INTERNATIONAL TRADE AND WELFARE IMPLICATIONS OF TRANSBORDER DATA FLOWS*

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All countries are finding their economic growth determined increasingly by investment in information technology. In the ultimate analysis, the welfare effects will be determined by which industries are strengthened or weakened. Whether the technology is benign or not depends on the objectives of international communication systems and the policies for achieving them. International policy must be geared to specific objectives.

THE EMERGENCE OF TRANSBORDER DATA FLOWS (TBDF)

As the interface between satellites and computers grows and as computer-to-computer communications become more widespread, countries both developed and developing find their economic growth increasingly determined by investment in information technology. Information is a precondition for estimating export and import variables that determine the volume and value of international trade. It is a central factor for identifying supply and demand elasticities for reducing uncertainty and for facilitating trade flows. It is also an integral part of trade in services and constitutes a classification in and of itself.

Over the past decade dramatic advances in both computer and telecommunications technologies have led to their convergence in telematics. As a consequence, time and distance as obstacles to exchange of information have been overcome through sophisticated computer services that process, store, and retrieve machine-readable data. International data transmission not only facilitates trade flows but leads to fundamental changes in the composition and pattern of trade. It gives rise to issues similar to those challenging the present international economic order, *viz.*,

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developing countries being the major suppliers of raw materials. Will they continue to supply raw data and import processed information? Should the new international economic order address the issues of balance of payments deficits of developing countries enhanced by costly imports of information networks? The international market for information is changing at the intensive and extensive margins as claimed by Melody due to the lower costs of information processing.[1] Institutions that are connected with trading operations like export corporations, banks, and insurance companies are all equipped with the capacity to receive and co-ordinate information from diverse sources and to make this information easily accessible to a magnitude previously unknown. The welfare effects of such developments need to be carefully assessed even though we cannot predict their final outcome.

The emergence of TBDF has resulted in the gradual displacement of smokestack industries, but the communication hardware industries are still to make a significant impact on actual levels of employment and economic growth. Should then such industries be treated as infant industries and afforded protection as did other similar industries in the past? According to an OECD study the electronics revolution will change the face of advanced industrial societies and it may well change or accelerate the economic growth rate of developing nations. Already some of these countries are being confronted with the implications of TBDF which have directed them to convening major intergovernmental conferences in 1983 to deal with these issues. They do not need to insulate their economies from the changes triggered by TBDF, but to optimise their benefits and minimise their costs. There are a range of issues that the Third World needs to consider with reference to TBDF such as a new international division of labour under which the capacity of these countries to establish their own telematics facilities can be strengthened and the gearing up of domestic communication industries to face international competition vis-a-vis transnational corporations. Technical co-operation among less developed countries (LDCs) and newly industrialising countries (NICs) becomes vital for accessing data and scientific information that will help them participate and benefit from the Information Age.

While the all-encompassing effects (both positive and negative) of TBDF have been discussed by institutions like the OECD and the UN Center for Transnational Corporations, guidelines for policy formulation remain to be deliberated. Whether these data flows will continue under a laissez-faire approach or will be subject to tariff and non-tariff barriers will ultimately determine the

maximum realisation of their full potential. More empirical research in this area is called for. Employment in the services sector continues to accelerate in contrast to the declining trend in the manufacturing sector which makes it possible to break down the services activities into information and non-information categories. This trend is perceived both within the OECD countries as well as in the NICs. It is shifting the patterns of investment and trade.

TRADE THEORY AND INFORMATION FLOWS

International trade operatives have always relied on information flows for estimating import and export elasticities and to determine prices, quantities, and currency rate exchanges. The increasing decentralisation of information-intensive industries such as banking, insurance, tourism, and transportation has intensified the demand for instant availability of information. Elaborate information support systems have been set up to service the demands of user groups. Commercial marketing of data is done on a wide scale with the use of a communications infrastructure providing both economies of specialisation leverage and economies of scale. Consequently when information flows at the international level it is based on contractual relationships. It gets packaged and sent across national borders just like any other economic good. The economic value of such service derives from the growth of the new and unique computer based service industry.

