The Local/Global Integration of MNC subsidiaries and their Technological Behaviour: Argentina in the Late 1990s

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Abstract

This paper examines reasons for differences in the innovative activity of MNC subsidiaries in the context of a late industrialising host economy, Argentina in the late 1990s. It builds on our earlier work which demonstrated that local spillovers from FDI did arise, but not as a generalised consequence of all kinds of FDI-mediated technology transfer from parent companies. Instead spillovers were associated with the existence of significant knowledge-creation and related innovative activity undertaken by the local subsidiaries themselves. That local technological behaviour varied widely between subsidiaries. We have provisionally explored reasons for this variability, highlighting the possible significance of location-specific factors. In this paper we examine the importance of the subsidiaries’ functional integration within (a) their global corporations and (b) the host economy. The results show that functional integration into the local economy is on its own associated with low levels of local innovative activity. In contrast, close corporate integration has positive effects on local innovative activity under particular conditions - when subsidiaries also functionally integrated into the local economy or when they are integrated into global markets as well as the global corporation.
1. INTRODUCTION

This paper is about the technological capabilities and innovative activities of MNC subsidiaries in middle-income, late-industrialising countries. It follows earlier work in which we indicated that, in the case of Argentina, these capabilities and activities played a central role in generating FDI-related spillovers in the host economy. We challenged the conventional model that sees such spillovers as driven simply by the international transfer of superior technology from parents to subsidiaries and its subsequent ‘leakage’ to other firms in the host economy. In particular we questioned the presumption that subsidiaries played technologically passive roles in the knowledge-pipelines that are supposed to link parent companies’ knowledge stocks to productivity effects among locally owned firms in host economies. Instead, following research over recent years giving much more attention to the roles of MNC subsidiaries (Birkinshaw and Hood, 1998; Paterson and Brock, 2002), we argued that any significant spillover effects were likely to reflect the active accumulation and creation of knowledge on the part of subsidiaries themselves. Our empirical results matched this perspective

These findings prompted the obvious question: what could explain the underlying heterogeneity of innovative activity by the MNC subsidiaries? An equally obvious answer was that it reflected well-known differences in the inherent ‘technology-intensity’ of broad groups of industries. It seemed plausible that the types of industry with relatively high/low levels of R&D-intensity (and associated innovative activities) in the advanced economies would have correspondingly high/low levels of innovative activity when they were relocated via FDI into middle-income economies like Argentina. However, this proved not to be the case. The heterogeneity of subsidiary behaviour did not appear to be an industry effect, reflecting in Argentina simply a paler shadow of broad inter-industry differences in the more advanced economies.

If we set that aside as an explanation, the literature provides surprisingly little guidance about other possible answers. This may seem surprising since there is now a well-established body of literature about MNC strategies and the international location of their innovative activities (e.g. Ghoshal and Bartlett, 1988(a); Nobel and Birkinshaw, 1998; Pearce, 1999, Kuemmerle, 1999; Zander, 1999; Kumar, 2001; von Zedwitz and Gassman, 2002). However, much of the previous research in these areas has identified patterns that are common to particular industries and/or locations, not patterns of differentiation within industries and locations - our puzzle in the case of Argentina. Also, hardly any of this analysis relates to the particular conditions of late-industrialising, middle income countries – the focus of our interest.

We therefore pursued the question further in this paper. In doing so, we examine the influence of the structural position of subsidiaries within their corporate organisations and the host economy. In particular we focus on a distinction that has been prominent in research on the strategy and structure of MNCs since at least the mid-1980s and studies such as Doz and Prahalad (1984), Porter (1986), Bartlett (1986), and Prahalad and Doz (1987). In slightly differing ways, the distinction has identified two types of corporate structure: (i) those in which the functions and roles of subsidiaries are closely integrated into the overall global activities and strategies of the corporation as a whole, and (ii) those in which subsidiaries, being more ‘responsive’ to the specificities of national/local situations, have greater responsibility for a wider range of functions and are more integrated into the local economy as parts of ‘country-centred’ or ‘multi-domestic’ corporate structures.

Differences in the structural position of subsidiaries with respect to these two dimensions have been shown to have important implications for the nature and scale of subsidiaries activities in
host economies. For instance Jarillo and Martinez (1990) examined aspects of MNC subsidiary behaviour, including their R&D, in Spain in the 1980s and early 1990s. They noted in particular a distinct trade-off between two types of structural position occupied by subsidiaries. Between the early 1980s and the early 1990s, many of them moved towards greater corporate integration at the expense of localised integration. As a result, many Spanish subsidiaries “... are losing some ‘Spanish content’” – apparently including some of the Spanish content of their R&D (p.501). We explore that kind of relationship in our study in Argentina.

For at least two reasons Argentina provides a particularly appropriate and demanding context for examining the heterogeneity of innovative behaviour of foreign affiliates in industrialising economies. First, it has a relatively FDI-intensive industrial economy, reflected for example in the fact that FDI via wholly owned MNC subsidiaries accounted for 50% of the largest industrial firms in 2002 (Kulfas et al, 2002). Second, it is a mature industrialising economy with substantial human resources and prior industrial experience, constituting a substantial base for developing innovative capacities. At the same time, two other features of Argentina add to its value as a case study context. On the one hand, it went through a phase of radical macro-economic change in the 1990s, and our data for the late 1990s may reflect a common post-reform experience of other industrialising countries that went through similar phases in the 1980s and 1990s. Second, Argentina has a record of economic and political instability and uncertainty which is a common characteristic of industrialising regions, perhaps especially in Latin America (Cimoli and Katz; 2003, Arza, 2005).

The empirical analysis uses information provided by the national Innovation Survey (1998-2001), though we have excluded the effects of the extreme instability of the financial crisis that began in 2000 by using only the data for 1998. The Innovation Survey is a novel source of information for this type of study of MNC subsidiaries, providing both detailed information about their behaviour and a large number of observations (333). The survey, following the broad framework of the Oslo Manual, provides information about a wide range of technological activities at the firm level. We use this data to construct a range of indicators of the innovative activity of MNC subsidiaries, and also of their functional integration within (i) their global corporations, (ii) global markets and (iii) the local economy.

We combine these indicators to identify five groups of subsidiaries with differing structural positions with respect to local/global integration. We find that these groups differ significantly in the levels and types of innovative activity they undertake. In particular we identify only two groups with relatively high levels of local innovative activity, and both of these involve subsidiaries that are highly integrated into their global corporations.

