the English Public Debt in 1777” and “Dutch Foreign Investment 1738-1800” published in *Economica,* New Series, XX, Nos. 78 & 80 (1953) respectively and the exchange between the two authors in the *Economic History Review*, Second Series, XII, 2 (1960), pp. 434-444

[16] An excellent example of this process is provided by Christine Macleod, “The 1690s Patents Boom: Invention or Stock Jobbing ? “, *Economic History Review,* Second Series, XXXIX, 4 (1986) which may be set in its general context by reference to D. W. Jones, *War and Economy in the Age of William III and Marlborough* (Oxford, 1988)

[17] Mark Overton, and Bruce M. L. Campbell, “Production and Productivity in English Agriculture, 1086-1871” as quoted by J. L. van Zanden in his paper “Pre-modern economic growth: the European Economy 1500-1800” presented at the 4e Journées Braudèliennes. NIAS-MHS seminar on “Early modern capitalism”, held at Wassenar, 23rd-24th May 1997.

[18] J. Carswell, *The South Sea Bubble* (London, 1960) and the studies of Julian Hoppit: *Risk and Failure in English Business 1700-1800* (Cambridge, 1987), pp. 132, 164 and “Financial Crises in Eighteenth-Century England”, *Economic History Review,* Second Series, XXXIX, 1 (1986), pp. 47-8.

[19] Jennifer Newman, “Anglo-Dutch commercial co-operation and the Russia trade in the eighteenth century” in *The Interactions of Amsterdam and Antwerp with the Baltic Region 1400-1800. Papers presented at the third international conference of the ‘Association Internationale d’Histoire des Mers Nordiques de l’Europe’, Utrecht, August 30th-September 3rd 1982* (Leiden, 1983), pp. 95-104.

[20] Jennifer Newman, “‘A very delicate Experiment’: British mercantile strategies for financing trade in Russia, 1680-1780" in Ian Blanchard *et al.* (eds.), *Industry and Finance* … pp. 115-141.

the end of the eighteenth century, in countries like Russia, it had became an axiom of economic policy making that,

> "... the greatest part of our domestic industry was put into movement by the advances that the English make to us and which allow our peasants to be put to work..."[21]

Even as Count Strogonov penned these lines, however, the age of which he wrote was passing. The French wars, from 1792-1815, interrupted the process. During these years, from 1792-1815 the recipient economies themselves began to mature whilst English capital markets felt the baleful effects of government intervention. Signs began to appear that far from maintaining its position as a capital exporter, Britain was again becoming a capital importer drawing finance during the years 1790-1820 from Russia, Holland and Prussia to fund commerce and industry which was starved of capital by the demands of a rapacious government.[22]

II

This paper examines, in the context of these changes in international money and financial markets, the transformation of the iron industry, a producer of a basic low-value, high-bulk commodity. As from c. 1570 maritime freights fell and specie-stock differentials opened up, the pre-existing pattern of ubiquitous industrial activity and trade based on the exchange of products of differing chemical composition gradually became confined to the landward provinces of the European economy. Protected by high overland transport costs, the old ways continued in these landward provinces into the new age.[23] Where consumers enjoyed access to iron transported by sea, however, they turned away from the old product and in these regions the creation of new smelting capacity was retarded[24] as production became concentrated first in Sweden and then from the mid-eighteenth

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[21] *Vneshniaia Politika Rossii. Seriia pervaia, 1801-1815* (Moscow, 1965), IV, p.108 as quoted in B. V. Anan'ich and S. K. Lebedev, "Russian Finance during the French Revolution and the Napoleonic Wars", paper presented to session B1, "Economic Effects of the French Revolutionary and Napoleonic Wars" of the Tenth International Congress of Economic History, Leuven, 19-24 August 1990

[22] On Dutch capital imports at this time see the unpublished paper of E. S. Brezis, "International Capital Flows During the Eighteenth Century: Did Holland Finance the British Industrial Revolution?" and on Russian financing of British foreign trade Jennifer Newman, " 'A very delicate Experiment'..." p. 135.