The literature of economics has already developed a powerful case against markets as guarantors of efficiency even within the framework of pure competition. This is especially true of international markets because they are influenced by political and social systems. In trade theory, specialisation combined with laissez-faire should result in factor-price equalisation and elimination of the differences in incomes paid to the factors of production. This theory explained only the pattern of trade and not its efficient operation. It made no attempt to include such dynamic variables as technical change emerging from inputs of knowledge and information. Trade gets influenced directly by the impact of communication technology on economic growth rather than on comparative cost ratios which are an indirect response to price changes. The benefits from importing information stem from increased productivity which depends on the price paid for such imports.

In developing countries the application of computer-to-computer information flows may either have an import biased effect or an export biased effect. When transnational corporations base their

subsidiaries in LDCs, their intrafirm flows add to the imports of the host country. Likewise when information flows from the host country it has an export biased effect for the LDC.

The separation of national markets gives rise to a demand lag for imported technical information as a response to competition in supplies of information-intensive output. This trend is more marked in commodities like computers, videotape recorders, and digital telephone exchanges imported by developing countries. Such lags get reduced when the importing country produces its own information hardware. The reason for such lags is that in the past, trade theory had considered transportation costs as being relevant to technology transfer but not information costs. Not only are information gathering costs high, but the uncertainty of dealing with foreign markets makes these costs necessary.

With more information-intensive industries entering international trade, the structure of marginal productivities of labour and capital get altered and in turn, the terms of trade also change. The ratio of productivity to wages is higher in technologically advanced economies based on higher levels of information inputs and consequent higher skills formation. Capital normally flows to countries with higher productivity to wage ratios thereby increasing the technology gap and the wage differentials. Free trade is not likely to increase the relative information endowment of LDCs. In a real world situation favorable terms of trade for fostering scientific data flows to and from the Third World will have to be administered and deliberately arrived at. This is because under normal trade relations, international differences in productivity are not offset by differences in wages so that trade is based more on productivity differentials than on wage differentials. As a result LDCs, in an attempt to leapfrog technology, have a growing demand for satellite communications, optical fiber networks, digital telephone exchanges, and computer facilities for storage and retrieval of data.

In terms of international trade, the world market for data processing systems amounted to $50 billion in 1980 and this market is expected to grow at an annual rate of 17 per cent.[2] Simultaneously, the market for telecommunication equipment is estimated at $30 billion with an annual growth rate of 8 per cent. The incomes generated by TBDF are increasing because of the application of a technology that is synergetic in its impact. It is difficult to segregate the input of information in an economic production function. For example, the technology is convergent not only because of the merger of computers with telecommunications, but because information technology has become an integral part of

the production process of most other industries, be they automobiles, aircraft, steel, or construction. Therefore, as international trade grows in complexity, global concern is being expressed regarding the future of trading prospects of high technology and developing countries. In an age of computerised networks, LDCs feel threatened by a repetition of historical trading patterns which, in future, may once more relegate them to suppliers of primary data and importers of sophisticated information systems.

Market imperfections for information goods and services have added to the apprehension of developing countries and compel them to join the 'countertrade' movement. At present countertrade transactions constitute 25 to 30 per cent of total world trade. A recent study states that countertrade plays an important role when quality information is not available.[3] This is the case with East-West trade in Europe for which information lags affect the pattern of trade. A better example of countertrade is Brazil's decision to commission a communication satellite from Canada's Spar Aerospace jointly with Hughes Aircraft. These two companies have, under the terms of the agreement, contracted to import $130 million worth of Brazilian exports into Canada. This trend may result in industrialised countries having to export markets as substitutes for credit. However, such a trend may have a trade limiting effect if it ushers in a retreat to bilateralism.