The structure of the paper is as follows. In the next section we review previous research and outline the hypotheses explored in the paper. In Section 3 we explain the methods used, and we report the results in Section 4. The findings are discussed in Section 5.
2. OUR ANALYTICAL FRAMEWORK AND HYPOTHESES

2.1 The broad analytical framework

The broad framework for our study is summarised in Figure 1 below. The dependent variables in the analysis (Block C) relate to various aspects of the innovative behaviour of subsidiaries. We focus on these because, as noted above, we believe the heterogeneity of subsidiaries’ technological behaviour constitutes an important condition underlying differences in technology-related spillovers associated with FDI.

In common with most studies of firm-level innovation in industrialising economies, we take a broad view of innovation. This encompasses both the activities performed (not merely R&D but also a wide array of design and engineering activities), and the outputs they generate (not just innovations that are globally novel and reflected in patents but, much more common, a wide range of major and incremental changes that are novel with respect to the local industry or firm itself). Moreover, such locally innovative activities and outputs may encompass much more than new kinds of product and process hardware, but also new form of organisation and procedure. We elaborate in Section 3 on these variables and the indicators used.

Since there is considerable complexity about the interactions between variables within Block (A), as well as complexity and ambiguity in the relationship between those variables and the degrees of corporate/local integration of functions in Block (B) in this paper we simplify our task by setting aside any further consideration of the of issues covered in Block (A), and we...
focus on the relationship between subsidiaries’ patterns of functional integration and their innovative activities in host countries. Also, as elaborated a little in the next section, we try to take considerable care with the terms and concepts we use in dealing with ideas about the functional integration of subsidiaries.

Our central focus is on variables in Block B concerned with the structural positioning of subsidiaries in relation to two aspects of their contexts: their global corporations and their local host economy. As summarised earlier, we build on a well established conceptual framework in this area that has distinguished between two dimensions: (i) differing degrees of integration within the global corporation and global economy and (ii) differing degrees of functional localisation and integration within the host economy.

With roots in earlier work on the centralisation/decentralisation of corporate structures and strategies, studies focusing more specifically on MNCs in the 1980s opened up the analysis of broad concepts of globally integrated and locally dispersed functional structures. For example, Porter (1986) defined a set of strategies for MNCs based on a combination of (a) geographically dispersed/concentrated configurations and (b) high/low co-ordination of activities (p. 27). Similarly, Bartlett (1986) distinguished between MNC strategic responses to forces driving towards (a) greater global integration and (b) greater national differentiation. Subsequently Jarillo and Martinez (1990) developed a framework based on similar concepts in their analysis of the structure of a wide range of activities of subsidiaries in Spain.

The corporate integration/localisation dichotomy has also been applied more specifically to issues about technology and innovation in the MNC. It underpinned Ghoshal and Bartlett’s (1988a) identification of two dominant modes of MNC innovation: (i) “center-for-global” innovation that was largely undertaken at the corporate centre, with dispersed subsidiaries undertaking at most only minor complementary activities that were highly integrated into the corporate structure and processes; and (ii) “Local-for-local” innovation in which large proportions of the innovation functions were localised at subsidiary level, with outputs destined primarily for application in local production and/or markets. With respect to our later findings, it is pertinent to note, however, that Ghoshal and Bartlett also identified a small number of cases where new organisational forms were emerging that combined aspects of these extreme forms of centralisation/decentralisation: (iii) “local for global” innovation (later called “locally leveraged” innovation – Bartlett and Ghoshal, 1997) that involved locally originated innovation that later diffused more widely in the global corporation; and (iv) “Global-for Global” innovation (later “globally linked” innovation) that involved the combined innovative activities of dispersed organisational units of the corporation within an integrated global innovation process.

Variations on this kind of distinction in the way MNCs organise their R&D have been developed in numerous later studies such as Nobel and Birkinshaw (1998), Pearce (1999) and Zander (1999). An interesting further development has been made by von Zedwitz and Gassman (2002), who identified a four-quadrant typology based on distinctions between centralised and dispersed execution of the two distinct functions of R on the one hand and D on the other.

We elaborate in the next section on the particular approach we take to the application of these integration/localisation concepts in our study of subsidiaries in Argentina.
2.2 Subsidiaries’ structural positioning: an elaboration of the concept

Given the complexities and ambiguities outlined above, we try to disconnect our specification of the concepts of local/corporate functional integration from presumptions about the possible correlates or causes of difference on those dimensions. Hence we set these ideas within an overall concept of “structural positioning” which we hope is relatively neutral with respect to ideas associated with terms like autonomy, control, dependent, receptive, strategy, subsidiary development, active/passive and so forth. We also make three modifications to the basic form of framework that has been most commonly used. These can be outlined with reference to Figure 2 below which combines the two dimensions of corporate integration and functional localisation, but identifies five structural positions of subsidiaries.

![Figure 2](image-url) The Structural Positioning of MNC Subsidiaries

First, we take a specifically technology-centred perspective on the localisation/integration dichotomy. We suggest that the two dimensions reflect two alternative mechanisms by which subsidiaries may acquire and accumulate the knowledge and capabilities to generate innovation: from the parent and other companies in their global corporations, or by building and accumulating them at the local level. We therefore restrict the scope of the analysis by focusing on the integration/localisation of a limited range of functions: those that are technology-related. In connection with the corporate integration dimension we do so exclusively. In the case of functional localisation we take a somewhat broader view of the functions involved and include both technology related functions and others concerned with wider roles in the firm’s value chain. We distinguish between (a) the local existence of technology-related functions such as R&D or design and (b) the scale and other attributes of the activities involved. The first is an aspect of the subsidiaries’ functional localisation; the latter constitute aspects of the innovative behaviour of subsidiaries. As we shall see later, the two may diverge widely.

Second, we take an unusual approach to the lower-left quadrant which is commonly left ‘unoccupied’ in other applications of this kind of typology, for example, in Bartlett (1986) or Jarillo and Martinez (1990). However, in the context of emerging/developing economies like
Argentina, both the levels of competition and the technological complexity of demand are typically relatively low. Consequently there may well be a considerable number of subsidiaries which, focusing on the relatively ‘easy’ local market, have neither a significant level of integration into the technological functions and resources of the parent corporation nor a significant array of their own localised technological and other functions. We therefore consider this group of *Dually Isolated* subsidiaries a potentially relevant category.