[23] On production patterns in the iron industry prior to ca. 1570 see R. Sprandel, *Das Eisengewerbe im Mittelalter* (Stuttgart, 1968), Erich Landsteiner, "Furnace owners, forge masters and iron merchants in 16th century Austria. A commodity - chain approach" unpublished paper presented Session: Commodity markets and industrialisation at Conference 'Trade, commodity markets and the mercantile contribution to industrialisation' held at The University of Glamorgan, 20-21 April 2001

[24] On output retardation in England see Michael W. Flinn, "Growth of the English Iron Industry, 1660-1760", *Economic History Review*, Second Series, XI, 1 (1958); Peter King, "The Production and Consumption of Bar Iron in Early Modern England and Wales", *Economic History Review*, Second Series, LVIII, 1 (2005)

century in Russia.[25] From 1660 Swedish and then Russian iron came to dominate international, and particularly this rapidly expanding British, market. The dramatic expansion came first in Sweden. Its bar iron exports increased from a quite insignificant figure in the seventeenth century to more than 25,000 tonnes at the end of that century and to about 40,000 tonnes in the late 1730s. Then followed a period of stagnation, which was prolonged by political decisions around the middle of the century: production was restricted, partly with the aim of limiting charcoal consumption and partly in the hope of stabilising prices by diminishing output, or at least keeping it constant. The export figures from the end of the century were only slightly higher, a little more than 45,000 tonnes, than before. Russia, on the other hand, had in the seventeenth century been an importer of iron. The enormous eighteenth-century growth of the nation's industry was localised in the Ural region. From very modest beginnings, it developed gradually, reaching nearly 40,000 tonnes in 1760 and 50,000 in 1770. In 1800 after a final expansive effort during the last two decades of the century, it reached 100,000 tonnes.[26] The Swedes, faced from the 1760s with this new competitive force, assumed that the Russians exported about half of their bar iron, a figure largely confirmed by contemporary customs-production statistics. On the all-important English market, the Russians had been quite insignificant up to about 1730; they reached half the Swedish figure as late as the 1750s. But they completely outdistanced the Swedes halfway through the next decade. In the period 1770-1800 they accounted for 60 per cent of total English iron imports, which in turn served to satisfy at least half of that nation's consumption of malleable iron.

As "real" iron prices fell within this new trading system, moreover, consumption of the product increased, inducing in England at least, not only an expansion in the production of 'traditional' wares[27] but also a new wave of technological innovation in the fabrication of the raw material. At first slowly and then from ca. 1660 rapidly, in England, manufacturers, utilising increasingly cheap funding and a high-skill labour force, developed the "mechanical arts" in relation to the fabrication of imported iron. New production centres arose in Newcastle, Sheffield, Birmingham and London from whence the new technologies were disseminated in the early eighteenth century to

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[25] K-G Hildebrand, *Fagerstabrkens historia*, I (Uppsala, 1957); "Foreign markets for Swedish iron in the eighteenth century", *Scandinavian Economic History Review*, VI (1958); *Svenskt järn. Sexton- och sjuttinthundratalen.Exportindustri före industrialismen* (Stockholm, 1988) translated as *Swedish Iron in the Seventeenth and Eighteenth Centuries. Export Industry before Industrialization* (Stockholm, 1992) and "Swedish and Russian Iron in the Eighteenth Century" in Ian Blanchard *et aliis* (eds.), *Industry and Finance in Early Modern History. Essays presented to George Hammersley on the occasion of his 74th Birthday* (Stuttgart: Franz Steiner Verlag, VSWG-Beihefte, 98. 1992), pp.226-244.

[26] M. D. Chulkov, *Istoricheskoe opisanie rossiiskoi kommertsii pri vsekh' portakh' i granitsakh do nin' nastoyashchago i vsekh' preimushchesshvennikh ukazonenii po onoi gosudarya imperatora Petra velikago i nin' blagopoduchno tsarsshvuyushchei gosudarin imperatritsi Ekaterini velikiya* (St. Peterburg, 6 vols. In 21 books, 1786), VI/2, pp.547-598. N. Baklanov, *Tekhnika metallurgicheskogo proizvodstva XVIII v.na Urala* (Moscow-Leningrad, 1937), app. 3, pp. 310-323. B F J von Hermann, *Sochineniya o Sibirskikh' rudnikakh' i zavodakh', sobanniya nadvornim' soveshnikom' i akademikom Ivanom' Germanom'* (St. Petersburg, in 3 chast', 1797-1801), I, pp 194-203 and *Die Wichtigeit des Russischen Bergbaue* (St. Petersburg, 1810); *Annuaire du journal des mines de Russie*, XIII (St. Petersburg, 1840). V. K. Yatsunskii, "Materiali po istorii ural'skoi metallurgi v pervoi polovine XIX v." *Istoricheskii arkhiv*, IX (1956)