THE ROLE OF TRANSNATIONAL CORPORATIONS IN THE PRICING AND CONTROL OF TBDF

Control over data flows is difficult to measure chiefly because the content of information does not have a palpable physical construct which can be recorded by conventional accounting practices. In other words the flows are more or less intangible. This 'undetectability' of TBDF creates opportunities and problems of control, fraud, misuse, and flight of profits.[4]

In empirical terms the international data market has an oligopolistic structure because transnational corporations (TNCs) are major users of data flows and providers of the hardware and the telecommunication links. They have made long-term investments in value-added networks specifically dedicated to data transmission and use these to link their intracorporate flows via closed user group networks. TNCs monitor their affiliates and implement an integrated global strategy of production and marketing based on corporate data flows. The economic effects of such control are

mainly on the international division of labour. Developing countries can only indirectly benefit from the system as host countries but without their own telematics networks. While the pool of scientific knowledge grows, access by LDCs is limited due to investment costs and lack of regulations for widening participation in TBDF. Table 1 shows the geographic concentration of data bases which becomes a cause of concern to those countries wishing to access data. Payments for access are becoming significant in the balance of payments of user countries, mostly developing ones. As deficits mount, policy gets directed to intervention and control over imports which may prove detrimental not only to trade but to the development prospects of host countries. TNCs do not have the same impact on all host countries but they do contribute to the adverse balance of payments of host countries if the data flows and related services are largely imported.

Table 1. Reference Data Bases and Data-Base Records Distribution

Area	Year		
	1975	1977	1979
USA:			
Number of Data Bases	177	208	259
Number of Records (million)	46	58	94
Other Developed market economies:			
Number of Data Bases	124	154	269
Number of Records (million)	6	13	55

Source: ASIS (American Society for Information Science), *Bulletin*, 7, December 1980, pp. 27–9.

Apart from the geographic concentration, TBDF has enabled TNCs to internalise opportunities for data transmission and bypass normal trade channels altogether. The ten largest data base distributors in the USA are:

McGraw Hill
OCLC Inc.
Equifax
Reuters
Dun & Bradstreet, Inc.
Mead Data Central
DIALOG Information Services, Inc.
Bunker Ramo Corporation
Dow Jones and Company
PRC Realty

These are on-line data bases which TNCs use but are not prepared to share with LDC users who may become potential domestic competitors in host countries. Even within developed countries there is a growing apprehension of US domination of the market for computer communications. Sweden, West Germany, France,

Norway, and Denmark are all enacting privacy legislation and non-tariff regulations to control the transmission and storage of personal data in foreign countries. This tendency alarms transnational corporations because data protection laws would interfere with their operations and have a negative effect on their profits.

As TNCs derive more and more economies of scale and economies of specialisation from their control over TBDF, the policy options for pricing these flows become limited. In the US alone there are two million computer systems in use as of 1981 and it is anticipated that this number will rise to seven million by 1984. The current total value of installed bases of $140 billion will mount to a quarter of a trillion dollars by 1984. While data flows are as subject to market forces of supply and demand as any other commodity, their prices are declining chiefly because of the lower costs of information processing and telecommunications hardware.

The concentration of production activities in the data processing industry by TNCs has introduced the issue of data technology dependency and domination. TBDF have evoked a whole set of national sentiments sensitive to areas of privacy, piracy, and the race for technological supremacy and control of markets. The contribution of information related hardware to GNP has been growing particularly in the United States. *Fortune* estimated that leading exporters in information goods have a high percentage of export sales as a proportion of total sales as shown in Table 2. The ten companies in the table rank among the *Fortune* 500. The data show the growing share of the information sector in the exports of the corporations.