Third, we also take a somewhat unusual approach to the top-left quadrant. The standard approach quite reasonably presumes that a subsidiary that is highly integrated into the corporate structure will also be well integrated into global markets – exploitation of global market opportunities is, after all, the purpose of corporate integration of technological functions. However, in the relatively ‘easy’ markets of economies like Argentina, MNC subsidiaries may undertake locally only quite limited technological and other functions to serve only domestic, not global, markets, while being highly integrated into the technological functions of the corporation. Consequently, within the overall *Globally Integrated* category, we distinguish conceptually between (a) subsidiaries that are highly integrated within the corporation only (*Corporately Integrated*), and (b) those that are highly integrated within both the corporation and global markets (*Fully Globally Integrated*).

### 2.3 Our Hypotheses

We develop hypotheses with respect to the four segments of Figure 2 above. However we believe that on some issues the literature provides an adequate basis for advancing alternative hypotheses in this area that seem equally plausible *a priori*. We therefore adopt a relatively ‘open’ perspective and, where relevant, outline alternative contradictory propositions. In summary, these combine the following arguments.

In more detail, the hypotheses are developed as follows.

**1. Low corporate integration and low functional localisation: Dually Isolated subsidiaries**

Since these subsidiaries occupy a position of low integration into the technology-related functions of the global corporation, their technological behaviour is unlikely to be affected by the parent: neither constrained by control nor supported by corporate resources. At the same time with only a limited range of functions undertaken locally, they are unlikely to engage intensively in innovative activities. Consequently:

*H.B.1 Subsidiaries with Isolated structural positions are likely to demonstrate low levels of innovative activity.*

**2. High corporate integration and low localisation: Globally Integrated subsidiaries**

There appear to be two lines of argument about global integration in the literature, and also more generally in policy debate.

First, in some perspectives, high corporate integration is seen as reflecting high levels of control, linked to corporate interests in minimising duplication and aligning dispersed innovative activities with overall corporate interests. In many host-country contexts, therefore, one would expect high levels of corporate integration to be associated with relatively low levels of local innovative activity, especially when (as in this segment of the
quadrant) corporate integration is associated with a limited range of functions being undertaken locally.

Second, however, the perspectives underlying that hypothesis may be unduly focused on more advanced forms of R&D and globally novel forms of innovation, giving inadequate attention to D, D & E functions involved in a wider range of innovative activities – for example, those associated with incremental product and process upgrading to sustain a subsidiary’s competitiveness in domestic or export markets. There is a growing body of evidence to suggest that MNC subsidiaries pursue such wider forms of innovation relatively intensively. Moreover, parent companies can draw on the global resources of the corporation to provide various forms of support for such innovation, without establishing formal structures for the localisation of R or D or design functions in the subsidiary.

But this supportive role of corporate integration is may not hold across all circumstances, and is more likely to be contingent on other factors. In particular, it may depend on the extent of the subsidiary’s strategic significance for the parent or group as a whole. For example, where a subsidiary has a substantial role in linking the corporate group to the host country market, ‘supportive’ forms of corporate integration are more likely; and the same will probably hold when a subsidiary plays a large role in linking production in the host economy to global markets.

Consequently we have three hypotheses with respect to global integrated structural positions, two alternatives relating to corporate integration on its own, and one relating to full global integration.

H.B. 2.1 Subsidiaries with Corporately Integrated structural positions (by definition involving low localisation of technological and other functions) are likely to demonstrate low levels of local innovative activity

H.B. 2.2 Subsidiaries with Corporately Integrated structural positions (despite their low localisation of technological and other functions) are likely to demonstrate high levels of local innovative activity.

H.B. 2.3 Subsidiaries with Fully Globally Integrated structural positions are likely to demonstrate high levels of local innovative activity.

3. High localisation and low corporate integration: Locally Integrated subsidiaries

A key feature of this position is the breadth and depth of the functional localisation, encompassing not just technology-related functions but also a relatively wide array of roles along a firm’s value chain, a structure that is likely to be relatively intensive in its demands for supporting innovative activities. This kind of structure is also likely to be associated with some maturity of the subsidiary in host economy and also with relatively high firm size, both likely to reinforce the development of innovative activities. Consequently:

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1 An exception to this is likely to arise in knowledge-rich host country contexts where subsidiaries pursuing knowledge-augmenting strategies might undertake relatively high levels of local R&D and perhaps a wider range of innovative activities as well. But if such subsidiaries are quite narrowly specialised in advanced R&D functions (e.g. ‘outpost’ laboratories not associated with local production or marketing), they would fit the low localisation conditions of this quadrant.
H 3 Subsidiaries with Locally Integrated structural positions are likely to demonstrate relatively high levels of local innovative activity.

4. High corporate integration and high functional localisation: Dually Integrated subsidiaries

Subsidiaries in this position are likely to exploit both the mechanisms noted above for acquiring knowledge and related capabilities for innovation: (a) in the form of support secured via close integration of technology-related functions with their corporate group, and (b) via local accumulation associated with the extensive functional localisation and integration into the local economy. These subsidiaries would also have higher incentives to invest in such capabilities if they were also integrated into global markets. Consequently:

H.B. 4 Dually Integrated subsidiaries which combine locally integrated structural positions with high levels of corporate integration are likely to demonstrate relatively high levels of local innovative activity.
3. DATA AND METHODS

3.1 The data source and sample

The empirical analysis reported here uses information provided by the National Innovation Survey in Argentina (1998-2001). The sample used in the survey (1688 firms, 333 of which are MNC subsidiaries) is representative of the total population of industrial firms in the country. The survey provides basic economic information at firm level for 1998 and 2001 (size, age, exports, imports, sales, employment, etc). In addition, following the broad framework of the Oslo Manual it provides information about a wide range of technological activities at the firm level. We draw on the two sets of information for the year 1998 to compute several measures of economic performance and technological behaviour on the part of the sample of 333 MNC subsidiaries.

3.2 Measuring the structural positions of MNC subsidiaries

As outlined above, we focus on three dimensions of the structural positioning of subsidiaries: (i) their integration into the MNC global corporation; (ii) their integration into global markets; and (iii) the localisation of their activities and functions. The mode of analysis rests on a typology that classifies firms into a small number of categories on the basis of their ‘High’ and ‘Low’ positions on each of these three dimensions, and these three dichotomies are combined to develop a typology of five types of structural position that might be taken by subsidiaries. The indicators and classification methods used to identify these types of structural position are outlined below.

3.2.1 The degree of integration into the global corporation

As explained earlier, our intention in this paper is to focus quite specifically on integration with respect to the ‘technological’ functions of the corporation. Consequently the degree of integration into the global corporation was identified on the basis of the subsidiaries’ responses to questions in the Innovation Survey about the following three issues.