[27] Chris Evans, Owen Jackson and Göran Rydén, "Baltic Iron and the British Iron Industry in the Eighteenth Century," *Economic History Review*, LV, 4 (2002)

France.[28] From *c.* 1660-1788, the products made by this English metal-fabricating manufactory dominated both domestic and international markets. Indeed as late as 1825 a Royal Commission, categorically established that whilst English bar iron could not be sold abroad, castings and other wares fabricated from iron found a ready market.[29] The iron industry, in an increasingly integrated market, from *c.* 1660 evolved in terms of comparative advantage.

In North-western Europe, in conditions of closing specie-stock differentials and increased capital availability the "mechanical arts" developed in relation to the fabrication of imported iron (and in the Netherlands copper). Producing high value-added metal wares - ranging from the new navigational chronometers-clocks and 'singsongs' (mechanical toys) to large-scale constructional castings- their goods found markets throughout the world. The raw materials for this rapidly expanding manufactory were increasingly produced in Northern and Eastern Europe –iron and copper in Sweden and Russian iron. Output and exports of these materials, as has been shown, increased rapidly.

Until ca. 1740 this export growth may in part have been related to relatively lower production costs, which may have existed in Russia at least because of the diminutive level of silver stocks in that nation and the relatively high purchasing power of imported supplies of that metal.[30] As, from 1740-1790, that nation's monetary stocks rapidly increased and international silver-purchasing price parity was achieved, however, any such "monetary" advantage enjoyed by producers disappeared.[31] It was then revealed that Russia did not enjoy any particular "real" labour-raw material price advantage during the years of export growth from 1740-1790. It was not endowed as has sometimes been suggested with either cheap serf-labour or cheap timber.[32] Stands of timber were indeed abundant in the Urals at this time, but because wood was a renewable agrarian product yields were conditional upon environmental factors. [33] Even in the relatively favourable

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[28] The story of industrial development in these centers has yet to be told. See, however, D Hey, *The Rural Metalworkers of the Sheffield Region: A Study of Rural Industry before the Industrial Revolution* (Leicester University, Department of English Local History, Occasional Papers, 2nd Series, 5. 1972). W H B Court, *The Rise of the Midland Industries, 1600-1838* (London, 1953), M. B. Rowlands, *Masters and Men in the Midlands Metalware Trades before the Industrial Revolution* (Manchester, 1975). P. Frost, "Yeomen and Metalsmiths: Livestock in the Dual Economy of South Staffordshire, 1560-1720", *Agricultural History Review*, XXIX (1981) On the dissemination of information concerning these technologies John Harris "The First British Measures against Industrial Espionage" in Ian Blanchard et al. (eds.) *Industry and Finance in Early Modern History...* pp. 205-226.

[29] Report of the Select Committee on Manufactures, Commerce and Shipping, Great Britain, Parliamentary Papers, VI 1833.

[30] Jennifer Newman, *Russia's Foreign Trade, 1680-1780* (unpublished Edinburgh Ph.D thesis, 1985), pp. 164-5.