It is becoming increasingly clear that the relevant economic distance between nations hinges on factors such as the quality of data transmitted and received, the quality of the communication media, and the availability of communication channels and supporting services.[5] The economic efficiency of international markets will depend on access to communication channels and informational resources as much as on differences in information endowments. Economic theory ascribes market failures not merely to a breakdown of factor endowments principles and comparative advantage but at the micro level to organisational failures due to inadequate and unreliable information.[6] TNCs replace information acquisition through market channels by vertical integration and internalised information flows. From an organisational point of view TNCs are responding to problems of resource allocation within an informationally constrained environment. This leads to a negative perception about unrestricted data flows associated with TNCs. These concerns get magnified for those countries whose

Table 2. US Leading Exporters in Information Goods

Rank		Company	Products	Total Exports as Per Cent of Sales
1981	1980			
9	9	IBM	Information handling systems, equipment	6.39
11	13	Westinghouse	Generating equipment and defence systems	14.00
12	19	Signal Companies	Trucks, engines, audio-video systems	22.81
17	19	Hewlett Packard	Electronic equipment	27.14
29	38	Digital Equipment	Computer systems	21.42
36	35	Rockwell International	Electronic, automative, and industrial equipment	7.51
37	39	Sperry	Computer systems and equipment	9.45
45	48	Minnesota Mining and Manufacturing	Industrial, health care, graphics, electronics products	6.52
47	47	Control Data	Computers and equipment	13.29
50	45	Emerson Electric	Electronic components	20.59

Source: *Fortune* 9 August 1982.

industrial mix has a disproportionate percentage of foreign owned organisations. Under these circumstances national controls over data flows are rationalised on grounds of national security, economic vulnerability, and infringement of the country's legal system.

TRADE PROTECTIONISM AND TBDF

In 1980 approximately 46 per cent of world trade was controlled by tariff and non-tariff barriers. The General Agreement on Tariff and Trade (GATT) concedes that a large portion of traded goods is adversely affected by import restrictions introduced by industrialised nations. The trend for greater protectionism which started with the oil crisis challenges TBDF in an interdependent world, even though the costs of such a protectionist policy are likely to exceed the benefits. Industries in the information area are so internationalised that the issues are difficult to assess in national terms. Problems of debt payments, recession, and unemployment in the high technology countries are setting a pattern and a drift

towards protectionism. Reciprocity and retaliation are being favored by architects of commercial policy. GATT principles do not cover trade in services although GATT has begun to take note of the importance of this sector to the accounting of international transactions. This is the key concern of the information processing industry.

Protectionism has taken the form of restrictions on data flows, specification of equipment to be used, location of storage and monitoring of distribution.[7] Sweden initiated non-tariff barriers with a Data Act enacted in 1973. There are, in ten years, 22 countries actively enacting or considering laws to regulate TBDF. West Germany prohibits a company from bringing internationally leased lines into the country unless they are wired into a single terminal or terminate in a computer which will process the data and then distribute it to users. This is not a privacy regulation but an economic non-tariff trade barrier. Japan places similar restrictions on data transfer over the leased lines of KDD (Kokusai Denshin Denwa Company). Brazil has set up a commission to control TBDF and to acquire computing equipment. Norway, Denmark, Austria, Luxembourg, Canada, and Mexico have a variety of restrictions on data flows and usage. France has imposed a duty on computer software imports. This trend negates the benefits from international division of labour.

Tariff policies and data protection legislation in Europe are based on the common objective to confront the impact of US technological superiority in computer communications. The PTTs in Europe are apprehensive of revenue diversion if private networks proliferate.[8] Likewise, Third World informatics policies are directed towards stemming the tide of information processing dominance in their countries by the exports of industrially advanced countries. While these countries asserted the critical usefulness of informatics to development at the SPIN Conference in Torremolinos in 1978, they expressed concern over the establishment of information power zones which would reduce LDCs to mere peripheral agents. If such trends materialise there would be an additional claim for greater equity in the proposed new world orders for communications and economic systems.

Trade barriers on data flows are closely related to the negative impact of foreign-based data processing centers on the balance of payments of trading nations. Even though the technology of the eighties is introducing substantial cost reductions and greater decentralisation in data distribution, the problem of 'time-lag' in penetration of telecommunications technology between the developed and developing countries will remain unsolved.