(i) The Main sources of information for innovation activities.
The Survey asked firms about the importance of alternative sources of information for innovation activities. Headquarters and other affiliates were two options among eleven possible sources offered by the Survey. Others included internal sources, competitors, suppliers, domestic institutions, journals, etc. The firms were asked to rank the importance of any sources identified.

(ii) Financial resources for innovation activities.
The survey asked firms about sources of financing for their innovation activities. Parents and other affiliates were two of twelve options provided. Others included internal resources, partners, suppliers, clients, banks, etc.

(iii) Interactions with other agents for solving problems in innovation.
Firms were also asked about their main interactions with other agents for solving problems. Parents and other affiliates were two of twelve options provided. Others included universities, technology centres, suppliers, consultants, etc. (More detail about this Survey question is provided in section 3.3.3 below)

Cutting across these three issues, subsidiaries were classified as demonstrating High Integration into the global corporation when they:
a) identified headquarters or other affiliates as ‘very important’ sources of information for their innovation activities, and
b) indicated that they received more than 20% of their financial resources for innovation activities from the corporate group, and
c) indicated that interactions with their parents and other affiliates were very important for their problem-solving activities.

All other subsidiaries were classified as showing Low Integration in the global corporation.

3.2.2 The degree of localisation of functions.

As indicated earlier, the concept functional localisation relates here to localisation with respect to the subsidiary’s ‘technological’ functions, and it is simply concerned with the existence of activities concerned with these functions, not with their scale, effectiveness, etc. But in the case of localisation, the concept also relates more broadly to the subsidiary’s position (or roles) in its own value chain. Measurement was therefore based on the use of responses to five questions in the Survey:

(i) The origin of the products sold by the company
Firms were asked to identify the proportion of their sales arising from two possible origins: goods produced by the company (own products) or other firms’ products.

(ii) The importance of imports of final goods
Firms were asked to identify the proportion of their total imports falling into four categories: inputs, parts, final products and capital goods.

(iii) The existence of R&D facilities
Firms were asked whether or not they had R&D laboratories.

(iv) The existence of specialised design employees
Firms were asked whether or not they employed workers exclusively in the design function.

(v) The use of different types of systems and equipment in design tasks.
Firms were asked about the use of different systems and equipment for their main tasks. Among the alternatives provided to the company the Survey included three systems, which are utilised exclusively for design tasks: CAD, CAT and CAE.

Subsidiaries were classified as demonstrating a High Localisation of functions when:

a) more that 60 per cent of their sales consisted of their own products, and
b) less than one-third of their imports consisted of final products, and
c) they had an R&D laboratory or employees exclusively dedicated to design, and
d) their localisation of design functions involved the use of CAD, CAT, or CAE systems.

All other subsidiaries were classified as demonstrating a Low Localisation of functions.

3.2.3 The degree of integration into global markets

The Innovation Survey asked firms about the total value of sales, exports and imports. We used the responses to calculate a firm level ‘openness coefficient’ (exports plus imports as a
proportion of total sales). Subsidiaries with a coefficient higher than the median (around 20 per cent) were classified as demonstrating *High Integration* into global markets and those with coefficients less than the median were classified as demonstrating *Low Integration*.

### 3.2.4 A synthesised typology

The distribution of subsidiaries with respect to each of the three types of structural position is shown in Table 2

**Table 2 Classification of the Structural Positioning of Subsidiaries**

<table>
<thead>
<tr>
<th></th>
<th>A Degree of integration into the global corporation</th>
<th>B Degree of localisation of functions</th>
<th>C Degree of integration into global markets: within High A plus Low B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(No. of Subsidiaries)</td>
<td>(No. of Subsidiaries)</td>
<td>(No. of Subsidiaries)</td>
</tr>
<tr>
<td>‘High’</td>
<td>120</td>
<td>110</td>
<td>41</td>
</tr>
<tr>
<td>‘Low’</td>
<td>213</td>
<td>223</td>
<td>34</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>333</strong></td>
<td><strong>333</strong></td>
<td><strong>75</strong></td>
</tr>
</tbody>
</table>

These classifications are combined to yield a set of MNC subsidiary types, reflecting the earlier discussion of subsidiaries’ structural positioning. The primary dimensions of the typology are the degree of corporate integration and the degree of localisation of functions. These yield a 2 x 2 set of ‘High-Low’ combinations. However, we subdivide one of these (High corporate integration plus Low localisation) by distinguishing between high and low integration into global markets. This results in the following set of five types of subsidiary.

**Table 3 Typology of Subsidiaries’ Structural Positions**

<table>
<thead>
<tr>
<th>Type</th>
<th>Positioning Classification</th>
<th>Title in this study</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>Low corporate integration, Low functional localisation</td>
<td>Dually Isolated</td>
<td>148</td>
<td>44%</td>
</tr>
<tr>
<td>Type II</td>
<td>High corporate integration</td>
<td>Corporately integrated</td>
<td>34</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Low functional localisation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Low global market integration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type III</td>
<td>High corporate integration</td>
<td>Fully Globally integrated</td>
<td>41</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Low functional localisation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ High global market integration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type IV</td>
<td>Low corporate integration</td>
<td>Locally integrated</td>
<td>65</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>High functional localisation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type V</td>
<td>High corporate integration</td>
<td>Dually integrated</td>
<td>45</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>High functional localisation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>333</td>
<td>100%</td>
</tr>
</tbody>
</table>
3.3 Measuring the Innovation Activity of MNC subsidiaries

The Survey data were used to compute a number of different indicators of innovation-related activities of MNC subsidiaries. These fall into two broad groups concerned with: inputs to innovation (Section 3.3.1 below), and inter-organisational interactions involved in the process of innovation (Section 3.3.2).

3.3.1 Innovation inputs

This group of indicators captures an array of different kinds of input to innovation. They stretch beyond the limitations of narrowly R&D-based indicators to capture other kinds of input.

(i) Investment in disembodied knowledge. These include:
   (1) R&D expenditures,
   (2) Training expenditures
   (3) Expenditures on innovation-related industrial design,
   (4) Expenditures on innovation-related management
   (5) Expenditures on innovation-related consultancy

(ii) Investment in ‘embodied’ technology. These include:
   (6) Expenditure on capital goods for innovations,
   (7) Expenditure on IT hardware and software for innovation tasks,
   (8) Payments for technology transfer contracts.