[31] Ian Blanchard, *Russia's "Age of Silver." Precious Metal Production and Economic Growth in the Eighteenth Century* (London, 1989), pp. 335-355; Boris N. Mironov, *Khlebnie tseni v Rossii za dva stoletiya, XVIII-XIX vv.* (Leningrad, 1985)

[32] K-G Hildebrand, "Swedish and Russian Iron in the Eighteenth Century" in Ian Blanchard *et al.* (eds.), *Industry and Finance* … p.230, 233-6

[33] Ian Blanchard, "Times of Feast, Times of Famine: A critical examination of recent British research concerning market structures and trends in the production of carboniferous fuels, 1450-1850" in Paul Benoit and Catherine Verna (eds.) *Le charbon de terre en Europe avant l'usage industriel du coke* (Turnhout: De Diversis Artibus t. 44 [ns.7] Proceedings of the XX International Congress of the History of Science, Liège 20-26 July 1997, vol. IV. 1999), pp. 71-75.

conditions, prevailing during the early eighteenth century the Russian "coaler" was a high-cost producer. Regionally adverse climatic conditions resulted in long timber maturation periods and necessitated that Uralian iron-masters "set aside wood for the whole works that is not less than thirty years, being near to the factory in which it is adjacent."[34] Their English counterparts at this time could depend upon a twelve-year renewal cycle for coppice timber. The relatively fast-growth characteristics of the arboreal varieties-pine, fir, birch, aspen and larch- which made up the nation's woodland cover, moreover, produced wood, which was converted into charcoal at lower conversion rates than English beech or oak. Thus whilst Russian wood was cheap the "coalers'" raw material costs were about forty per cent higher than those of their English counterparts.[35] Russian unit labour costs, for "coalers" employing the prevailing Anglo-Russian technologies, were also higher. With the "real" resource cost of their charcoal being more than twice that of their English counterparts, therefore, Russian iron-masters were seriously disadvantaged when in the 1730s they began for the first time to attempt a penetration of international markets. Nor was this penetration of international markets a result of differential labour costs. Possessional and assigned peasants concentrated in the Russian metallurgical industry were a "privileged" group who, thanks to government wage legislation, saw a steady increase in their earnings. The Russian iron-master thus benefited from neither cheap wood nor labour. Their response was to innovate. They introduced a new and far more productive charcoal-making technology.[36] Accordingly, when Russian "coalers" were faced from ca. 1760-1790 with a rise in timber prices of even greater dimensions than in the West,[37] unlike their English counterparts, who failed to innovate, they had the means to compensate. With the diffusion of the new technology, Russian charcoal prices were stabilised at a level below those prevailing in the West. Thereby Russian iron-masters established a competitive advantage over charcoal producers elsewhere. They also secured lower fuel costs than those prevailing in the English coke-smelting industry. By the 1780s, moreover, in the most advanced areas of production- Russia- particularly in the iron and copper industries, energy costs were heavily reduced in vast integrated "factories" within which all activities were powered by a highly capital-intensive hydraulic-water wheel complex.[38] The Russian iron-master thus benefited from neither cheap wood nor labour. His low costs were a result of high productivity levels achieved by organizational and technological innovation. This allowed the Urals charcoal iron producer to maintain his competitive position in relation to his British coke-smelting rival throughout the years 1780-1850.

As "real" iron prices fell within the international trading system the Russian and Swedish iron industry thus continued to evolve in terms of comparative advantage,

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[34] Wil'helm de Hennin, *Opisanie ural'skikh i sibirskikh zavodov 1735*, edited by M A Pavlov (Moskva, 1937), pp. 354-371

[35] At some 56d sterling equivalence for one Kentish cord at the current 1704 exchange rates in comparison with 72d for the Kentish wood, largely as a result of differences in the relative purchasing power of silver in England and Russia- I Blanchard, Times of Feast, Times of Famine, p.71 n.32.

[36] Described ibidem, pp. 72-74.

[37] Boris N. Mironov, "'Revolyutsiya tsen' v Rossii v XVIII v.", *Voprosi istorii,* 11 (November, 1971), pp. 54-5.

[38] Ian Blanchard, "Water- and Steam Power: Complementary or Competitive Sources of Energy?" Paper presented at the Istituto Internazionale di Storia Economica "F. Datini", XXXIV Settimana di Studi "Economia ed energia secc. XIII-XVIII" Prato, 15-19 April 2002

establishing during the years, c. 1660-1790 a dominant position in international markets. In the context of changes in international money and financial markets, they benefited from the willingness of Anglo-Dutch merchants to roll over short-term bill finance to provide that long-term investment, which allowed the industry to be put into movement and the peasant-workers to be put to work. Their competitive position, however, was first and foremost a result of an indigenous process of technological change, only in the case of metal fabrication there being any evidence of technological diffusion from North-west Europe.[39]