Telecommunication companies in Europe and Japan receive a fair measure of protection from their governments because GATT excludes telecommunications from its Procurement Code. Under such conditions data flows get categorised as telecommunications in order to give them immunity from international competition.

This entire issue of emerging protectionism, based either on infant industry arguments or on the need to prevent electronic imperialism, refutes traditional trade theory inasmuch as comparative advantage is now man-made, stemming from mastery of science and technology. The accumulating factor is information intensity. But microelectronics has enabled this factor intensity to pervade so many spheres of production that the negative effects on national income get neutralised. In fact, the availability of information intensity has increased the gains from trade for several NICs (Newly Industrialising Countries). These are now faced with the threat of robotisation in information technology within developed countries. Whatever the method of technology transfer, the relocation of information processing industries in LDCs operates imperfectly and with considerable lags. It is this technology gap that forms the basis of trade in data flows. In terms of opportunity costs of investment in acquiring the technology for themselves, developing countries will find import substitution counter-productive, eventually adding to social costs. As such, protectionist policies are premature.

If protectionism is based on privacy rights, in economic terms such rights can be conceptualised as a right to property like land and other tangibles. In this case the principle for policymakers should be based on the value of the data used to ascertain if that value for a single economic activity exceeds the cost of privacy intrusion (real or potential). If such a framework gets established then data will flow to its highest value use. On the other hand, if data flows are protected by exclusive use provisions then transaction costs resulting from multilateral contracting between a data vendor and a host of buyers would be formidable. Protectionism based on privacy considerations would then impair the allocative efficiency of data inputs for production.

Both Europeans and Americans want free flow of data but the Europeans want it through regulation and the Americans want to support a framework of rules to ensure free flows. The objective is the same, namely to prevent freezing of research and development in the application of innovative technology. In this context Matthew Nimetz called for unified national policies to introduce "barriers against barriers".[9] The new international regime may require voluntary agreements to minimise restrictive trends in an age of growing interdependence.

The major cause of concern resulting from protectionist policies is the threat of a global trade war in services. In high technology industries the link between merchandise trade and trade in services is very strong. Already services account for 25 per cent of the total value of international trade. Furthermore, trade in 'invisibles' is growing at 24.2 per cent whereas trade in merchandise is growing at 21.7 per cent. Therefore, the US raised the issue of trade in services at the GATT ministerial meeting in 1982. While the GATT procedures move slowly, technology will not wait. TBDF is expanding exponentially. Foreign data companies have begun to explore the American market which is estimated at $25 billion in 1982 and growing to $100 billion in 1990. If reciprocity in terms of restrictions begins to multiply there will have to emerge an international legal regime to make the future of computerised societies less vulnerable to trade wars than currently.

WELFARE IMPLICATIONS OF TBDF

It is not just the cost/benefit aspect of a trade policy that requires quantification of welfare, but economic relationships have to be measured in order to ascertain which changes in trade policy are desirable for economic welfare. When information technology enters the welfare calculus, market distortions have to be assessed against satisfying the first-best condition that free trade is better than no trade. Under conditions of oligopoly in the supply of computers, the holding of data bases, and the launching of satellites, global welfare is conditioned by the second-best proposition of restricted trade being better than no trade. This solution gets further limited for LDCs who rely on transnational corporations for their information processing services and their telecommunications hardware.