(iii) Human capital. These include:
   (9) Skill intensity in production, measured as the number of engineers, other professionals and technicians employed in production as a proportion of total employment.
   (10) ‘Specialised’ Innovative Labour, Measured as the proportion of employees exclusively dedicated to R&D or design tasks.

These ten indicators are employed in three ways in the analysis. First, they are combined in three composite indexes of technological effort, calculated using factor analysis (see Annex 1 for an explanation of the methodology and weights). Second, the indicators included in (i) and (ii) above are aggregated into two categories: investments in ‘embodied’ and ‘disembodied’ technology. Third some of them are used separately, reflecting particular kinds of innovative activity undertaken by the firms.

3.3.2 Innovation-related interactions

The Survey asked firms a number of linked questions about their interactions with other organisations in connection with innovation and problem-solving. We used the responses from two of these.

(a) Whether or not they used interactions with any of eleven types of organisation: (a) Universities, (b) Technology Research Centres, (c) Laboratories, (d) Institutions of
Technological Co-operation, (e) Suppliers, (f) Clients, (g) Headquarters, (h) Other affiliates, (i) Other companies, (j) Consultants, and (k) Public Agencies.

(b) The geographic area where the identified organisations were located. They were given the following options: 1) Local, 2) Regional, 3) National, 4) Latin-America, 5) European Union, 6) USA or Canada, 7) Asia, 8) Others.

Three indicators of innovation-related interaction were constructed.

(i) **Networking intensity.** In order to reflect the general intensity with which the subsidiaries used interactions with other organisations in their innovation and problem-solving activities, an indicator was calculated:

(1) simply as the sum of all the ‘Yes’ answers to question (a) and (b). Consequently it includes relations with all possible agents located in all possible areas.

(ii) **Linkages with other organisations specifically in the host country.** An indicator was calculated as:

(2) the sum of interactions with local, regional or national agents.

(iii) **‘Vertical’ linkages with other firms in the host economy.** An indicator was calculated as:

(3) the sums of interactions with suppliers or clients in Argentina.

### 3.4 Associating the types of subsidiary with innovative behaviour

In order to test the significance of our typology in explaining different innovative behaviour, we use ANOVA or Chi2, the first type of test was used for testing associations between behaviours measured in continuous variables (e.g. training intensity); the second, for categorical or non continuous variables (e.g. the age of the products, or the indicators of interaction with other organisations). Thus, a post hoc test (a Bonferroni test) was carried out to detect the particular pairs of subsidiary type that differ significantly relative to the type of subsidiary with the highest values.
4. Results

This section comments briefly on some general features of the different types of subsidiaries (Section 4.1), and then reports on the association between them and the subsidiaries’ technological behaviour (Section 4.2). Section 4.3 explores possible interpretations for these associations, not by offering a preferred set of explanations but by indicating how easy it would be to err in doing so.

4.1 The typology of subsidiaries in Argentina: Some general features

A number of general characteristics of the groups of subsidiaries are shown in Table 5.

Table 5: A typology of subsidiaries: Some general economic features

<table>
<thead>
<tr>
<th>Indicator</th>
<th>I: Dually Isolated</th>
<th>II: Corporately Integrated</th>
<th>III: Fully Globally Integrated</th>
<th>IV: Locally Integrated</th>
<th>V: Dually Integrated</th>
<th>Average all firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of firms %</td>
<td>148 (44%)</td>
<td>34 (10%)</td>
<td>41 (12%)</td>
<td>65 (20%)</td>
<td>45 (13%)</td>
<td>333 (100%)</td>
</tr>
<tr>
<td>Size – employees (Median)</td>
<td>262</td>
<td>244</td>
<td>535</td>
<td>711</td>
<td>466</td>
<td>409</td>
</tr>
<tr>
<td>Sales/employee – ’000 pesos (Median)</td>
<td>108,148</td>
<td>140,353</td>
<td>165,665</td>
<td>134,128</td>
<td>119,444</td>
<td>1,214,89</td>
</tr>
<tr>
<td>Export Intensity – (%) (Mean)</td>
<td>15</td>
<td>4</td>
<td>26</td>
<td>17</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Market Share(^1) – (%) (Mean)</td>
<td>3.5</td>
<td>3.8</td>
<td>4.5</td>
<td>4.3</td>
<td>3.2</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Calculated as the ratio between a firm’s total sales and the aggregate sales of all firms in its 5-digit industry.

It is striking to note that the first two groups, combinations of corporate and local integration that are typically treated as empty cells in the application of this kind of typological framework in advanced economy contexts, account for more than half of all the subsidiaries in Argentina. Within that, the Dually Isolated group account for more than 40 per cent.

The distribution of the types of subsidiary in terms of firm size (number of employees) is roughly what one might expect. The Locally Integrated subsidiaries (Type IV), which perform the widest array of functional tasks within in the host economy, are not surprisingly the largest firms. Conversely, the low locally integrated subsidiaries (Types I and II) are the smallest.

It is also perhaps not surprising that Globally Integrated subsidiaries (Type III) seem to be the most efficient category of subsidiaries in terms of sales per employee. They also have, on average, the highest domestic market share and export-intensity within the sample.

4.2 Types of subsidiary and local technological behaviour
Table 6 shows the relationships between the types of subsidiary and their various kinds of technological behaviour with respect to innovation inputs. It is striking that on almost all the indicators it is subsidiaries of Type III (Fully Globally Integrated) and Type V (Dually Integrated) that commit significantly larger inputs to innovation.

Table 7 shows the relationships between the types of subsidiary and their technological behaviour with respect various kinds of interaction with other organisation. As one might expect, the Corporately Integrated subsidiaries are less strongly interactive with local organisation – either in general or through vertical linkages with suppliers and customers. Relative to common expectations in much Latin American policy debate, it is more surprising that the Locally Integrated group is not the one with the most intensive innovation-related interactions with local organisations in general, and their vertical interactions more specifically with local firms in not significantly more intensive than those of the Isolated Type I subsidiaries. Contrasting with both these patterns of relatively weak interaction, the Fully Globally Integrated (Type III) firms are the most intensively interactive category in all three ways: (a) in general, which perhaps not surprising, (b) with host country organisations in general, and (c) with host economy customers and suppliers.
Table 6: Types of subsidiary and innovative behaviour: Inputs