III

Then this highly integrated market disintegrated. Aware of the necessity of protecting England's new, but high-cost and inefficient, coke smelting iron works, the British government from 1790 began to raise tariffs against Swedish and Russian imports.[40] Thereafter, until ca. 1826, if unimpeded by war or commercial restrictions, the Russian product, if not the Swedish, could potentially undersell English iron on the London market, but was prevented from doing so by a tariff, which was steadily enhanced to £ 6. 10s.0d per ton in 1815[41] As a result of this British tariff increase and Napoleonic trade embargoes, both total Russian bar iron exports and those destined for the United Kingdom declined markedly. Total exports fell from some 3.5 million puds (56, 270 tons) in 1793 to 0.887 million (14,260 tons) in 1817.[42] Nor with the subsequent heavy reduction of the British tariff in 1826 (to £1.10s.0d a ton) was the Russian product able to re-establish its former position on that nation's market. The fall in English bar iron prices, ca. 1800-1830 to a position of parity with Russian ones ensured that the Russian bar-iron trade could effect but little market penetration. In the 1780s the Russians had exported 23,700 tons of bar iron annually to Britain. During the 'thirties and 'forties of the nineteenth century they were only able to export there some 3,200 tons of Russian iron a year on average. In the 'fifties this fell to some 1,700 tons.[43] In conditions of manufacturing price parity between the two nations, such as prevailed during the years 1828-1851, the Russian product could make but little headway on the British market. Yet it should perhaps also be noted that the British product was no more successful in penetrating the Russian market in free trade conditions after 1850.[44] From, ca. 1800-1850 the commercial battle between the world's two great iron- making powers was fought out on third-party markets. Even as Russian iron exports to Britain were first impeded, in 1790, by the imposition of tariffs, St Peterburg shippers began a process of market diversification. Until the outbreak of the French Revolutionary Wars this largely

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[39] Harris "The First British Measures against Industrial Espionage" in Ian Blanchard *et al.* (eds.) *Industry and Finance…*pp.208-211
[40] C. K. Hyde, Technological Change, table 6.3, p.105
[41] H. Scrivenor, *A Comprehensive History of the Iron Trade* (London, Second Edition, 1854), p.131
[42] Russia, Departament' Vneshnei Torgovli, *Gosudartstvennaya Torgovlya … goda v' raznikh eya vidakh,* various years (Sankt Peterburg, 1803-1861)
[43] Ibidem
[44] Ian Blanchard, "Russian railway construction and the Urals charcoal iron and steel industry, 1851-1914," *Economic History Review,* Second Series, LIII, 1 (2000), p.108

involved increased exports[45] to the United Provinces (220 tons)[46], the Austrian Netherlands (42 tons) and France (1,535 tons)[47]. As the British tariff began to bite and Russian bar-iron exports, from St Petersburg via the Sound, to the British market stagnated (23,500 tons), therefore, the iron trade continued to expand as new markets were opened up. With the outbreak of war, however, this situation was transformed. British naval blockades and the subsequent imposition of the Napoleonic Continental System impeded Russian access to European markets via the Baltic and led to a redirection of the iron trade via Arkhangel'sk which occasionally (1805 and 1812-5) augmented the burgeoning new trade via port of Odessa.[48] This realignment of the Russian iron trade, moreover, was also associated with a continuing market diversification. Until the Napoleonic invasion of Russia in 1812 both processes continued apace. In 1810 Russia was still exporting some 35,000 tons of iron, or a level comparable with that of exports during the pre-war years, but only some 8,000 tons were now exported to Britain. A not insignificant proportion of the residual exports now passed to the United States.[49] Indeed from 1796-1810 it was the United States which had become the principal non-British market for Russian bar iron, some 4,000-6,000 tonnes being exported thence during the first decade of the nineteenth century.[50] The events of 1812, however, were to prove disastrous for both the Russian industry and trade.[51] The Napoleonic invasion and war with France seriously undermined the St Peterburg iron trade and resulted in a diversion of about half of total supplies towards the Black Sea ports of Rostov-on-Don and Taganrog from whence it was trans-shipped to Odessa and the Mediterranean ports beyond. As an ally of Great Britain, moreover, Russia was also affected by the outbreak in that year of hostilities between that nation and the United States which from 1812-1815 brought Russian-American trade to a halt and allowed Swedish iron to displace the Russian product on that market. In these circumstances the Russian bar-iron trade seriously declined, only some 23,300 tons being exported on average annually during these years.