It is difficult to extend the welfare hypothesis used in conventional trade theory to information flows because external economies are divergent between information-rich and information-poor countries. Divergences stem from differences in wage-price ratios, from differences in private and social marginal rates of transformation, and from differences in communication networks. Considering only the allocative part of the concept of welfare without introducing considerations of compensation, the allocation of information resources cannot be optimised only through trade. While the share of developing countries in world trade in information goods and services is increasing as a proportion of the value of total world trade, their success is as much

the result of their own efforts as of the welfare effects of the trading system. Their participation in systems of electronics fund transfer, telex, and facsimile via satellite and computer-to-computer networks all facilitate greater information inputs into their production and export activities. They are able to diversify their trade patterns so that they can offset the decline in terms of trade by gains in export receipts. Part of this welfare impact results from growing south-south trade which is based on economies of specialisation among LDCs themselves. The World Bank Report (1981) includes the finding that the services sector generated one-third more revenue for developing countries for exports than did agricultural exports for the year 1980. Reciprocity demands could become unidirectional if low-income countries are called upon to reduce their import barriers against data flows but are not given matching concessions by industrialised countries.

The Brandt Commission's new 1983 report, *Common Crisis*, puts trading countries of both hemispheres on alert because the common crisis impacts the welfare of both north and south. Countries of the south have always been vulnerable to business slumps in the north but because of instant communication networks, the industrial countries have become vulnerable to economic depression in the developing countries. Massive debt defaults are not only shaking the foundations of international banking but slowing the recovery for First World democracies.

According to a report in *Business Week*, the main engine of growth in the global economy during 1980–81 was the Third World.[10] It expanded at a growth rate of 3.1 per cent annually against 0.9 per cent for the industrialised countries. Real output for LDCs grew by 3.3 per cent against 0.2 per cent for the more developed countries. Europe now finds its exports to the LDCs declining and this trend is a threat to the recovery of industrialised countries. US exports to Mexico have fallen by $5 billion during 1982. This means that LDCs can no longer fuel the recovery of First World countries because they are themselves in the depths of a recession. In contrast to the Soviet bloc of countries the Third World market is crucial to the recovery of the north. LDCs accounted for 40 per cent of US exports in 1982 and 28 per cent of all exports from the 24 OECD countries. UNCTAD claims that the welfare effects of this expanding trade are skewed in favour of the First World and compensation demands are growing. The massive transfer of resources demanded by the LDCs is falling into place not because of governmental aid but because of loans from Western commercial banks. The Third World owes $640 billion to these banks but the welfare effects have been unevenly spread. Brazil,

Mexico, Argentina, Nigeria, and Venezuela have received more bank loans than the poorest nations of Asia and Africa.

Consequently, developing countries will have to find practical solutions to the newer problems of trade imbalance generated by information goods and services. The imbalance is not just confined to the rich and poor nations but is between the developing nations themselves. Trade is essential to keep the massive loans of Western banks afloat. South-south trade does not earn hard currencies for LDCs, who either have to export to hard currency areas or obtain credit. Awareness of this intractable nature of the crisis has led LDCs to rethink their attitude towards TNCs in general and communication hardware suppliers in particular. There is now greater willingness to ascribe a developmental role to TNCs. This may lead to a restructuring of the global economy if only protectionism in the industrialised countries could be eased and liberalised. In the context of TBDF, greater technology intensive production processes may impinge on levels of employment, making protectionism more regional, sectoral, and national. Trade in data flows is leading to more bilateral trade relations and countertrade contracts which will further restrict free trade and reduce the welfare impact of free flow of information.

In the ultimate analysis the welfare effects will be determined by which industries are being strengthened by information technology and which are being weakened.[11] The declining costs of micro-computers should lead to decentralisation of information storage and retrieval. In turn such decentralisation can admit developing countries to international computer network systems. Whether the technology is benign or results in social anarchy will depend on the objectives of international communication systems and the policies for achieving them. Trade in information flows continues to grow and may soon become the most important single determinant of the dissemination of an information society. International policy with regard to information flows will have to be geared to specific objectives, the most important criterion being to devise a global objective which is "functionally useful" in assisting policymakers to select a strategy from existing options.[12] The process of mutually agreeable negotiations will be beset by commercial and national sovereignty considerations, among others. As TBDF grows in volume and value it becomes more difficult to allocate resources on the basis of economic efficiency coupled with distributive equity.

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