<table>
<thead>
<tr>
<th>Indicators</th>
<th>I Dually Isolated</th>
<th>II Corporately Integrated</th>
<th>III Fully Globally integrated</th>
<th>IV Locally integrated</th>
<th>V Dually integrated</th>
<th>ANOVA Test</th>
<th>Post Hoc test&lt;sup&gt;4&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Indexes&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Index</td>
<td>-0.24</td>
<td>-0.01</td>
<td>0.31</td>
<td>-0.11</td>
<td>0.56</td>
<td>Significant ***</td>
<td>V &gt; I, IV ***</td>
</tr>
<tr>
<td>Separate Index 1</td>
<td>-0.14</td>
<td>-0.17</td>
<td>-0.04</td>
<td>-0.03</td>
<td>0.58</td>
<td>Significant ***</td>
<td>V &gt; I, II, III, IV ***</td>
</tr>
<tr>
<td>Separate Index 2</td>
<td>-0.21</td>
<td>0.19</td>
<td>0.56</td>
<td>-0.13</td>
<td>0.17</td>
<td>Significant ***</td>
<td>III &gt; I, IV ***</td>
</tr>
<tr>
<td>Aggregated indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investments in Embodied Technologies&lt;sup&gt;2&lt;/sup&gt;</td>
<td>2.4</td>
<td>1.8</td>
<td>2.2</td>
<td>1.4</td>
<td>3.3</td>
<td>Significant ***</td>
<td>V &gt; IV ***</td>
</tr>
<tr>
<td>Investments in Disembodied Technologies&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1.6</td>
<td>1.3</td>
<td>2.5</td>
<td>1.1</td>
<td>2.5</td>
<td>Significant ***</td>
<td>III &gt; IV ***</td>
</tr>
<tr>
<td>V &gt; IV ***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V &gt; IV ***</td>
</tr>
<tr>
<td>Selected Individual indicators&lt;sup&gt;5&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skills Intensity</td>
<td>16.0</td>
<td>16.6</td>
<td>27.9</td>
<td>14.5</td>
<td>18.8</td>
<td>Significant ***</td>
<td>III &gt; I, II, IV, V ***</td>
</tr>
<tr>
<td>Investments in capital goods</td>
<td>5.8</td>
<td>4.5</td>
<td>8.2</td>
<td>9.2</td>
<td>6.0</td>
<td>Significant ***</td>
<td>Not Significant</td>
</tr>
<tr>
<td>R&amp;D expenditures</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
<td>0.2</td>
<td>0.2</td>
<td>Significant ***</td>
<td>III &gt; IV ***</td>
</tr>
<tr>
<td>Labour in innovation activity</td>
<td>3.1</td>
<td>3.7</td>
<td>5.7</td>
<td>4.5</td>
<td>5.3</td>
<td>Significant ***</td>
<td>III &gt; I ***</td>
</tr>
</tbody>
</table>

<sup>1</sup> See Annex I for an explanation of the indexes

<sup>2</sup> Calculated as the sum of the items under category (ii) in section 3.3.1 above.

<sup>3</sup> Calculated as the sum of the items under category (i) in section 3.3.1 above.

<sup>4</sup> The test identified the pairs that differ significantly. In this table we only include the comparisons that differ significantly relative to the Type with the highest values.

<sup>5</sup> For simplicity only some of the indicators discussed in section 3.3.1 – the more conventional – are included separately here. However, all of them show a similar pattern.
Three broad common observations cut across the results in Tables 6 and 7.

First, high levels of corporate integration seem, on their own, to be associated with patterns of limited local innovative activity: the indicators for various types of activity are uniformly fairly low, typically being little different from those of the Isolated Subsidiaries. In this sense, high corporate integration appears to have the kinds of implications for local innovative behaviour that one might expect from studies like Jarillo and Martinez (1990).

Second, high levels of local integration do not seem, on their own, to be associated with high levels of local innovative activity. With a few exceptions, the indicator values for the technological behaviour of this group of subsidiaries are among the lowest in the whole sample. In other words, although these firms typically have some of the functional bases for innovative activity (they have R&D laboratories, employ specialised design employees and use specialised design systems), they do not do a great deal with them – neither allocating particularly high levels of inputs to innovation nor engaging in strong innovative-related interactions with local firms and other organisations. In the few cases where the indicators for this group do have relatively high values, the innovative behaviours are fairly commonplace - e.g. investment in plant and machinery or the certification of products. In other words, high levels of local integration (even when focused heavily on the integration of technological functions) do not appear to generate the relatively high levels of innovative activity that are commonly expected.

Third, it is only when high corporate integration is combined with something else that high levels of innovative activity are evident. This arises in two groups: (a) in the Type III combination (Fully Globally Integrated) involving high corporate integration plus a high level of integration in global market, and (b) in the Type V combination (Dually Integrated) involving high levels of both corporate and local integration.
<table>
<thead>
<tr>
<th>Indicators</th>
<th>I Isolated</th>
<th>II Corporately Integrated</th>
<th>III Fully Globally integrated</th>
<th>IV Locally integrated</th>
<th>V Dually integrated</th>
<th>ANOVA Test</th>
<th>Post Hoc test</th>
</tr>
</thead>
<tbody>
<tr>
<td>General networking intensity</td>
<td>5.6</td>
<td>6.8</td>
<td><strong>10.1</strong></td>
<td>8.5</td>
<td>9.1</td>
<td>Significant ***</td>
<td>(III&gt;I)***</td>
</tr>
<tr>
<td>Linkages in the host country</td>
<td>3.3</td>
<td>4.1</td>
<td><strong>5.5</strong></td>
<td>5.1</td>
<td>4.9</td>
<td>Significant ***</td>
<td>(III&gt;I)***</td>
</tr>
<tr>
<td>Vertical linkages to other firms in the host country</td>
<td>1.2</td>
<td>1.5</td>
<td><strong>1.8</strong></td>
<td>1.7</td>
<td>1.7</td>
<td>Significant ***</td>
<td>(III&gt;I) ***</td>
</tr>
</tbody>
</table>

Table 7: Types of subsidiary and innovative behaviour: inter-organisational interaction
So, with respect to our alternative hypotheses we reach the following conclusions.