Nor did peace in 1815 significantly alter this situation. Faced with renewed competition the British imposed in that year a new and draconian tariff on Russian bar-iron imports and before this was removed in 1826 the French had also followed suit. From 1815-1840 combined sales (3,300 tons) on these markets amounted to no more than quarter of the Russian trade. The United States, with Russian iron imports of some 11,033 ton in 1829, now not only in relative but also in absolute terms, became the Russian iron-masters' major foreign customer.[52] Yet even here they could not re-establish their previous hegemony over the market. During the years 1821-1824 about three times

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[45] I n 1793 St Petersburg also exported some 12,533 tons of bar-iron to intra-Baltic markets.

[46] Most of which was re-exported to more southerly continental European ports.

[47] Particularly at Marseilles-Toulon K-G. Hildebrand, "Foreign markets for Swedish iron in the eighteenth century", *Scandinavian Economic History Review,* VI (1958), pp. 48-9

[48] Russia, Departament' Vneshnei Torgovli, *Gosudartstvennaya Torgovlya … goda v' raznikh eya vidakh,* various years (Sankt Peterburg, 1803-1861)

[49] R. Adamson, "Swedish Iron Exports to the United States, 1783-1860", *Scandinavian Economic History Review*, XVII (1969), pp. 70-1.

[50] Ibidem, table 1, p. 61

[51] B. B. Kafengauz, "Voina 1812 goda i ee vliyanie na sotsial'no-ekonomicheskuyu zhizn' Rossii (po materialam predpriyatii N Demidov", *Voprosi istorii*, no.7 (1962), pp. 69-80.

[52] Russia, Departament' Vneshnei Torgovli, *Gosudartstvennaya Torgovlya 1829 goda v' raznikh eya vidakh,* (Sankt Peterburg, 1830)

as much Swedish as Russian iron was imported into the United States and in 1825-1828 about four times.[53] The threat to the Russian's position thus came not from the rolled and hammered products of the British coke smelting industry, which were imported into the United States only in tiny quantities at this time. Its main competitor was the Swedish charcoal-iron industry, which at this time was rapidly adopting the "new" *lancashiresmide* refinery process and associated rolling mills.[54] As in the 1840s, however, the American iron industry began to develop, Swedish iron-masters found themselves in a position where "no way could be found of bringing the manufacturing price of Swedish iron a good deal lower" and their trade collapsed.[55] The Russians, whilst lowering the export price of their bar-iron at this time fared little better. Excluded by the imposition of tariffs and the development of import-substituting iron industries (in the United Kingdom, France and the United States) the Russian producer again had in the 1840's to seek new outlets for his wares. These "new" markets, in the Baltic (Denmark, Prussia and the Hanseatic towns) and the Mediterranean (Spain/Portugal, Sicily, the Ionian Islands and Turkey) where their product was still able to hold its own against its competitors, however, had but little potential for increased sales.

The iron industry, in an increasingly integrated market, from *c.* 1660-1780 evolved in terms of comparative advantage. In North-western Europe, in conditions of closing specie-stock differentials and increased capital availability the "mechanical arts" developed in relation to the fabrication of imported iron (and in the Netherlands copper). The raw materials for this rapidly expanding manufactory were increasingly produced in Northern and Eastern Europe –iron and copper in Sweden and Russian iron. Output and exports of these materials increased rapidly. Nor subsequently from *c.* 1780-1850 did Swedish and Russian iron masters loose their competitive position. The highly integrated market itself disintegrated as national governments in North-western Europe and America raised tariffs against the Swedish and Russian product

[53] Adamson, Swedish Iron Exports, pp. 75 ff
[54] A. Attman, *Fagerstabrucks Historia.* Vol. II *Adertonhundratalet* (Uppsala, 1958).
[55] Adamson, Swedish Iron Exports, p.103