### Table 8  Hypotheses and Findings

<table>
<thead>
<tr>
<th>Structural positions</th>
<th>Expected Level of innovative activity</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H 1 Isolated</td>
<td>Low</td>
<td>Supported</td>
</tr>
<tr>
<td>Types II and III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H 2.1 Corporately Integrated</td>
<td>Low</td>
<td>Supported</td>
</tr>
<tr>
<td>H 2.2 Corporately Integrated</td>
<td>High</td>
<td>Not supported</td>
</tr>
<tr>
<td>H 2.3 Fully Globally Integrated</td>
<td>High</td>
<td>Supported</td>
</tr>
<tr>
<td>Type IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H 3 Locally Integrated</td>
<td>High</td>
<td>Not supported</td>
</tr>
<tr>
<td>Type V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H 4 Dually Integrated</td>
<td>High</td>
<td>Supported</td>
</tr>
</tbody>
</table>

#### 4.3 Interpreting the findings

We believe our findings about the relationship between subsidiaries’ structural positioning and their innovative activity are robust. However, we do not suggest that they should be interpreted in a narrow and deterministic way since more than just the subsidiaries’ structural positioning needs to be woven into the picture to understand the heterogeneity of their technological behaviour.

To start with, we have said almost nothing about the historical processes by which the subsidiaries arrived at the structural positions in which we captured them in our snap-shot typology in 1998. But it is almost certain that history matters here. To take one aspect, it has been frequently highlighted in other studies that the legacy effects of former independent companies that became subsidiaries via mergers and acquisitions (M&As) have a major influence on what one finds as characteristics of subsidiaries in snap-shot observations. This could be especially important in this study, given the large role of FDI via M&As in Argentina during the 1990s. For example, does this help to explain the Type IV *Locally Integrated* group which demonstrated the presence of formal bases of localised technological functions (the existence of R&D laboratories, the employment of specialised design personnel, etc.), but also low levels of technological activity and limited innovation-related interaction with local firms or other organisations? One might argue that a significant proportion of the subsidiaries demonstrating this peculiar combination were the technological ‘shells’ of former locally owned firms which had undertaken significant technological activities in the past that have subsequently been run down following FDI via merger or acquisition. That perspective starts from a preconception about FDI’s inherently destructive role with respect to local technological activities, and one might just as easily start from a more positive preconception. For example,
one might argue that the strong technological activities of subsidiaries in the *Dually Integrated* group reflect MNC strategies of acquiring locally owned firms with strong technological activities and then adding considerable technological support for their further technological development. Perhaps both these historical trajectories had occurred under differing specific circumstances that we do not yet understand.

Another strand of historical process is also likely to have been important – the evolution away from subsidiary structures and behaviours that were prevalent during the earlier policy regime of import substituting industrialisation. It is well recognised that such policy contexts encouraged the emergence of multi-domestic subsidiaries demonstrating low degrees of corporate integration and highly extended arrays of localised functions – our Type IV subsidiaries. In that context, does the large number of subsidiaries in our Type I category (*Dually Isolated*) reflect the erosion of those positions as former Type IV multi-domestic subsidiaries have ‘withered’ in a more open economy – moving towards a narrower range of localised functions and a more limited degree of integration in the local economy?

A little light is thrown on these and other issues by Table 9 which indicates the association between our five groups of subsidiaries and (a) the type of industry in which the subsidiary is engaged, (b) the age of the subsidiary (not the firm), and (c) the degree of foreign ownership. It is of interest that the age of the subsidiaries is in general so high (around 35 years), reflecting the long established importance of FDI in Argentina. But also the subsidiaries’ age does not differ significantly across the groups. Among other things, this suggests that none of the categories was dominated by relatively recent FDI during the 1990s – raising further questions about, but not necessarily invalidating, our speculations above about the possible role of subsidisation via M&A-intensive FDI during the 1990s.

In the context of numerous studies of the consequences of differing degrees of foreign ownership on the characteristics of subsidiaries, it is also of interest that, although in general the average degree of ownership was very high (above 80 per cent in all cases), this variable was significantly different across the types of subsidiary. In particular, it was highest in Type III subsidiaries – the *Fully Globally Integrated* category that also demonstrated relatively high levels of local innovative activity.

There also appear to have been significant differences between the types of industry that were most important in each category of subsidiaries – based on broad distinctions similar to those in the commonly used OECD categories of differing ‘technology-intensity’, but modified by Ferraz et al. (1997) to be more appropriate in the context of Latin America. While this is of interest, it is difficult to discern any clear pattern because in several cases the same kinds of industry were important for different types of subsidiary. For instance, the production of durable goods was important for diametrically contrasting categories *Dually Isolated* and *Dually Integrated* subsidiaries; and production in the automotive sector was important for three groups of subsidiaries: not only the two groups with high local innovative activity – the *Fully Globally Integrated* and *Dually Integrated* groups - but also the *Locally Integrated* group with relatively limited local innovative activity. Fairly clearly, if there is an ‘industry effect’, as suggested by the statistics, it must be fairly subtle, possibly associated with the specific local circumstances of quite narrowly defined industries. This would be consistent with our earlier study (Bell and Marin, 2004) in which we showed ‘technologically active’ subsidiaries and locally owned firms clustered in (parts of) particular narrowly defined industries.
<table>
<thead>
<tr>
<th>Type of subsidiary</th>
<th>Chi 2</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated Corporately Integrated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully Globally Integrated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locally Integrated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dually Integrated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of industry</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI, V, I</th>
<th>II, V</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>1, 2</td>
<td>IV, I</td>
<td>III</td>
<td>V, I, VI</td>
<td>II, V</td>
<td>V, IV, II</td>
<td>II</td>
<td>V</td>
</tr>
<tr>
<td>Significant***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>37</th>
<th>33</th>
<th>38</th>
<th>35</th>
<th>32</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of foreign ownership</td>
<td>85%</td>
<td>86%</td>
<td>94%</td>
<td>99%</td>
<td>81%</td>
<td>84%</td>
</tr>
<tr>
<td>Significant***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. The type/s of sector allocated to each group of subsidiaries is the type in which they are over-represented in relation with the average for all firms.

2. Based on Ferraz et al. (1997) which classified all three digits industries in six types.
5. CONCLUSIONS

5.1 Summary

Our main findings need only a very brief summary, as follows.

- Significant numbers of subsidiaries in Argentina in the late 1990s occupied types of structural positions that have often been ignored, or identified as logically or empirically empty cells, in similar 2 x 2 typologies: the *Dually Isolated* subsidiaries and those that were only *Corporately Integrated*, not fully globally integrated.

- A significant number of subsidiaries also occupied the *Dually Integrated* position, indicating that high corporate integration and high localisation of technological functions are not necessarily alternatives, but may be complementary.

- Three kinds of structural position were occupied by subsidiaries that demonstrated limited local technological activity: the *Dually Isolated*, *Corporately Integrated*, and *Locally Integrated* groups, and these accounted for about 75 per cent of all the subsidiaries.

- Relatively high levels of technological activity were demonstrated only by the remaining 25 per cent of the subsidiaries occupying the two other structural positions: *Fully Globally Integrated* and *Dually Integrated*. Since we earlier showed that it was these kinds of technologically active subsidiary that were associated with significant spillover effects, it seems that one should expect significant spillovers in association with only about one quarter of the subsidiaries in Argentinean industry.

We have also suggested that our findings about the structural positioning of subsidiaries and their technological behaviour must be interpreted in the context of a wide array of other explanatory factors associated with such things as specific historical processes, particular industrial activities, and an array of issues concerned with the differing strategies of global corporations. If we take all these issues together, the puzzle that needs explaining is perhaps not the heterogeneity of subsidiaries but why anyone ever thought they might be homogeneous, giving rise, for instance, to general FDI-related effects like ‘spillovers’, especially in the particular context of industrialising/emerging economies.

5.2 Further Discussion and Possible Implications

As far as we know, this study is the first that has examined issues about the structural positions of MNC subsidiaries and their technological behaviour on the basis of data derived from a large-scale national innovation survey. The consequent ability to work with a large sample of more than 300 observations adds robustness to the reported findings, as well as providing a basis for further, more fine-grained analysis. We hope this encourages others to explore similar issues with similar types of data resource.

This would not just be interesting, but possibly important too, because two aspects of our findings run in opposite directions to views that are common and influential, especially in Latin America.

- The first relates to views about the technological role of FDI. Our findings suggest that close integration of a subsidiary into corporate technological functions can be positively associated with relatively high levels of local technological activity – either (i) in combination with high levels of integration into the global economy (the *Fully Globally Integrated* group) or (ii) in combination with high levels of localisation of technological and other functions (the
Dually Integrated group). This runs counter to widely held views that see FDI in general, and close corporate integration of technological activities in particular, as having negative effects on local innovative activity.

- The second relates to views about the importance of more extensive localisation of functions in subsidiaries. Our findings suggest that, on its own, greater localisation (as in the Locally Integrated group) is not associated with high levels of local technological activity in subsidiaries. This runs counter to common expectations that more extensive localisation of subsidiaries’ functions will have positive effects on local technological activity. Policy measures reflecting such expectations that the greater the extent of localisation the greater will be the depth of local innovative activity have not only been widely debated in Argentina; they have also been implemented in recent years.

Taking these two issues a little more broadly, and adding a bit of speculative history as earlier, it may be that what we have observed is the lagging emergence of positive technology-related consequences of the liberalisation of the Argentine economy and the greater integration of Argentine industry into the global economy, combined with the negative outcomes associated with the erosion of structural positions and technological behaviours that were built up during the previous policy regime. Until now, it has been mainly the negative erosion effects that have been highlighted (e.g. in Cimoli and Katz, 2003). Consequently it would be extremely interesting if other studies could explore whether similar kinds of lagged transition towards positive outcomes are also under way in other Latin American economies.

It is common at this stage in a paper of this type to comment on the implications for policy. However, precisely because of the uncertainties emphasised above, we hesitate to do so in this case. Nevertheless, three cautious and brief comments might be warranted.

- First, as with our previous papers (Marin and Bell, 2004, 2005), our results emphasise that it is probably not the existence of FDI that yields external benefits for the economy. Instead, what matters much more is what subsidiaries actually do once they have been established or acquired. Consequently, policy measures that focus simply on attracting FDI may be wasting scarce resources. Instead, much greater inventiveness needs to be applied to developing policy measures that influence the technological and other behaviour of subsidiaries in ways that do yield in practice the externalities that are commonly expected.

- Second, within such inventive policy development, measures that reinforce both subsidiaries’ investment in building their technological capabilities and their closer integration into, and hence access to, the technological resources and strategies of parent corporations may be particularly important.

- Third, considerable scepticism might usefully be directed towards policy measures that seek merely to extend the functions that are locally undertaken by subsidiaries. This is because (i) our findings suggest that these are unlikely on their own to have much effect on externality-generating technological behaviour, (ii) such approaches are likely to mitigate against the development of specialisation in particularly competitive functions, and hence against the emergence of more Fully Globally Integrated positions with higher local innovative activity, and (iii) our earlier findings (Bell and Marin, 2004) suggest that it may be around such areas of specialisation that both subsidiaries and local firms build interactively their externality-generating technological activities.
References


Ernst, D., 2004, ‘Internationalisation of innovation: Why is chip design moving to Asia?’, East-West Center Working Papers, Economic Series No. 64, East-West Center, Honolulu


ANNEX 1

1) Indexes of technological efforts

We use Principal Factor Component Method –PFC- (to extract factors) rather than Maximun Likelihood (which is more sensitive to departure from normality). PFC method is justified here because we want to explain the total variance of some subsets of variables with all of them being grouping variables of some more disaggregated features.

The use of only one index/factor provides the following weights for each variable

<table>
<thead>
<tr>
<th>Innovative Investment</th>
<th>One INDEX</th>
<th>Index1</th>
<th>Index2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weights</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>0.30</td>
<td>0.40</td>
<td>-0.02</td>
</tr>
<tr>
<td>Investments in equipments for innovations</td>
<td>0.27</td>
<td>0.09</td>
<td>0.31</td>
</tr>
<tr>
<td>Management</td>
<td>0.27</td>
<td>0.11</td>
<td>0.31</td>
</tr>
<tr>
<td>Consultancy</td>
<td>0.25</td>
<td>0.37</td>
<td>-0.05</td>
</tr>
<tr>
<td>Hardware</td>
<td>0.17</td>
<td>0.28</td>
<td>-0.07</td>
</tr>
<tr>
<td>R&amp;D expenditures</td>
<td>0.17</td>
<td>-0.09</td>
<td>0.39</td>
</tr>
<tr>
<td>Technology Transfer</td>
<td>0.14</td>
<td>-0.12</td>
<td>0.38</td>
</tr>
<tr>
<td>Training</td>
<td>0.13</td>
<td>0.22</td>
<td>-0.06</td>
</tr>
<tr>
<td>Labor</td>
<td>0.11</td>
<td>0.05</td>
<td>0.10</td>
</tr>
<tr>
<td>Design</td>
<td>0.06</td>
<td>-0.02</td>
<td>0.12</td>
</tr>
</tbody>
</table>

With one INDEX we explain around 25% of variation in the data, with 2: index 1 and index 2 in the table, we explain 45%.